Final Draft

HABITAT RESTORATION NEEDS PLAN FOR THE COASTAL AND HEARTLAND NATIONAL ESTUARY PARTNERSHIP AREA

Photo Credit: Charlotte Harbor Preserve State Park, Cape Coral | *Gail Stenger*

Prepared by

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ESA

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COASTAL & HEARTLAND NATIONAL ESTUARY PARTNERSHIP

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- Policy Committee,
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Appendix G contains a list of the individual committee member's names and the report authors.

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ACRONYM LIST

Acronym	Definition
AHA	Additive Hybrid Approach
BMPs	Best Management Practices
CCMP	Comprehensive Conservation and Management Plan
CHNEP	Coastal and Heartland National Estuary Partnership (formerly known as the Charlotte Harbor National Estuary Program).
CLIP	Critical Lands and Waters Identification Project
CREW	Corkscrew Regional Ecosystem Watershed
ESA	Environmental Science Associates
FEMA	Federal Emergency Management Agency
FWC	Florida Fish and Wildlife Conservation Commission
FLUCCS	Florida Land Use Cover Classification System
GIS	Geographic Information System
HEM	Habitat Evolution Model
HRCC	Habitat Resiliency to Climate Change
HRN	Habitat Restoration Needs
IHN	Integrated Habitat Network
LCD	Landscape Conservation Design
LID	Low Impact Development
LiDAR	Light Detection and Ranging
MET	Management/Enhancement Targets
MFLs	Minimum Flows and Levels
MHHW	Mean Higher High Water
MLW	Mean Low Water
N/A	Not Applicable
NAVD88	North American Vertical Datum of 1998
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
PCO	Preservation/Conservation Opportunities
Plan	Habitat Restoration Needs Plan
RO	Reservation Opportunities
RT	Restoration Targets
SFWMD	South Florida Water Management District
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management

EXECUTIVE SUMMARY

This Habitat Restoration Needs (HRN) Plan (Plan) was developed to guide habitat preservation/conservation, connectivity, management, restoration, sustainability, and resiliency throughout the Coastal and Heartland National Estuary Partnership (CHNEP) area. The Plan identifies preservation/conservation and reservation opportunities, as well as management/enhancement and restoration targets, in each basin within the CHNEP area. Full implementation of the Plan would have substantial positive impacts on the long-term sustainability of water quality, water quantity, natural systems, and species populations in the CHNEP area.

Working collaboratively with stakeholders throughout the region, the CHNEP has developed the following habitat restoration vision:

> ***Vision: A diverse environment of interconnected, healthy habitats that support natural processes and viable, resilient native plant and animal communities***

The overarching goal of the Plan is to increase the acreages of native habitats in the CHNEP area, both strategically and opportunistically. In support of this goal, several alternative approaches to developing quantitative habitat targets were assessed and evaluated. Several types of information were considered including: habitats status and trends analysis, existing preservation and conservation lands, proposed land acquisition priorities, listed species critical habitats and migratory corridors, river floodplain functions, long-term trends in freshwater flows, historical soils distributions, projected sea level rise, and modeled coastal habitat migration in response to sea level rise.

Through this "weight of evidence" process the project team developed an ***additive hybrid approach***. This approach utilizes geospatial tools to identify habitat opportunity areas, and to develop quantitative habitat management/enhancement and restoration targets that are "place-based" – that is, they can be mapped. In addition, the additive hybrid approach is both retrospective and prospective in that it is informed by past changes, but is focused on what is possible today rather than replicating some historical ecological condition. Finally, the additive hybrid approach incorporates future stressors – including climate change, sea level rise, and urban development – into target development.

The Plan addresses the entire CHNEP area, but is primarily focused on tidal wetland, freshwater wetland, and upland habitats that fall within three distinct spatial strata – coastal, river floodplain, and upland as described below and in Section 3. Submerged estuarine habitats such as seagrasses, oysters, and hard-bottom communities were not addressed in this study nor were open water areas. Habitat opportunity areas and quantitative habitat management/enhancement and restoration targets are presented for the eight major basins within the CHNEP area. In addition, three spatial

strata are defined within the CHNEP area to distinguish different habitat management and restoration priorities. These spatial strata are described as follows:

- Coastal stratum – The area extending from the Mean Low Water line up to 5-feet above the Mean High Water line, as referenced to the NAVD88 datum. This stratum can be approximated by the 5-foot contour, and encompasses the vast majority of the tidal wetlands and coastal upland habitats in the CHNEP area. This stratum is also projected to experience increased tidal flooding and inundation resulting from sea level rise.
- River floodplain stratum – The area encompassed by the 100-year FEMA floodplains of the Peace, Myakka, and Caloosahatchee Rivers. This stratum primarily includes forested freshwater wetlands that provide important flood storage and water quality functions, as well as serving as wildlife migratory corridors.
- Upland stratum – The upland stratum includes areas above the coastal stratum, and outside the 100-year river floodplains. Habitats in the upland stratum include xeric and mesic forests such as sand pine scrub and longleaf pine, as well as hydrologically isolated forested and herbaceous wetlands. These are wetlands with no apparent surface water connection to perennial rivers and streams, estuaries, or the Gulf of Mexico. These habitats provide important ecosystem services including aquifer recharge, and habitat and migratory corridors for rare and threatened species including the Florida panther.

There are many different types of native habitats within the CHNEP area; however, due to data limitations, it was not possible to develop quantitative targets for the entire suite of native habitats. Therefore, for the development of quantitative habitat opportunity areas and targets, the various habitat types were rolled up into three major habitat categories: tidal wetlands; freshwater wetlands; and uplands.

The primary results of the additive hybrid approach are presented as numeric ***opportunities*** and ***target*** acreage***s*** throughout this report. Preservation/Conservation Opportunities (PCO) and Reservation Opportunities (RO) are identified for areas that have the potential for preservation, conservation, or reservation activities. Management/Enhancement Targets (MET) and Restoration Targets (RT) are identified for existing native and non-native habitats that may be actively managed, enhanced, or restored. These analyses were conducted excluding developed areas, and "other" areas without identified habitat value (e.g. open waters) by agencies, the CHNEP Management Conference, or other organizations, or not within the scope of this project (e.g. submerged habitats). Figure ES-1 shows a graphic flow chart depicting how opportunities and targets were derived.

Opportunities

Opportunity areas for preservation/conservation and reservation activities were identified using the above mentioned methodologies and mapped. Preservation and conservation activities include both public land acquisition, and the placement of conservation easements, for the purposes of environmental protection. Reservation activities are only applicable in the coastal stratum, and involve zoning restrictions that prevent more intense land uses. The purpose of reservation is to

maintain existing lower intensity land uses so that these areas will be available to accommodate tidal wetland migration with future sea level rise. The two types of opportunities are discussed further below.

Preservation/Conservation Opportunities (PCO)

The PCO were identified from private lands that may be considered for preservation or conservation through acquisition, easement, or other means. A total of **517,776 acres** were identified as potential PCO, which constitutes only 17 percent of the total lands within the overall CHNEP area. Of this total, 60 percent was classified as native habitats and 40 percent was classified as non-native land use/land cover types. These areas represent important opportunities where state and local land acquisition and easement programs can invest in order to save priority habitat areas.

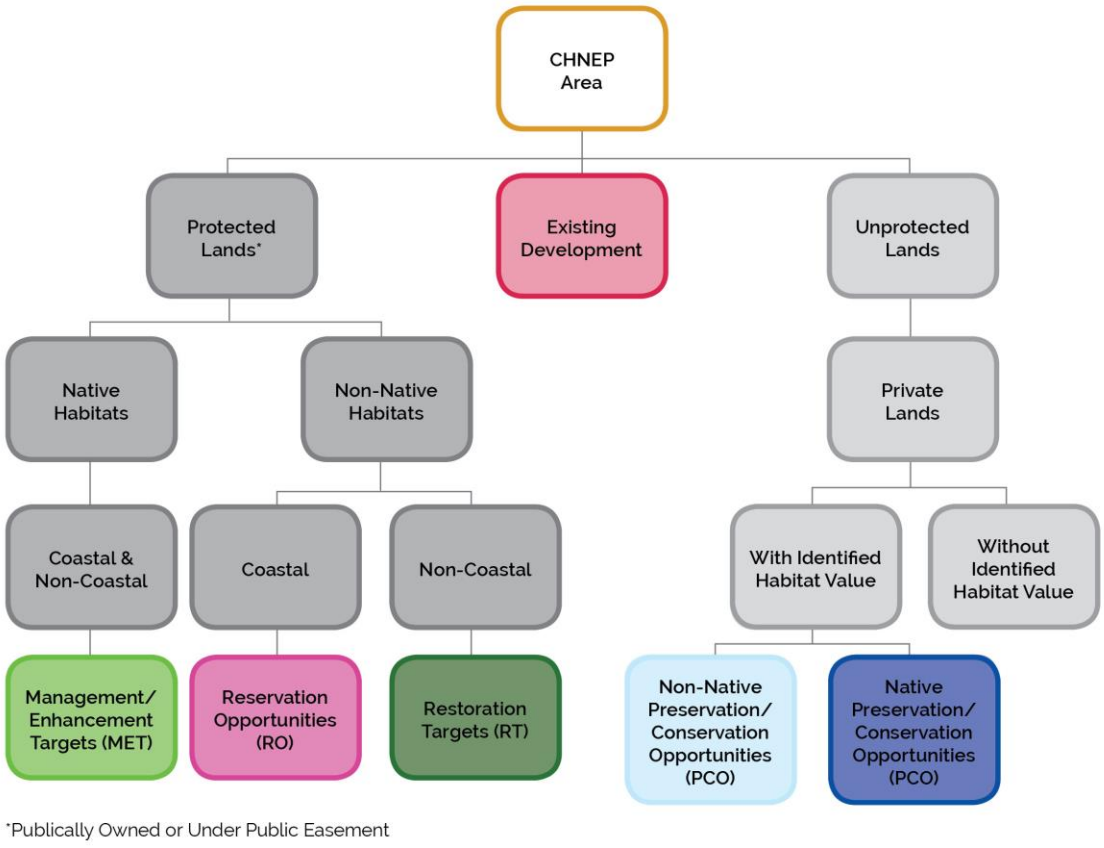


Figure ES1. Opportunity Identification and Target Setting Flow Chart

Reservation Opportunities (RO)

The RO were derived from non-native habitats within publicly-owned lands, and private lands that are currently under conservation easements. These areas are within the coastal stratum that would likely stay non-native land (i.e. ballfields, golf courses, etc.). A total of **1,590 acres** were identified as RO, which constitutes less than one percent of the total lands within the overall CHNEP area. Though relatively small in scale, these areas are important for local governments to be aware of in

order to avoid intensification of use and hardening so that the habitat migration functionality can be maintained.

Targets

Targets were derived from the analysis of publicly-owned preservation or conservation lands, and private lands under conservation easement, that need varying degrees of management/enhancement or restoration to achieve desired natural habitats. These resulted in numeric acreage targets that are summarized in the following sections. For areas with existing native habitats, it is expected that ongoing improvements or maintenance will be needed in order for them to reach their greatest ecological function potential. The acreage total of these areas comprise the Management/Enhancement (MET). For areas that are currently non-native habitats, the numeric acreage targets derived from this Restoration Target (RT) analysis represent areas that could benefit from restoration activities and their identified approximate habitat endpoints. Both categories contain numeric targets (in acres) for the three major native habitat types (tidal wetlands, freshwater wetlands, and uplands) based upon the best available data at the time of this analysis.

Management/Enhancement Targets (MET)

The MET include both public and private lands that are currently under conservation easements or are otherwise protected for preservation or conservation purposes. The MET were derived from native land use classifications identified by Florida Land Use Cover Classification System (FLUCCS) codes. These areas represent natural lands that may need ongoing management and enhancement activities (e.g., prescribed burning, exotic species control). A total of **447,683 acres** were identified as potential MET, which constitutes 15 percent of the total lands within the overall CHNEP area.

Restoration Targets (RT)

The RT also include both public and private lands that are currently under conservation easements or otherwise protected for preservation or conservation purposes. The RT area limits are defined by FLUCCS mapped non-native lands, but are quantified in each of the three major native habitat types – tidal wetland, freshwater wetlands, and uplands – based on Natural Resource Conservation Service (NRCS) soils data. The RT areas represent potentially restorable non-native habitats that could benefit from more intensive restoration activities (e.g., regrading/planting, hydrologic restoration). In total, **88,130 acres** were identified for potential restoration, which constitutes 3 percent of the total lands within the overall CHNEP area.

Table ES-1 provides a summary of the recommended numeric opportunities and targets for the three major habitat types, while Figure ES-2 shows all mapped opportunity and target areas within the entire CHNEP area. Figure ES-3 presents the approximate boundaries of the three spatial strata: coastal, river floodplain, and upland.

TABLE ES1. HRN OPPORTUNITIES AND TARGETS FOR THE OVERALL CHNEP AREA BY MAJOR HABITAT TYPE.

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	151,080	N/A	207,767	56,092
Freshwater Wetlands	148,781	N/A	181,214	31,952
Tidal Wetlands	9,134	N/A	58,702	86
Non-Native	208,781	1,590	N/A	N/A
Total	517,776	1,590	447,683	88,130

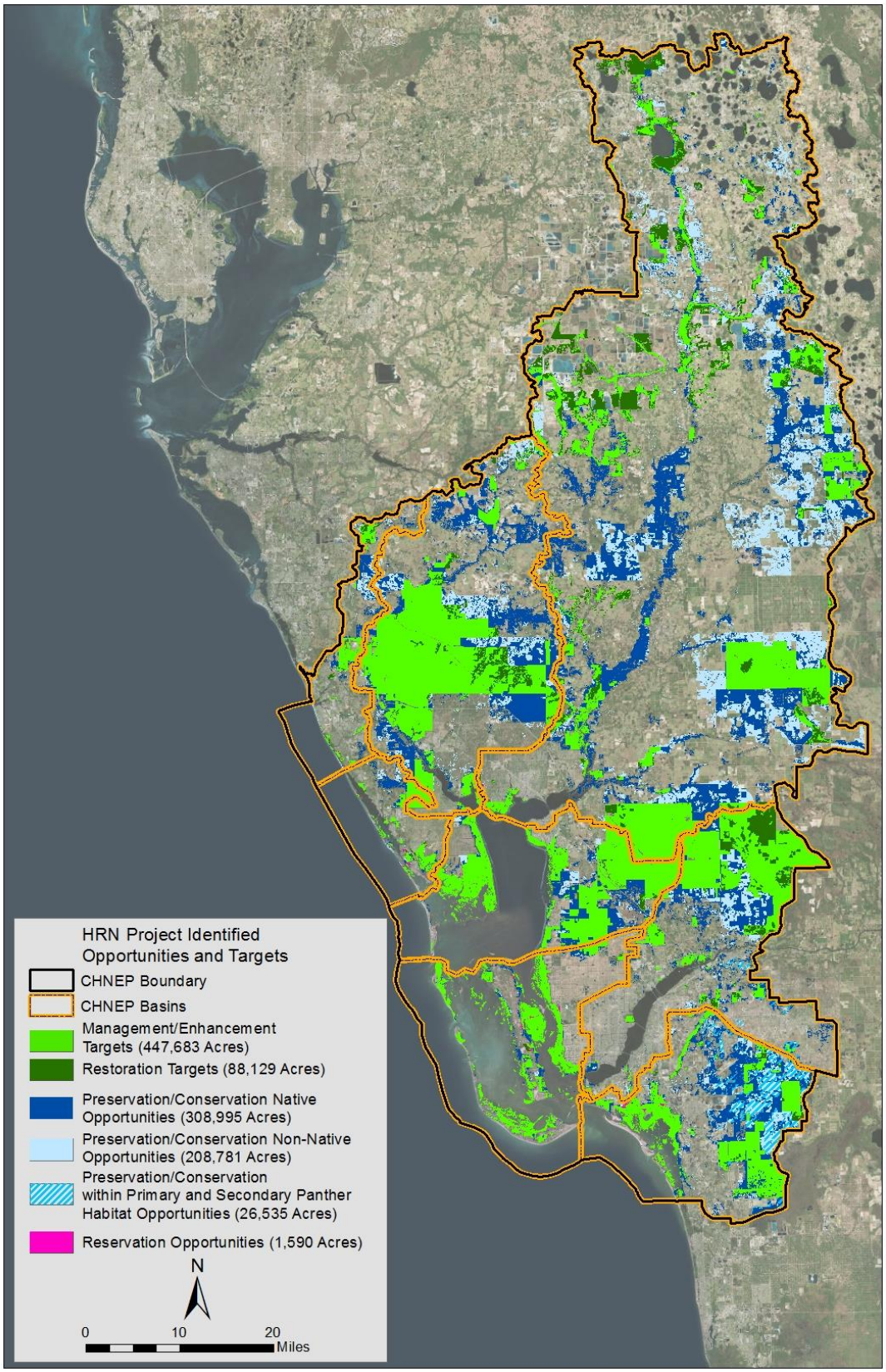


Figure ES2. HRN Project Identified Opportunities and Targets (figure illustration excludes developed lands and other lands [lands without identification])

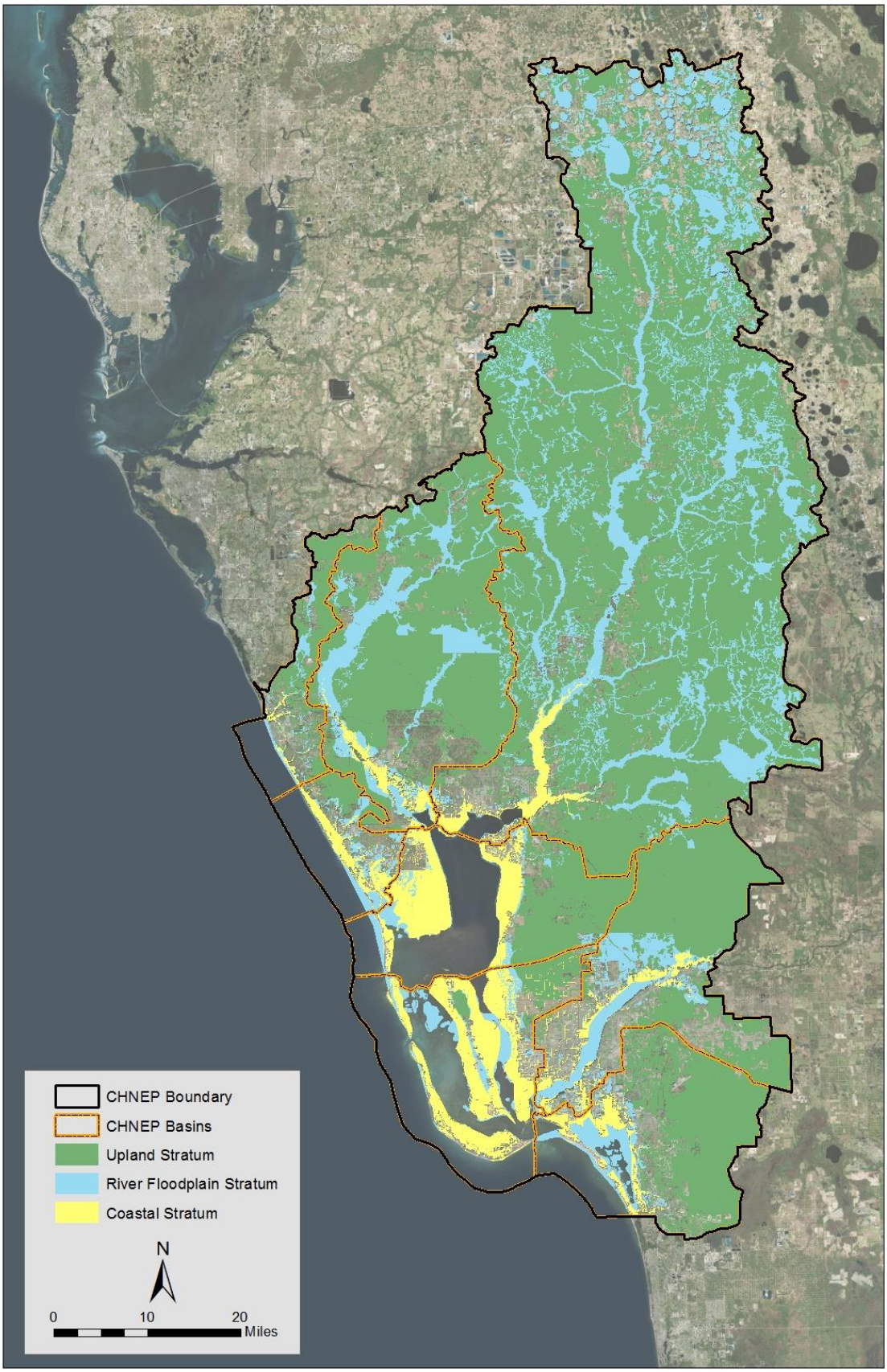


Figure ES3. Three spatial strata: coastal, river floodplain, and upland.

Conclusions and Recommendations

As discussed above, the HRN project utilized a "weight of evidence" process to derive numeric opportunities and targets (in acres). Several ancillary work products supported the development of numeric opportunities and targets, and contributed to other project conclusions and recommendations. They are discussed below.

As part of the HRN study, a habitat change analysis was conducted for the period 1995-2009/11 for the CHNEP area utilizing land use/cover geospatial data provided by the Southwest Florida Water Management District (SWFWMD) and the South Florida Water Management District (SFWMD). This change analysis spanned a period of time during which modern environmental regulations were already in place (e.g., Clean Water Act, Environmental Resource Permitting). The results and conclusions from this analysis are summarized below.

- The total acreage of tidal wetlands was relatively stable over the change analysis period; however, the acreage of mangroves increased while the acreage of salt marsh decreased. This suggests that sea level rise is driving an ecological shift in the relative distribution of tidal wetland types.
- There were significant changes in various types of native freshwater wetlands, in particular the conversion of forested wetlands to non-forested wetlands; however, due to mapping inconsistencies it was not possible to quantify a net loss or gain.
- The total acreages of native upland habitat types declined significantly over the change analysis time period, primarily through conversions to agriculture and developed land uses. Coniferous forests (pine flatwoods) were most impacted, suggesting that greater protection of upland native habitats is needed.

Another supporting work product was created as part of the CHNEP Habitat Resiliency to Climate Change (HRCC) project. The outcome of the project was the development and execution of the Habitat Evolution Model (HEM) (see Appendix B). The HEM evaluated various sea level rise projections and modeled tidal wetland migration in response to sea level rise. The HEM predicts the continued increase in tidal inundation of the coastal stratum and the landward migration of mangroves, as well as the upstream migration of salt marshes in the tidal rivers and tributaries. In addition, the model predicts that mangrove acreage will increase, while salt marsh acreages will decline and be limited to the lower reaches of the tidal rivers.

A third important ancillary work product was the evaluation of potential restoration opportunities on reclaimed mined lands, which are extensive in the upper reaches of the Peace River watershed. This analysis showed that headwater stream restoration, and the restoration of river floodplain integrity, will be critical to ensuring a sustainable delivery of freshwater inflows to the Charlotte Harbor estuarine system.

Based on the analyses summarized above the following management recommendations for the three spatial strata are proposed.

- **Coastal Stratum** - The continued maintenance of and appropriate freshwater inflows in the tidal rivers and tributaries within the CHNEP area will be critical to the sustainability of salt marsh habitats, which are projected to migrate upstream with increasing sea level rise. Appropriate freshwater inflows will also be needed to maintain mesohaline and oligohaline salinity gradients that support nursery areas for economically important fish species. Continued coordination with

both the SWFWMD and the SFWMD will be needed to ensure that Minimum Flows and Levels (MFLs) are being attained, and adequately addressing these resource management concerns. In addition, the reservation of pervious coastal uplands will be critical to ensuring that tidal wetland habitats have the space to migrate landward with increasing sea level rise.

- **River Floodplain Stratum** – The native forested river floodplain habitats function as the "kidneys" of the estuarine system by storing and slowing flood flows, removing sediments and other pollutants, and delivering complex organic matter that drives the food web of the estuary. In addition, contiguous river floodplains provide migratory corridors to a wide range of fish and wildlife species. For these reasons, the restoration and maintenance of river floodplain integrity is a high priority in the CHNEP area. In particular, there are extensive opportunities for headwater stream and riparian wetland restoration in the Peace River watershed on reclaimed mined lands.
- **Upland Stratum:** Native upland habitats, primarily pine flatwoods, have suffered disproportionate losses. This stratum includes rare or highly threatened upland habitats including sand pine scrub, longleaf pine, and hydric flatwoods. It also includes wildlife corridors for the Florida panther. This stratum includes hydrologically isolated forested and herbaceous wetlands interspersed throughout the landscape. These are wetlands that are above the coastal stratum and outside the 100-year floodplain. Given the disproportionate losses of native upland habitats in the CHNEP area, greater preservation/conservation, and perhaps more stringent regulatory protection, of these areas should be a clear priority. In addition, for areas that are already under a conservation easement, the restoration upland habitats should be prioritized.

Implementation of the habitat preservation/conservation, management, and restoration targets and recommendations identified in this report are expected to result in the long-term sustainability of the spectrum of native habitats in the CHNEP area, as well as viability of animal populations that depend on these habitats.

To assist CHNEP stakeholders in implementing the Plan, it is also recommended that there be online access to the HRN Project database through the CHNEP Water Atlas and a strategy for regularly updating and using the goals, databases, and tools implemented.

The results presented in this report represent a "snapshot" of what is currently possible with the data provided. The areas analyzed in this report only represent those lands that were identified during the completion of this study for potential preservation/conservation and reservation opportunities, or for habitat management and restoration target setting. It should be noted that the identification of new environmental lands; and the ability to acquire, manage, enhance and/or restore such lands by local, state and federal agencies or conservation organizations within the overall CHNEP area, can change on a regular basis. These changes are dependent on current funding availability, administrative priorities, and economic conditions. There continue to be emerging needs and opportunities (with willing land owners) that have yet to be explored that will possibly identify additional areas for conservation or restoration that are not addressed here. Accordingly, the opportunities and targets defined in this HRN document should be periodically reevaluated based on current information. It should also be noted that this report is geared specifically toward habitat restoration, but does not preclude other plans that are more focused on other goals such as hydrologic restoration.

SECTION 1
Introduction

CHNEP Area

The Coastal and Heartland National Estuary Partnership (CHNEP) area encompasses **4,700 square miles (3,020,750 acres)** in central and southwest Florida including all or parts of seven counties (Figure 1). It consists of eight major basins: Dona & Roberts Bays, Lemon Bay, Peace River, Myakka River, Charlotte Harbor, Tidal Caloosahatchee, Pine Island/Matlacha Pass, and Estero Bay. Approximately 77% of the area is within the SWFWMD boundary, and 23% is within the SFWMD boundary. This report assesses the original CHNEP area (4,700 square miles) and does include the expansion area added in 2019. Table 1 provides the acreage by basin for the CHNEP area.

TABLE 1. CHNEP BASIN ACREAGES

Basin	Acreage
Dona & Roberts Bays	93,325
Lemon Bay	84,557
Peace River	1,494,057
Myakka River	382,772
Charlotte Harbor	224,073
Tidal Caloosahatchee River	271,955
Pine Island/Matlacha Pass	239,923
Estero Bay	230,086
Total	**3,020,750**

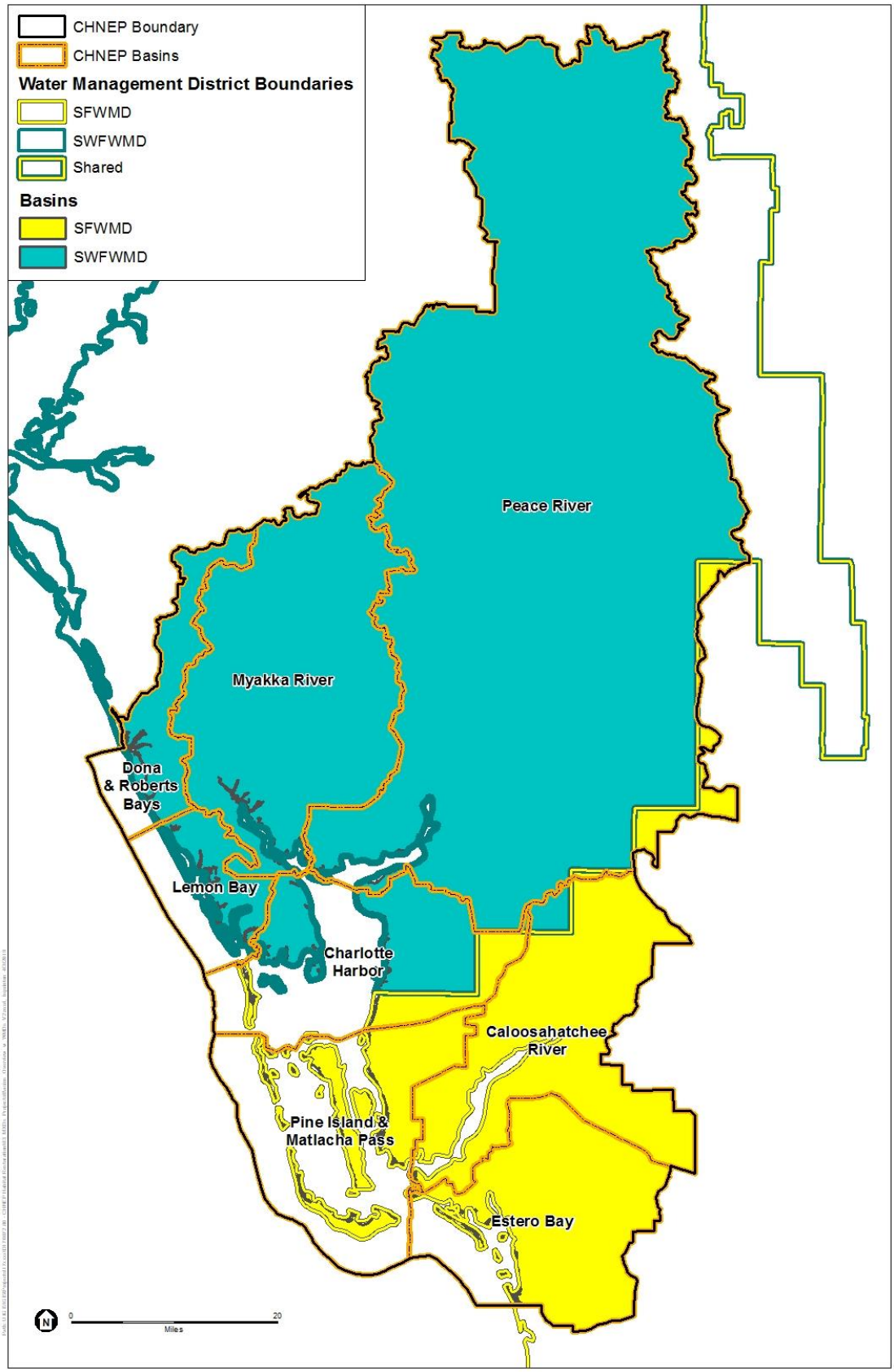


Figure 1. CHNEP Area

Purpose

The purpose of the HRN Project is to guide habitat preservation, conservation, reservation, and restoration efforts throughout the CHNEP area in refining the CHNEP habitat restoration vision for the next 50 years, and define the habitat restoration goals for the next 20 years. It also specifically identifies and quantifies habitat preservation/conservation and reservation opportunities and management/enhancement and restoration targets throughout the CHNEP area needed to reach the HRN vision and goals.

In addition to habitat protection, the goals, opportunities, and targets developed in this Plan can have a positive impact supporting, protecting, managing, and restoring water quality/quantity and natural systems. The information contained in this report helps to guide the CHNEP and its partners and stakeholders in implementing the CHNEP Comprehensive Conservation and Management Plan (CCMP) and other regional planning efforts, including the SWFWMD Surface Water Improvement and Management (SWIM) program. Additionally, this information can be used by local public and private land conservation and management entities to assist in their efforts to conserve connected priority habitats needed to conserve water and wildlife resources in their communities.

Habitat Types and Categories

Habitats within the CHNEP were identified using the 2009 SFWMD and 2011 SWFWMD FLUCCS for land use/land cover data. This system groups habitats with similar characteristics and assigns them a unique identifier code. To meet the purpose of the project, habitat types were grouped into native, non-native, and existing development categories (Tables 2 through 4). The whole of the current CHNEP area was analyzed and categorized, but did not include the expansion area added in 2019. Future HRN phases will address this new expansion area. The analyses presented here focus on identifying opportunities for land conservation/preservation or reservation and setting targets for conducting land management/enhancement or restoration within three strata: coastal, river floodplains, and uplands. The analyses conducted excluded developed areas and "other" areas that did not have identified habitat value for the purposes of this project (e.g. open waters) Priority area were identified by local state and federal agencies; CHNEP Management Conference member organizations, and other private land acquisition or governmental organizations. Section 3 summarizes how these habitat types and categories were used to identify preservation/conservation opportunities and set management/enhancement and restoration targets.

TABLE 2. NATIVE HABITAT LAND USE/LAND COVER CLASSIFICATIONS

Tidal Wetland Habitats		
Primary Classification	**Secondary Classifications**	**FLUCCS Codes**
Mangrove Swamps	N/A	6120
Saltwater Marshes	N/A	6420
Intermittent Ponds	N/A	6530
Salt Flats	N/A	6600
Freshwater Wetland Habitats		
Primary Classification	**Secondary Classifications**	**FLUCCS Codes**
Streams and Waterways	N/A	5100
	Natural Waterways	5110
	Channelized Waterway	5120
Lakes	N/A	5200
Slough Waters	N/A	5600
Wetland Hardwood Forests	N/A	6100
	Bay Swamps	6110
	Stream and Lake Swamps	6150
	Mixed Wetland Hardwoods	6170
	Mixed Shrubs	6172
	Willow and Elderberry	6180
Wetland Coniferous Forests	N/A	6200
	Cypress	6210
	Cypress Domes/Heads	6215
	Cypress Mixed Hardwoods	6216
	Cypress/Pine/Cabbage Palm	6240
	Hydric Pine Flatwoods	6250
Wetland Forested Mixed	N/A	6300
Vegetated Non-Forested Wetlands	Freshwater Marshes	6410
	Sawgrass	6411
	Wet Prairies	6430
	Emergent Aquatic Vegetation	6440
Upland Habitats		
Primary Classification	**Secondary Classifications**	**FLUCCS Codes**
Upland Hardwood Forests	N/A	4200/4300
	Live Oak	4270
	Oak/Cabbage Palm	4271
	Cabbage Palm	4280
	Hardwood/Conifer Mixed	4340
Upland Coniferous Forests	N/A	4100
	Pine Flatwoods	4110
	Longleaf Pine	4120
	Sand Pine Scrub	4130
Dry Prairie	N/A	3100
Shrub and Brushland	N/A	3200
	Palmetto Prairies	3210
	Coastal Scrub	3220
Mixed Rangeland	N/A	3300

TABLE 3. NON-NATIVE (POTENTIALLY RESTORABLE) LAND USE/LAND COVER CLASSIFICATIONS

Primary Classification	Secondary Classifications	FLUCCS Codes
Extractive	N/A	1600
	Strip Mines	1610
	Sand and Gravel Pits	1620
	Rock Quarries	1630
	Reclaimed Land	1650
	Holding Ponds	1660
Institutional	N/A	1700
	Educational	1710
Recreational	N/A	1800
	Golf Courses	1820
	Marinas and Fish Camps	1840
	Parks and Zoos	1850
Open Land	N/A	1900
Cropland and Pastureland	N/A	2100
	Improved Pastures	2110
	Unimproved Pastures	2120
	Row Crops	2140
	Field Crops	2150
Tree Crops	N/A	2200
	Citrus Groves	2210
	Other Groves	2230
	Abandoned Groves	2240
Feeding Operations	N/A	2300
Nurseries and Vineyards	N/A	2400
	Tree Nurseries	2410
	Sod Farms	2420
	Ornamentals	2430
Specialty Farms	N/A	2500
	Horse Farms	2510
	Dairies	2520
	Aquaculture	2540
	Tropical Fish Farms	2550
Other Open Lands	N/A	2600
Exotic Species	Brazilian Pepper	4220
	Melaleuca	4240
	Australian Pine	4370
	Wet Melaleuca	6191
Reservoirs (< 1 acres)	N/A	5300
Sand other than Beaches	N/A	7200
Disturbed Lands	N/A	7400
	Borrow Areas	7420
	Spoil Areas	7430
Utilities	N/A	8300
	Treatment Ponds	8360

TABLE 4. EXISTING DEVELOPMENT AND NOT APPLICALBE LAND USE/LAND COVER CLASSIFICATIONS

Primary Classification	Secondary Classifications	FLUCCS Codes
Residential, Low Density	N/A	1100
	Fixed Single Family Units	1110
	Mobile Home Units	1120
	Mixed Units	1130
	Low Density Under Construction	1140
Residential, Medium Density	N/A	1200
	Fixed Single Family Units	1210
	Mobile Home Units	1220
	Mixed Units	1230
	Medium Density Under Construction	1290
Residential, High Density	N/A	1300
	Fixed Single Family Units	1310
	Mobile Home Units	1320
	Mixed Units	1330
	High Density Under Construction	1390
Commercial and Services	N/A	1400
	Retail Sales and Service	1410
	Shopping Centers	1411
	Junk Yards	1423
	Cemeteries	1480
	Commercial Under Construction	1490
Industrial	N/A	1500
	Oil and Gas Processing	1540
	Other Light Industrial	1550
Recreational	N/A	1800
	Swimming Beaches	1810
	Race Tracks	1830
	Stadiums	1870
Reservoirs (≥ 1 acre)	N/A	5300
Non-Vegetated	N/A	6500
	Tidal Flats	6510
	Shorelines	6520
Transportation	N/A	8100
	Airports	8110
	Private	8113
	Grass Airports	8115
	Railroads	8120
	Roads and Highways	8140
Communications	N/A	8200
Utilities	N/A	8300
	Electric Power Facilities	8310
	Electric Power Transmission Lines	8320
	Water Supply Plants	8330
	Sewage Treatment	8340
	Solid Waste Disposal	8350

SECTION 2
Goals and Objectives

The goal of the HRN Project was to develop opportunities and targets to support the CHNEP CCMP (2019) natural habitat protection restoration objectives as set out in the Fish, Wildlife, and Habitat Protection Action Plan and other regional stakeholder needs (e.g. SWFWMD SWIM plans). Specifically, the HRN Project addresses the following CHNEP strategies to promote and facilitate permanent acquisition and effective protection and management of critical natural habitats including wildlife dispersal areas, movement and habitat migration corridors, wetlands, flowways, and environmentally sensitive lands and estuarine habitats.

- **FW-1.1:** Protect and restore beneficial submerged aquatic vegetation, seagrasses, oysters, and coastal wetlands to manage and enhance ecosystem services.
- **FW-1.2:** Research and promote best management practices for tidal creeks, rivers, canals, dredged channels, and stormwater conveyances that support habitats and native aquatic life.
- **FW-2.1:** Encourage and support the permanent conservation of environmentally sensitive lands and critical habitat areas through land acquisition and conservation easements held in perpetuity, including freshwater wetlands, flow-ways, corridors, and uplands adjacent to coastal habitats necessary for habitat resilience and migration.
- **FW-2.2:** Encourage management of public lands and private lands with public conservation easements to protect, restore, and create native plant and animal communities, including eradication of invasive exotic species, prescribed fire, and other appropriate management activities.
- **FW-3.1:** Assist in assessing and promoting the economic, social and environmental benefits of land protection and habitat restoration, including as a response to climate stressors.

The overall project objective was to establish the restoration vision and goals for the entire program area, and to identify specific preservation/conservation and reservation opportunities and management/enhancement and restoration targets for each basin within the CHNEP boundary. The development of the vision, goals, and objectives was a collaborative effort among the CHNEP Management Conference Committees. Two of the main objectives of the project were to 1) assess the status and trends of the current habitats and 2) develop the habitat restoration vision and goals for the program area. The status and trends were based on past and current conditions and analyzed by habitat type and by basin, using the best data available at the onset of the project. The development of the vision and goals was science-based, considering existing habitats, existing development areas, and potential future impacts from sea level rise.

CHNEP Habitat Restoration Goals

The habitat restoration goals were developed to support the CHNEP Restoration Vision that was developed in collaboration with the CHNEP Management Conference:

> ***Vision: A diverse environment of interconnected, healthy habitats that support natural processes and viable, resilient native plant and animal communities***

Using the Additive Hybrid Approach (AHA) methodology presented in Appendix A, the following goals were developed. These areas were used to develop the opportunities and targets discussed in later sections of this report.

- **Existing Development Areas:**
  - Minimize future increases in impervious areas (e.g. low impact development [LID], Best Management Practices [BMPs]).
  - Identify opportunities to enhance existing development areas (e.g. living shorelines along seawalls to increase habitat, rain gardens along sidewalks and roadways for stormwater attenuation and treatment).
- **Preservation/Conservation Areas:**
  - Increase preservation and conservation lands and conservation easements wherever feasible.
  - Preserve or conserve native habitats in areas within the coastal stratum.
  - Focus HRN opportunities and future potential targets in the 100-year floodplains and other identified wildlife corridors.
  - Focus HRN opportunities and future potential targets adjacent to other preservation and conservation lands.
  - Work with willing landowners to increase or enhance preservation and conservation lands.
- **Reservation Areas:**
  - Minimize future increases in impervious areas within the coastal stratum (Section 3).
  - Reserve pervious undeveloped non-natural areas to maintain current use (i.e. not intensify use or harden) to accommodate future tidal wetland migration.
- **Management/Enhancement Areas:**
  - Maintain or increase the acreage of identified priority coastal and watershed habitats.
  - Manage or enhance native habitats in areas within the coastal stratum (Section 3).
  - Manage or enhance native habitats within 100-year floodplains.

- Focus on offsetting native habitat losses identified in the status and trends analysis (Section 4).
- Acknowledge that there are opportunities to work with willing landowners to expand management and enhancement of habitats currently in non-optimal natural condition.

- **Restoration Areas:**
  - Restore non-natives habitats in areas within the coastal stratum (Section 3).
  - Restore publically owned or private lands under conservation easement that contain non-native habitats within 100-year floodplains.
  - Restore publically owned or private lands under conservation easement that contain non-native upland habitats.
  - Give priority to restoration activities on publicly-owned preservation and conservation lands.

SECTION 3
Analysis

The HRN study was focused on tidal wetland, freshwater wetland, and upland habitats that fall within three distinct spatial strata—coastal, river floodplain, and upland as described in this section. Submerged estuarine habitats such as seagrass and hard-bottom communities were not part of this study nor were open water areas. This section provides an overview of the analysis used to support the HRN opportunity identification and target setting process. The process included the following eight steps:

1. Assessment of available GIS land use/land cover datasets
2. Categorization of FLUCCS codes and NRCS Soils
3. Habitat status and trends analysis
4. Identification of opportunity and target types
5. Identification of spatial strata
6. GIS map series development
7. Quantitative opportunity and target setting
8. Consideration of other HRN work products.

Each of these steps is described below.

Step 1: Assessment of Available GIS Land Use/Land Cover Datasets

The first step was the assessment of available GIS datasets applicable to habitat status and trends analysis, and opportunity and target setting. Florida Water Management Districts have been utilizing GIS technology to conduct land use/land cover mapping since the early 1990's. The land use/land cover coding and classification system used in the Water Management District GIS datasets is the FLUCCS. One complication in performing the status and trends analysis was that the CHNEP area falls within the jurisdiction of both the SWFWMD and the SFWMD respectively. The frequency of mapping and the photointerpretation and coding methodologies employed by these two agencies differ somewhat. These differences can result in inconsistencies in both same-year and off-year datasets.

It was determined that the earliest, reasonably comparable, GIS datasets available from both SWFWMD and SFWMD were from 1995. The most current datasets available from these two agencies were from 2009 (SFWMD) and 2011 (SWFWMD). Although the 2009 SFWMD dataset

is two years older than the 2011 SWFWMD dataset, it was determined that the two datasets were reasonably comparable, and generally represented conditions in the same time. Therefore, the time period 1995 to 2009/2011 was used for the habitat status and trends analysis, which was used to inform habitat opportunity and target setting.

Step 2: Categorization of FLUCCS Codes and NRCS Soils

The second step involved the categorization of FLUCCS codes to provide the basis for habitat opportunity and target setting. The entire list of FLUCCS codes contained in the 1995-2009/2011 GIS datasets was sorted into three categories:

- Native habitats
- Non-native
- Existing development

Note: Lands that did not have specific habitat IDs, e.g. open water of CHNEP area, were not included in the development of identifying opportunities and setting targets.

The **native habitats** category covers the range of natural plant communities that are endemic to the CHNEP area. Consistent with the additive hybrid approach methodology developed during the HRN project (Appendix A), all coded native habitats (listed in Table 2) were grouped into three major native habitat types:

- Tidal wetland habitats
- Freshwater wetland habitats
- Upland habitats.

These three major habitat types represent the habitat resources identified for preservation/conservation, reservation, management/enhancement, or restoration. Although native habitat types within the overall CHNEP area are treated as having equal importance in the overall ecology of the system, priority habitats were identified for the overall CHNEP area, and the eight basins, based on the habitat status and trends analysis in each basin. This analysis was undertaken to focus on disproportionate losses of habitats within each of the eight basins and highlight rare or unique habitats as priorities.

The **non-native** category includes existing altered, but non-hardened pervious land use/land cover types that could potentially support native habitats through the restoration of more natural hydrology, soils, and/or topography. Examples include: non-mandatory and first generation reclaimed mine lands; golf courses and parklands; cropland and pastureland; and borrow and spoil areas. The listing of the non-native FLUCCS codes is provided in Table 3.

The **existing development** category includes hardened, impervious developed land use/land cover types that may not be suitable or currently available for conventional habitat restoration activities. Examples include residential, commercial, and industrial development; transportation facilities

such as roadways and airports; and utilities such as power plants, wastewater treatment plants, etc. While existing development land use/land cover types are not currently considered for habitat restoration activities, it should be noted there are many opportunities to enhance habitat functions in densely developed areas. Examples include the construction of living shorelines or submerged habitat modules along urban seawalls and rain gardens along sidewalks and roadways. The listing of the existing development FLUCCS codes is provided in Table 4.

Concurrent with the categorization of FLUCCS codes, NRCS published soils data (Appendix F) for each of the seven counties within the overall CHNEP area was compiled to generate a list of all soil types occurring within the overall CHNEP area. The project team, with stakeholder input, analyzed each soil type within the overall CHNEP area in order to place them into categories representing the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands. The classification of the soils into the three categories was performed in order to develop a consistent comparison with the FLUCCS land use/land cover categorization to be used in the target setting. This initial NRCS soils categorization effort is further developed in the below steps.

Step 3: Habitat Status and Trends Analysis

The third step was the habitat status and trends analysis. As discussed above, GIS datasets for the time period 1995 to 2009/2011 were used for the habitat status and trends analysis. The objectives of the status and trends analysis were to: 1) establish the current (circa 2010) acreage and spatial distribution of native habitats in the CHNEP area; and 2) determine the change in the acreage of native habitats between 1995 and the current period. Although the time period 1995-2009/2011 represents a relatively recent snapshot of habitat conditions in the CHNEP area, the approximate 15-year spread was considered to be adequate to determine recent changes in habitat acreages under current federal and state environmental regulations (e.g., Clean Water Act, Section 404; Environmental Resource Permit rules).

The habitat status and trends analysis both established the current (circa 2010) benchmark of habitat acreages and spatial distributions, and revealed which habitats were disproportionately lost or altered over the study period due to various stressors, including: development, agriculture and silviculture, mining, climate change and sea level rise, consumptive water use, and others. The results of the habitat status and trends analysis are presented in Section 4.

Step 4: Identification of Opportunity and Target Types

The fourth step involved developing a system of organization so opportunity and targets could be quantified. As discussed above, existing development land use/land cover types represent areas where native habitats once existed but have been replaced by urban and coastal development through dredging, filling and/or hardening (e.g., construction of impervious surface; vertical seawalls, etc.). For the purposes of habitat opportunity and target setting, current existing development areas were removed from the analysis and not considered in the establishment of the four primary opportunity and target types discussed below. A quantitative target for existing

development areas (e.g., a cap on future existing development acreage in the CHNEP area) was not developed.

The FLUCCS land use/land cover categorized in Steps 1 and 2, were used to develop opportunities and targets for native habitat types within the overall CHNEP area and the eight basins.

Opportunities are best defined as lands in native, or near-native condition that are not currently in preservation or conservation. These areas present an "opportunity" to work with willing land owners, both public and private, to preserve, conserve, and potentially enhance habitats within the watershed.

Targets are derived from both public and private lands under conservation easements or otherwise protected for preservation or conservation that have the potential to benefit from more active land management or restoration. For privately owned lands this could be accomplished with the support of willing landowners. Numerous funding opportunities and partnerships exist to support such purposes.

These analyses were conducted excluding developed areas, and "other" areas without identified habitat value (e.g. open waters) by agencies, CHNEP Management Conference, or other organizations, or not within the scope of this project (e.g. submerged habitats). Ultimately, two (2) opportunity and two (2) target categories were developed and defined using the process depicted in Figure 2.

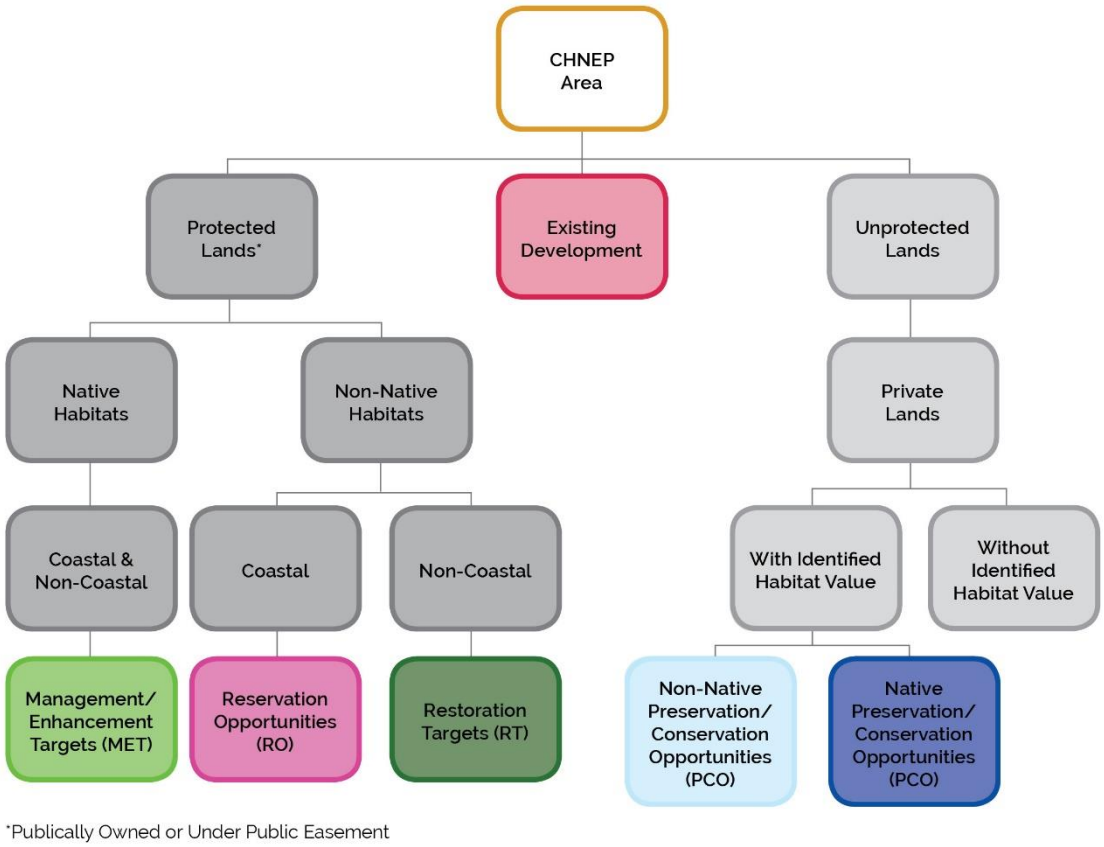


Figure 2. Opportunity Identification and Target Setting Flow Chart

The resultant opportunities and targets are discussed below.

Opportunities:

Preservation/Conservation Opportunities (**PCO**) include both native and non-native habitats that are not currently protected (e.g., in private ownership), and are identified for potential public acquisition or other mechanisms to ensure their preservation or conservation (e.g., conservation easements). These areas present an "opportunity" to work with willing land owners, both public and private, to preserve, conserve, and potentially enhance habitats within the watershed. These potentially restorable lands would expand existing preservation and conservation lands into larger ecosystem units and consolidate major wildlife corridors within the CHNEP area.

Reservation Opportunities (RO) include altered (non-native) but non-hardened pervious areas (e.g., ballfields, golf courses, etc.), within the nearshore coastal zone (see Step 5) that are expected to experience increased tidal flooding and inundation due to future sea level rise, and that could potentially accommodate tidal habitat migration in the future. The reservation concept is to discourage intensification of use in these areas.

Targets:

Management/Enhancement Targets (**MET**) include native public or private lands within the CHNEP area that are protected by conservation, easement or similar development constraints. These areas may be maintained in natural or near-native habitat, but could benefit from more active land management or habitat enhancement, and may support future restoration activities. Many of these lands, including those in private ownership, are eligible for a myriad of funding opportunities if willing landowners seek to enhance the native character, or habitat functionality of those lands.

Restoration Targets (**RT**) include both public and private lands under conservation easements or otherwise protected for preservation or conservation purposes that are currently in non-native habitat condition. The RT areas represent potentially restorable habitats that could benefit from more intensive restoration activities (e.g., regrading/planting, hydrologic restoration). The NRCS soils categorized in Step 1 and 2 were also applied to the RT to further refine those by habitat type and calculate targeted acreages in those habitats.

These opportunity and target maps were overlain to ensure there was no overlap between the categories defined above.

Step 5: Identification of Spatial Strata

The fifth step involved the identification of spatial strata. In addition to the three major native habitat types discussed above, three spatial strata were defined as focus areas for habitat opportunity and target setting, extending from the Charlotte Harbor system, up through the rivers and tributaries, to the upland reaches of the CHNEP area. The three spatial strata included:

- Coastal stratum
- River floodplain stratum
- Upland stratum.

The **coastal stratum** for this project is defined as the region where the interaction of sea and land processes occurs, and where sea level rise is mostly likely to be expressed over the next 100 years. This stratum includes the vast majority of existing tidal wetland habitats, as well as nearshore coastal upland areas that are expected to experience increased tidal inundation in the future as a result of sea level rise. Coastal uplands are essential to support landward migration of tidal wetlands with sea level rise.

This study includes all native habitats extending landward from the intertidal zone, but does not include the subtidal zone and associated habitats like seagrass and hard bottom. The seaward boundary of the intertidal zone is generally defined as the Mean Low Water (MLW) Line, or mean low tide. This is a convenient boundary as it generally corresponds to the seaward limit of mangroves in Southwest Florida estuaries. For the purpose of this study, the MLW line is used simply to demarcate the seaward limit of the habitats addressed in this report. The standard used to define tidal data was the North American Vertical Datum of 1988 (NAVD88). This study completed by NOAA established a consistent reference point for defining tidal data along the U.S. coastline. All tidal data used today are referenced to 0.00 NAVD88.

The 5-foot contour is used to define the HRN project's coastal stratum. Determination of the 5-foot contour is explained below. Consistent LiDAR or topographic data for the entire CHNEP area was not available, so a coastal boundary elevation layer was created for the project GIS analyses. Topographic data from the NOAA Sea Level Rise Viewer website was used to accomplish this. NOAA defines their 5-foot sea level rise scenario and GIS layer as 5 feet above the existing Mean Higher High Water (MHHW) line, which ranges from +5.27 to +5.31 feet NAVD88 in the Charlotte Harbor system. Therefore, the 5-foot contour, as presented in this report, extends landward from the MHHW line up to an elevation of 5-feet above MHHW.

In the HEM report (Appendix B), NOAA (2017) sea level rise projections for the coastal U.S was utilized for the analysis. The NOAA Intermediate High Scenario predicts sea level to rise 2.6 feet by 2070, and 6.6 feet by 2120. The 5-foot contour was deemed appropriate as it approximates the 2100 projection and is an understandable and consistent reference point measurement.

The **river floodplain stratum** includes all areas within the FEMA (1996) mapped 100-year floodplains for major tributaries to the Charlotte Harbor estuarine system. The 100-year floodplains of the major rivers – the Peace River, the Myakka River, and the Caloosahatchee River – and their respective tributaries, typically include forested and herbaceous freshwater wetlands and native riparian upland communities. River floodplains are the "kidneys" of the estuary, and these areas provide a wide range of ecosystem services including: flood storage and attenuation; water quality treatment; structural fish and wildlife habitat and migratory corridors; and the production of organic matter that serves as the basis of the estuarine food web.

The **upland stratum** includes areas that are landward of the coastal stratum and outside the 100-year river floodplains. Upland habitats provide important ecosystem functions including aquifer recharge and wildlife habitat. Rare or highly threatened upland habitats include sand pine scrub, longleaf pine, wet pine flatwoods, and hydrologically isolated forested and herbaceous wetlands. These are wetlands with no apparent surface water connection to perennial rivers and streams, estuaries, or the Gulf of Mexico. In addition, the upland stratum includes habitats documented as wildlife corridors important for listed wildlife species, such as the endangered Florida panther.

Step 6: GIS Map Series Development

In consideration of the steps discussed above, the next step involved the development of GIS map series to graphically depict two opportunity types and two target types. The analysis resulted in a three map series, which includes the following:

- Map Series 1 – Preservation/Conservation Opportunities (PCO);
- Map Series 2 – Reservation Opportunities (RO); and
- Map Series 3 – Management/Enhancement Targets (MET) and Restoration Targets (RT)

Map series 1 and 3 include maps of the entire CHNEP area as well as higher resolution maps for each of the eight major basins. Map series 2 includes only the coastal basins. The three map series are described in detail below.

PCO – These maps include only privately-owned lands. Mapped areas include portions of areas that have been recommended by stakeholders and/or other natural resource agencies for preservation or conservation through public acquisition or conservation easements. The mapped areas include native habitats (dark blue) (FLUCCS codes listed in Table 2), that if preserved or conserved would expand existing preservation and conservation lands into larger ecosystem units and consolidate major wildlife corridors within the CHNEP area. These maps also include non-native habitats (light blue) that fit the criteria to be PCO and that are potentially restorable. These lands are mapped throughout the entire CHNEP area and in all three spatial strata.

RO – These maps include publicly-owned and private lands that are currently under conservation easements lands within the coastal stratum, which are classified as containing non-native habitats (pink) (e.g., active recreational areas such as ballfields, golf courses, etc.). This stratum includes the vast majority of existing tidal wetland habitats, as well as nearshore coastal upland areas that are expected to experience increased tidal inundation in the future as a result of sea level rise. The mapped publicly-owned coastal uplands are recommended for reservation to accommodate landward migration of tidal wetlands with sea level rise. Privately-owned lands, not under conservation easement, in the coastal stratum are included in the PCO map series, with the assumption being that they must be publicly acquired or otherwise conserved before they can be designated for reservation.

MET and **RT** – These maps include both public and private lands that are currently under conservation easements or otherwise protected for preservation or conservation purposes. Native habitats within these areas are mapped for management/enhancement (light green); whereas, non-

native (potentially-restorable) land use/land cover types within these areas are mapped for restoration activities (dark green). These lands are mapped throughout the entire CHNEP area, including all three spatial strata.

Concurrent with the preparation of the MET and RT maps, the RT polygons (dark green) were overlaid onto the published NRCS soils data in a GIS mapping exercise and clipped to these boundaries. The raw data for each soil type that occurs within the RT areas were quantified for the overall CHNEP area and the eight basins. Each soil type and associated acreage was then placed into one of three native habitat types developed in Step 1 (tidal wetland, freshwater wetland, and upland habitat). The final product was a total of nine tables (Appendix E) that formed the basis for the Restoration targets.

The rationale for this approach is that habitat restoration and management/enhancement activities can best be conducted on lands that are already protected for preservation or conservation purposes. Native habitats within these areas (light green) are mapped to show where habitat management/enhancement activities can be conducted, including exotic species control and prescribed burning. Non-native (i.e., potentially restorable) land use/land cover types within these areas (dark green) are mapped to show where restoration activities can be conducted. This includes activities like regrading/planting and hydrologic restoration.

Step 7: Quantitative Opportunity and Target Setting

In the context of this HRN project, targets have been developed for the areas that should be managed/enhanced or restored, and opportunities have been identified for that areas that have the potential to be preserved/conserved or reserved. Opportunities were identified and numeric targets (calculated in acres) were developed from the 2009 SFWMD/2011 SFWMD GIS data used to create the three map series, as described below.

Preservation/Conservation Opportunities (PCO)

Using the PCO map series, opportunities were identified from private lands that should be first considered for public acquisition or conservation, and then investigated for MET and RT potential. The PCO for each habitat type are provided in Table 5 in Section 4, and constitute the acreage distribution of native habitats and non-native habitats that currently exist within the 517,776 acres of PCO lands. The native habitat opportunities derived from this analysis represent natural lands that could potentially be future PCO areas, and if these lands are publicly acquired or otherwise protected they could be potential MET. The non-native habitat opportunities derived from this analysis represent potential future RO areas that may be maintained in a non-natural state to accommodate potential habitat migration, and RT areas that could benefit from more intensive restoration activities (e.g., regrading/planting) once these lands are publicly acquired or otherwise protected.

Reservation Opportunities (RO)

Using the RO map series, opportunities were derived from publicly-owned lands, and private lands with conservation easements, within the coastal stratum that are currently non-native habitats. The RO for each habitat type are provided in Table 5 in Section 4, and constitute the acreage distribution of non-native habitats that currently exist within this category. As discussed above, the concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise through maintaining non-natural green spaces (not intensifying use or hardening). The non-native habitat opportunity derived from this analysis represent areas that could be retained as coastal upland buffers to accommodate projected sea level rise while maintaining their current level of use.

Management/Enhancement Targets (MET)

Using the MET and RT map series and NRCS soils tables, targets were derived from publicly-owned preservation or conservation lands, and private lands (i.e. mitigation banks) under conservation easement, that need varying degrees of management/enhancement for native lands. The MET for each habitat type are provided in Table 5 of Section 4, and constitute the acreage distribution of native habitats that currently exist within this category. The native habitat targets derived from this analysis represent natural lands that may need ongoing management activities such as prescribed burning, or larger scale activities like hydrologic restoration.

Restoration Targets (RT)

Using the MET and RT map series and NRCS soils tables, targets were derived from publicly-owned non-native preservation or conservation lands, and private lands (i.e. mitigation banks) under conservation easement that need restoration to return to native habitat types. The RT for each habitat type are provided in Table 5 of Section 4, and constitute the acreage distribution of non-native habitats that currently exist within this category. The non-native habitat targets derived from this analysis represent potentially restorable areas that could benefit from more intensive restoration activities (e.g., regrading/planting).

Step 8: Consideration of Other Work Products

Supplemental work products were incorporated into the HRN project to inform the habitat opportunity and target setting process described above. The Wood Group work products below were created to provide certain analyses and insights to support the overall HRN effort. The HRCC project was contracted as a separate effort to the HRN, but the results were incorporated into this project. Each of the works products is briefly described below with an explanation of how each was used to inform the opportunity and target setting process.

- **Appendix B: ESA Habitat Evolution Model (HEM) Report** – This document was prepared by Environmental Science Associates (ESA) as part of the HRCC project. This was not part of the HRN project, but the results from this study were used to inform the HRN project approach. The HEM results were used as the basis for the identification of the coastal stratum, and supported the development of the reservation concept identified in

the HRN approach. This HRCC project involved the development of a HEM specific to the CHNEP estuarine system. The HEM was used to develop predictions of tidal wetland changes (e.g., vegetation community shifts and landward migration) in response to various projected sea level rise scenarios. From this work, it was determined that tidal wetlands in the CHNEP area will become gradually more dominated by mangroves, which will supplant salt marshes over time. Under more extreme sea level rise projections, tidal wetlands in many portions of the estuarine system will lost entirely due to *pinch out* effects along urban shoreline. This *pinch out* effect refers to habitats getting pushed landward as a response to sea level rise but not coming up against hardened shoreline and not having anywhere to go. The work presented in this document solidified ESA's recommendations for including reservation areas as a primary opportunity type. In addition, this work also indicated that salt marshes will be disproportionately lost over the next several decades, and may need to be prioritized for restoration.

- **Appendix C: Headwater Streams Technical Memorandum** - This document was prepared by The Wood Group (John Kiefer, Ph.D.) as a sub consultant to ESA. The purpose of this study was to describe a prototypical restoration design approach specific to headwater streams in reclaimed mined lands. This work was used to inform the types of restoration projects that should be prioritized in the river floodplain stratum.
- **Appendix D: Mining Areas Technical Memorandum** - This document was prepared by The Wood Group (John Kiefer, Ph.D.) as a sub-consultant to ESA. The purpose of this document was to describe the various generations of reclaimed phosphate mined lands within the CHNEP area, to inform ESA's recommendation that the non-mandatory (pre-1975) and first generation (circa 1975-1980's) reclaimed mined lands should be prioritized for restoration activities.

SECTION 4
Results, Recommendations, and Conclusions

This section presents the results of the additive hybrid approach opportunity and target setting analyses. Results are presented for the entire CHNEP area as a whole, as well as each of the eight basins within. The results include a brief summary of the habitat status and trends analyses and the numeric opportunity and target tables by habitat or soil type; and a brief narrative of each opportunity or target type: PCO, RO, MET, and RT. Recommendations from the HRN study are presented following the results section and support four types of opportunities and targets with particular focus on the three strata identified in Section 3: tidal wetlands, freshwater wetlands, and uplands.

Results

To facilitate the implementation of the science-based habitat restoration vision for the CHNEP area, numerous sources were utilized including: a multitude of relevant GIS data layers (a comprehensive list is presented in Appendix F); land use/land cover data, Florida panther primary and secondary dispersal zones, and stakeholder input from members of the CHNEP Management Conference Committees. These sources were used to develop opportunities and targets for each of the major categories: PCO, RO, MET, and RT. The results generated from the implementation of the methods presented in Appendix A and analysis described in Section 3 are presented in this section.

Prior to the development of the HRN opportunities and targets, all existing development lands within the overall CHNEP area, as defined in Appendix A and Table 4, were identified and mapped. Existing development lands were those land use/land cover categories identified as not suitable, or currently available, to be restored to a native, more natural state. However, these habitats may be enhanced (e.g., living shorelines along seawalls, rain gardens along sidewalks and roadways). For example, residential and commercial infrastructure was excluded from the analysis. A total of 429,888 acres of existing development was identified within the overall CHNEP area and subsequently removed the target setting analysis (Figure 3). The majority of land use/land cover was classified as residential (341,096 acres; 79%).

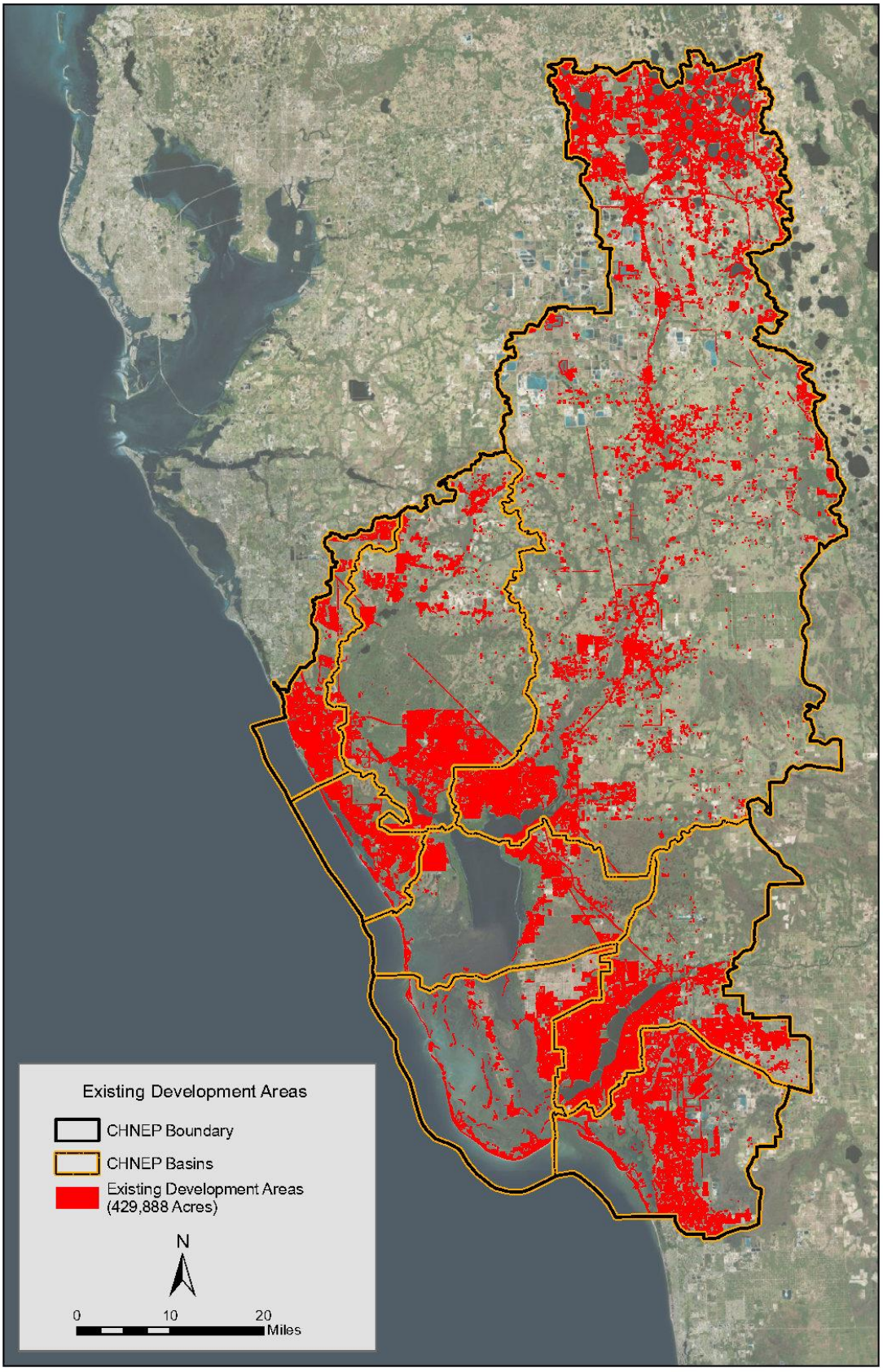


Figure 3. CHNEP Overall Area Existing Development Areas.

All maps and data presented for the PCO, RO, MET, and RT categories in this section exclude any lands that fall under the existing development category. The land use/land cover classifications that were not considered existing development were divided into native and non-native (potentially restorable) habitat classifications as defined in sections above, to better facilitate the preservation, conservation, and restorative capacity of the land use types. Native habitats analyzed are those lands that support a predominance of native plant species in an arrangement that can be defined as upland habitats (e.g. coniferous forests) or tidal or freshwater wetlands (e.g. saltwater or freshwater marsh). Non-native (i.e., potentially restorable) habitats are those lands that support altered habitats, e.g. extractive and recreation, converted lands such as pastures and croplands, and lands with a predominance of exotic plant species. To further support the habitats identified for restoration prioritization, a land use change analysis comparing the loss/gain of native habitats over the period of 1995 to 2009/2011 was performed. Summaries of the land use change analysis, and targets by land use/land cover classification (consistent with Table 2 and 3) for the overall CHNEP area, as well as for each of the eight basins, are provided below.

The following sections present the HRN opportunities and targets, habitat migration modeling results, and habitat status and trends analysis for the overall CHNEP area and each of its eight basins.

CHNEP Area

A brief description of the CHNEP area is provided in Section 1. The land use/land cover habitat classifications within the overall CHNEP area were divided into four categories: PCO, RO, MET and RT. The overall CHNEP area totals 3,020,750 acres. The following categories represent areas that were identified by regional agencies, stakeholders, and the CHNEP Management Conference as important areas for consideration; however, they do not include the entirety of the CHNEP area. Only priority areas outlined above were identified in the HRN project constituting approximately one-third of the CHNEP area. The results for the CHNEP area are presented in the following narrative and in Figures 4 through 6.

Preservation/Conservation Opportunities (PCO)

The PCO were identified from private lands that may be considered for potential acquisition. If acquired, these lands may later be investigated for potential MET and RT. There were 517,776 acres of PCO identified for the overall CHNEP area. These opportunities were broken out into three categories of major native habitats: uplands (151,080 acres), freshwater wetlands (148,781 acres), and tidal wetlands (9,134 acres). In addition, 208,781 acres of non-native PCO were identified (Table 5; Figure 4). Overall, the area identified as PCO constitutes 17 percent of the total lands within the overall CHNEP basin. The dominant native habitat communities were classified as shrub and brushland (52,919 acres; 10%), pine flatwoods (56,276 acres; 11%), and streams and lake swamps (52,455 acres; 10%). Cropland and pastureland (137,681 acres; 27%) was identified as the major non-native habitat classification within the overall basin. Appendix E presents the detailed results.

Overall, the PCO were distributed throughout the CHNEP limits (Figure 4). The native habitat communities were primarily found in association with the major tributaries which bisect the

CHNEP area. In contrast, the majority of non-native habitat communities were identified farther from the riverine systems. There were 26,535 acres of PCO identified within primary and secondary Florida panther habitat located in the southeast portion of the CHNEP area, predominantly in the Estero Bay basin. The Florida panther habitat acreages presented in Figure 4 are a map overlay on the main PCO mapped areas. That acreage is included in the overall PCO acreages.

Reservation Opportunities (RO)

The RO were derived from non-native public lands and private lands (i.e. mitigation banks) under conservation easement located within the coastal stratum. A total of 1,590 acres was identified as RO (Figure 5; Table 5). Overall, the acreage identified for RO constitutes less than one percent of the total lands within the CHNEP watershed. The dominant habitat community was classified as exotic species which consists of Brazilian pepper, Australian pine, and melaleuca (1,026 acres; Appendix E). RO were prominent near the estuarine complex within Charlotte Harbor (Figure 5).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in response to sea level rise in tidally influenced areas. The overall CHNEP HEM map (Figure 7) illustrates model Run 3 (Intermediate-High Sea Level Rise, Low Accretion) for Years 2016 and 2070. The results illustrate the large extent of open water created by sea level rise, as well as the loss of mangroves and its migration higher in the landscape. In the 2070 map, the *Juncus* marsh is almost entirely engulfed by open water, and is almost non-existent by 2120.

Management/Enhancement Targets (MET)

MET were derived from native land use classifications within publicly-owned preservation or conservation lands, and private lands (i.e. mitigation banks) under conservation easement. Overall, private lands in public easements represent only 10% of the target acreages. MET areas represent natural lands that may need ongoing management activities (e.g., prescribed burning), or larger scale restoration activities (e.g., hydrologic restoration). A total of 447,683 acres were identified as MET, which constitutes 15 percent of the total lands within the overall CHNEP area. MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be managed or enhanced (Table 5). The uplands category provides the greatest area for MET (207,767 acres) for the overall CHNEP area.

Restoration Targets (RT)

RT were identified for non-native lands within publicly-owned preservation/conservation lands that include private lands (i.e. mitigation banks) under conservation easement. Overall, private lands in public easements represents only 10% of the target acreages. The RT represent potentially restorable areas that could benefit from more intensive restoration activities (e.g., regrading/planting). In total, 88,130 acres were identified as RT, which constitutes 3 percent of the total lands within the overall CHNEP area (Figure 6; Table 5). RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands to distinguish the types of overall habitats that could be restored (Table 5). The uplands category provides the greatest area

for RT (56,092 acres) for the overall CHNEP area. The RT also provides for the potential restoration of 31,952 acres of freshwater wetlands.

Wildlife Corridors and Priority Native Habitats

Information related to focal species, e.g. Florida panther, black bear, red-cockaded woodpecker, Florida scrub-jay, and other state and federally protected wildlife species, and corridors that link preservation, conservation, and restoration lands within the southwestern portions of peninsular Florida were incorporated into the opportunity and target setting. Published habitat corridors include: Integrated Habitat Network (IHN), Southwest Florida Landscape Conservation Design (LCD), Critical Lands and Waters Identification Project (CLIP), and other corridor and native habitat data sets (see Appendix F). The habitat analysis results presented here identify habitats in decline and quantify (or document the lack of) important habitats (e.g. scrub oak/sand pine scrub and long leaf pine habitats) that are in such scarcity that they are in danger of being entirely lost, or are not being managed to maintain their full ecological function. In addition, important habitats for plants and animals whose survival and flow of genetic material are based on the existence of these habitats were also incorporated. For example, the incorporation of primary and secondary Florida panther habitats, known Florida scrub-jay and red-cockaded woodpecker territories, black bear home ranges, as well as habitats identified by IHN Priority Habitats ranking 5 through 10, further help refine declining native habitats and important habitats needed for ecosystem level habitat preservation and multiple species-specific habitats and habitat linkages needed for preservation and management.

The vision of various state, federal, and other organizations is to create a series of connected undisturbed natural communities and restored habitats to improve connections among currently fragmented regional habitat nodes, establish new nodes, and enlarge existing ones. The idea is to create a series of highly networked wildlife corridors linking some of the region's best remaining, and largest habitat nodes. Cooperative landscape conservation processes identify ecologically-connected networks of terrestrial, freshwater, coastal, and marine conservation areas and conservation priority areas that are likely to be resilient to climate change and support native biodiversity (and related ecosystem services) under changing conditions (NWRA 2017).

Florida Natural Areas Inventory, the University of Florida Center for Landscape Conservation Planning, and the Florida Fish and Wildlife Conservation Commission have developed the CLIP database to assess and incorporate available GIS data for identifying statewide areas of interest for protecting biodiversity, water resources, ecosystem services, and other natural resource values. (Oeting et al. 2016). Figure 8 and the list below, illustrate wildlife corridors that were identified by CHNEP stakeholders to be considered for connections to existing conserved public lands and private lands (i.e. mitigation banks) within the CHNEP limits.

- Myakka River Corridor
- Peace River Corridor
- Charlotte Harbor to Lake Okeechobee Corridor (through Webb and Babcock Ranch areas)

- Publicly owned areas along the "western wall" and "eastern wall" of Charlotte Harbor proper
- Estero Bay to Corkscrew Swamp Sanctuary Corridor

Habitat Status and Trends Analysis

A change analysis was completed for the entirety of the CHNEP area (Table 6), and the eight basins within. This analysis quantifies the overall gains/losses of habitats between 1995 and 2009/2011. The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitat changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within the overall CHNEP area, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development, agriculture, and mining areas;
- Forested freshwater wetlands converting to non-forested freshwater wetlands through silviculture;
- New non-forested freshwater wetlands from mine reclamation; and
- Salt marshes transitioning to mangroves.

Mapping inconsistencies observed in the change analysis included the following:

- 1995 existing development lands were re-mapped as dry prairie for Cape Coral and Lehigh Acres in 2009/2011;
- Slough waters classification was not used in 2009/2011;
- Increases in intermittent pond classification occurred from development between 1995 and 2009/2011. Also, open water ponds that became shallow ponds were re-mapped to intermittent ponds classification in 2009/2011; and
- Salt flats were mapped in 2009/2011 within Charlotte Harbor State Park (at the southern limits of the Cape Haze Peninsula, around Cattle Dock Point and the West Wall), where they had previously not been captured in mapping.

CHNEP Area Summary

When compared to other Florida estuarine systems, the surface area of the overall contributing watershed of the CHNEP area is relatively large (3,020,750 acres), while the proportion of existing development in the watershed, approximately 14 percent, is relatively small. And while most of the

existing development is concentrated along the Gulf coast and Charlotte Harbor, a substantial portion of the nearshore tidal wetlands and coastal uplands are already preserved or conserved in public ownership.

In terms of anthropogenic modifications, the three major river systems in the CHNEP watershed are very different. The Peace River has the largest watershed area and is free-flowing; however, the headwaters have been impacted by extensive phosphate mining, while the middle reaches are mostly characterized by agricultural land uses. A major surface water withdrawal for potable supply occurs on the lower Peace River. The Myakka River is impounded, but its watershed is relatively undeveloped and characterized mostly by native habitats and agricultural and residential land uses. The Caloosahatchee River is a highly modified system, with both impoundments and substantial channelized flow diversions from Lake Okeechobee, which is not historically a part of the Caloosahatchee drainage basin.

The habitat status and trends analysis for the CHNEP area showed that: 1) native upland habitats, primarily pine flatwoods, have suffered disproportionate losses from expanding urban development and should be considered a priority habitat for restoration; 2) forested freshwater wetlands have been converted to non-forested wetlands through silviculture activities; and 3) mangrove swamps are encroaching into native salt marshes. The latter observation confirms the findings of the HEM, which predicts the landward migration of mangroves, and the upstream migration of salt marshes in the tidal rivers and tributaries, in response to projected sea level rise over the next 100 years. Based on these predictions, ensuring appropriate freshwater inflows, and restricting future impoundments, in the tidal rivers and tributaries will be important to preserving the balance of the primary tidal wetlands, mangroves and salt marshes, throughout the CHNEP area.

Despite the changes noted above, the relatively small percentage of existing development in the CHNEP area allows extensive opportunities for preservation and conservation of the remaining native habitats in the CHNEP area. The 100-year floodplains of the three major river systems constitute important fish and wildlife corridors that are still relatively intact, but could be substantially improved by strategically-located public land acquisition – with over 517,776 acres of PCO identified by CHNEP stakeholders and other natural resource agencies. However, given that a substantial portion of the nearshore tidal wetlands and coastal uplands are already preserved or conserved in public ownership, relatively few opportunities for reservation, approximately 1,500 acres, were identified throughout the entire CHNEP area.

A total of 447,683 acres of native habitats, over 15 percent of the CHNEP area, occur within existing preservation and conservation lands; and these areas allow extensive opportunities for habitat management activities to optimize ecosystem functions. In addition, 88,130 acres of altered, non-native habitats occur within existing preservation and conservation lands; and these areas allow for extensive opportunities for true habitat restoration; extending from upland habitats, to freshwater wetlands, to tidal wetlands. The MET and RT targets were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the general classes of habitats that could be restored or managed. The uplands category provides the greatest area for both RT and MET, 207,767 acres and 56,092 acres, respectively, for the overall CHNEP area. The RT also provides for the potential restoration of 31,952 acres of freshwater wetlands. In

particular, the upper reaches of the Peace River basin provide extensive restoration potential for headwater streams and riparian wetlands on reclaimed mine areas. In conclusion, the CHNEP area offers large-scale opportunities for the preservation/conservation, and management/enhancement of existing native habitats, as well as the restoration of altered non-native habitats.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The results presented in the tables and maps below can form the foundation for future studies.

TABLE 5. HRN OPPORTUNITIES AND TARGETS FOR THE OVERALL CHNEP AREA BY MAJOR HABITAT TYPE.

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	151,080	N/A	207,767	56,092
Freshwater Wetlands	148,781	N/A	181,214	31,952
Tidal Wetlands	9,134	N/A	58,702	86
Non-Native	208,781	1,590	N/A	N/A
Total	517,776	1,590	447,683	88,130

TABLE 6. HRN CHANGE ANALYSIS GAINS/LOSSES FOR THE OVERALL CHNEP AREA BY HABITAT CLASSIFICATION TYPE.

FLUCCS Codes	Primary Classification	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	7,663	47,074	39,411	*
3200	Shrub and Brushlands	212,550	169,543	-43,007	-20%
3300	Mixed Rangelands	12,057	20,155	8,098	*
4100	Upland Coniferous Forest	267,232	198,335	-68,897	-26%
4200/4300	Upland Hardwood Forest	84,915	69,816	-15,099	-18%
5100	Streams and Waterways	27,411	28,313	902	3%
5200	Lakes	34,085	31,450	-2.635	-8%
5600	Slough Waters	597	N/A	N/A	*
6100	Wetland Hardwood Forest	164,424	178,819	14,395	9%
6120	Mangrove Swamp	60,990	61,894	904	1%
6200	Wetland Coniferous Forest	53,401	60,673	7,272	14%
6300	Wetland Forested Mixed	15,923	12,815	-3,108	-20%
6400	Vegetated Non-Forested Wetlands	196,930	242,525	45,595	23%
6420	Saltwater Marsh	12,436	12,206	-230	-2%
6530	Intermittent Ponds	97	652	555	*
6600	Salt Flats	4	563	559	*

*Differences in mapping methodologies between periods may account for some anomalies in the data.

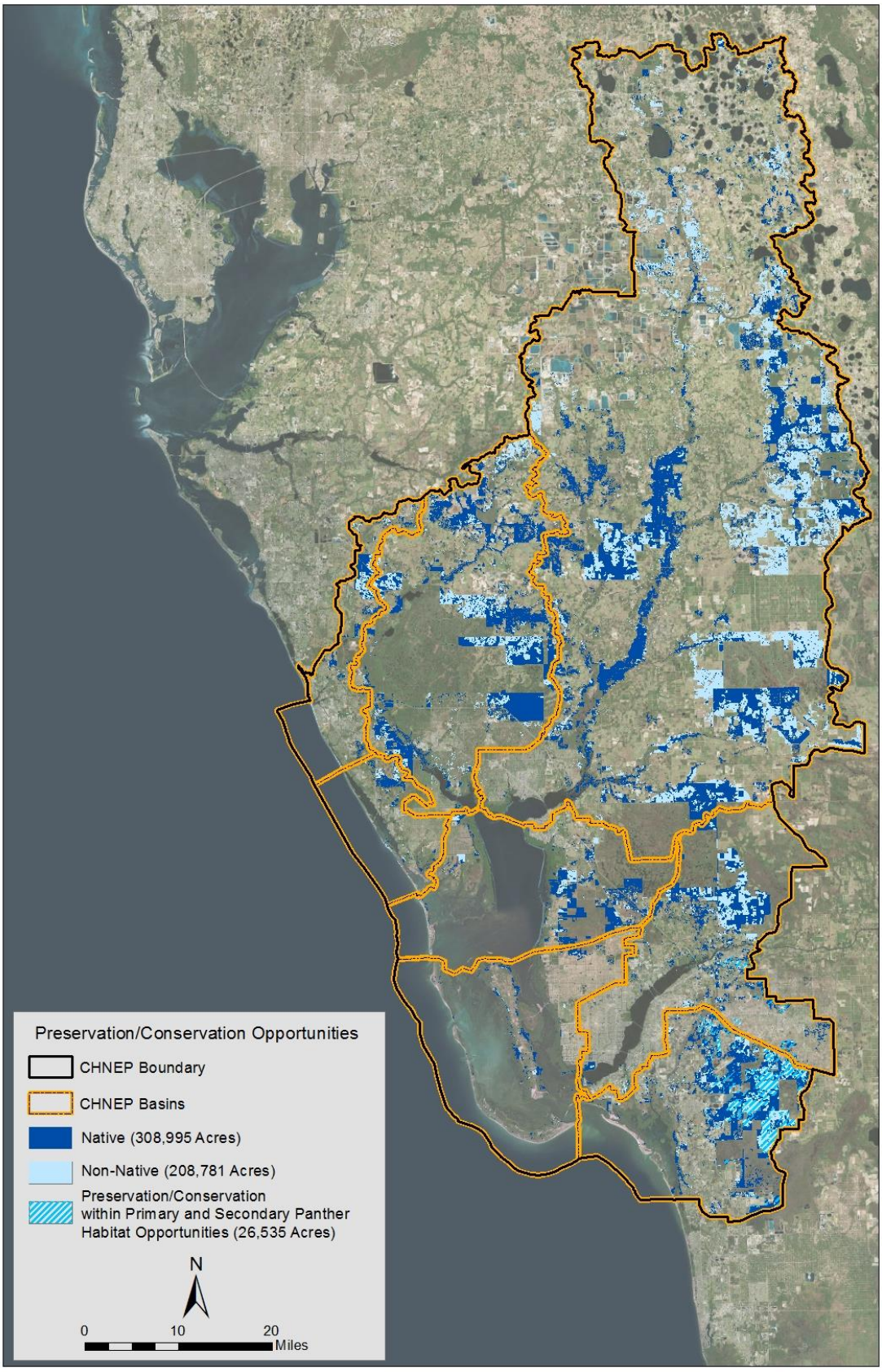


Figure 4. CHNEP Area PCO.

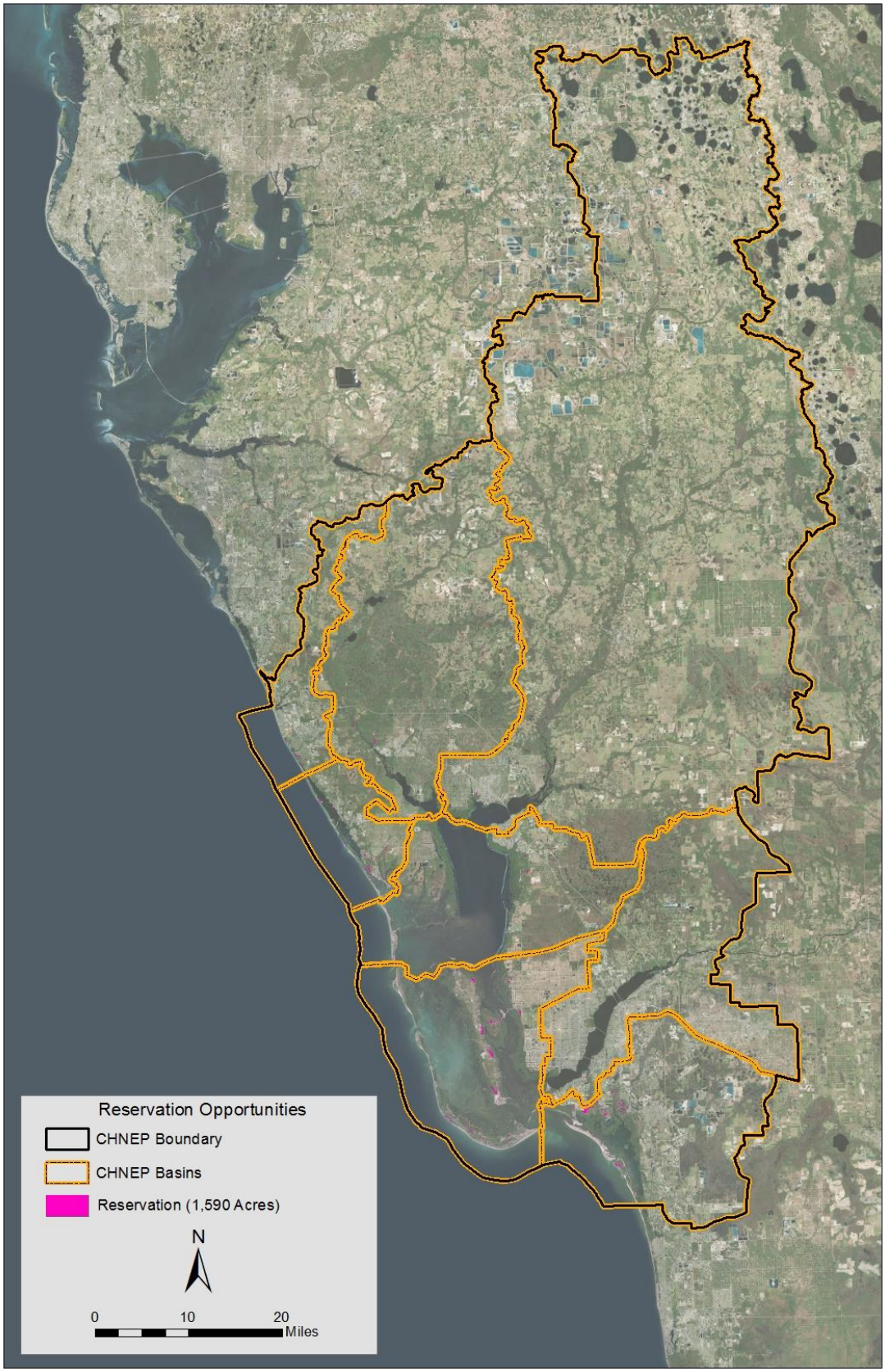


Figure 5. CHNEP Area RO.

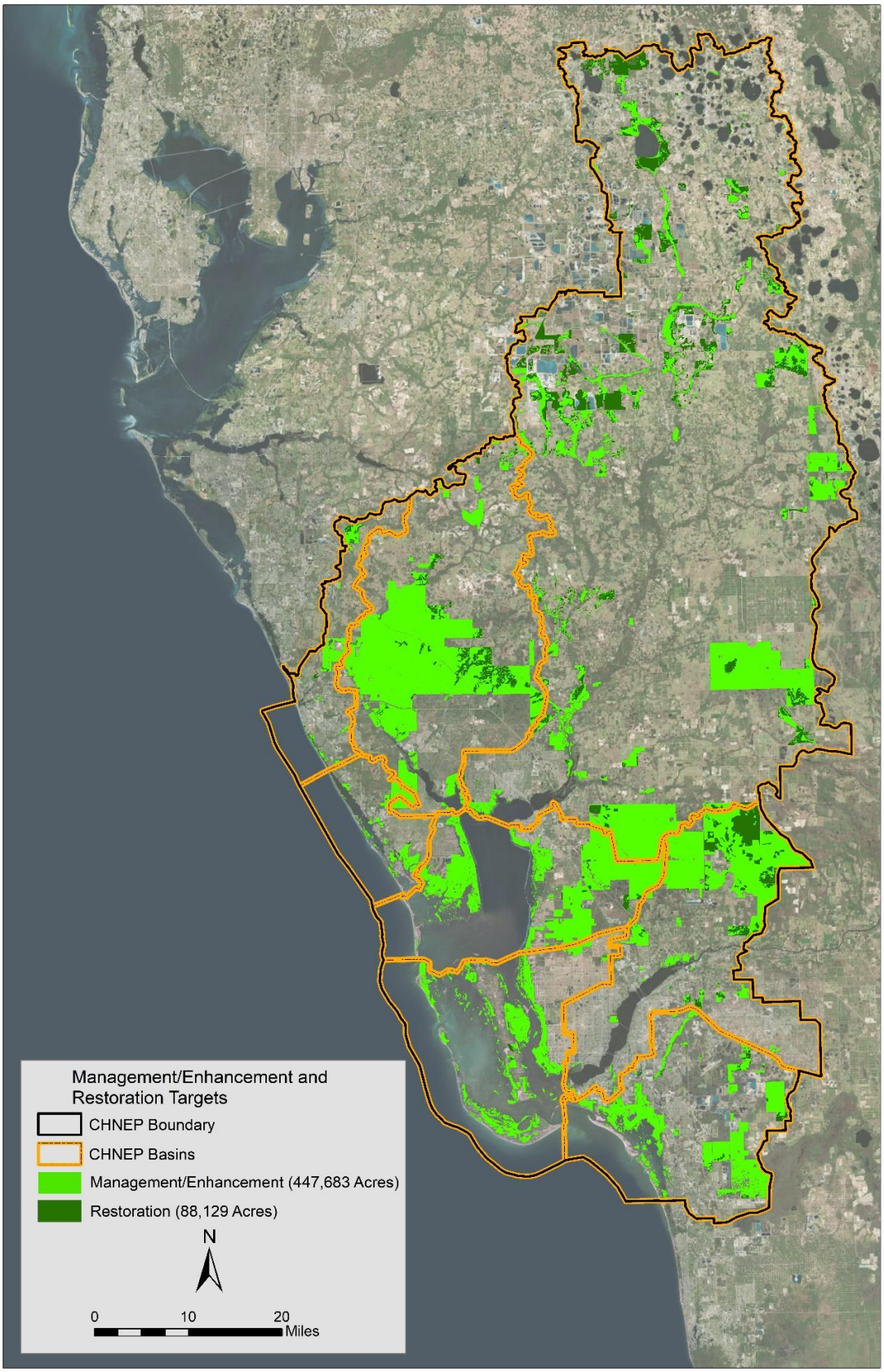


Figure 6. CHNEP Area MET and RT.

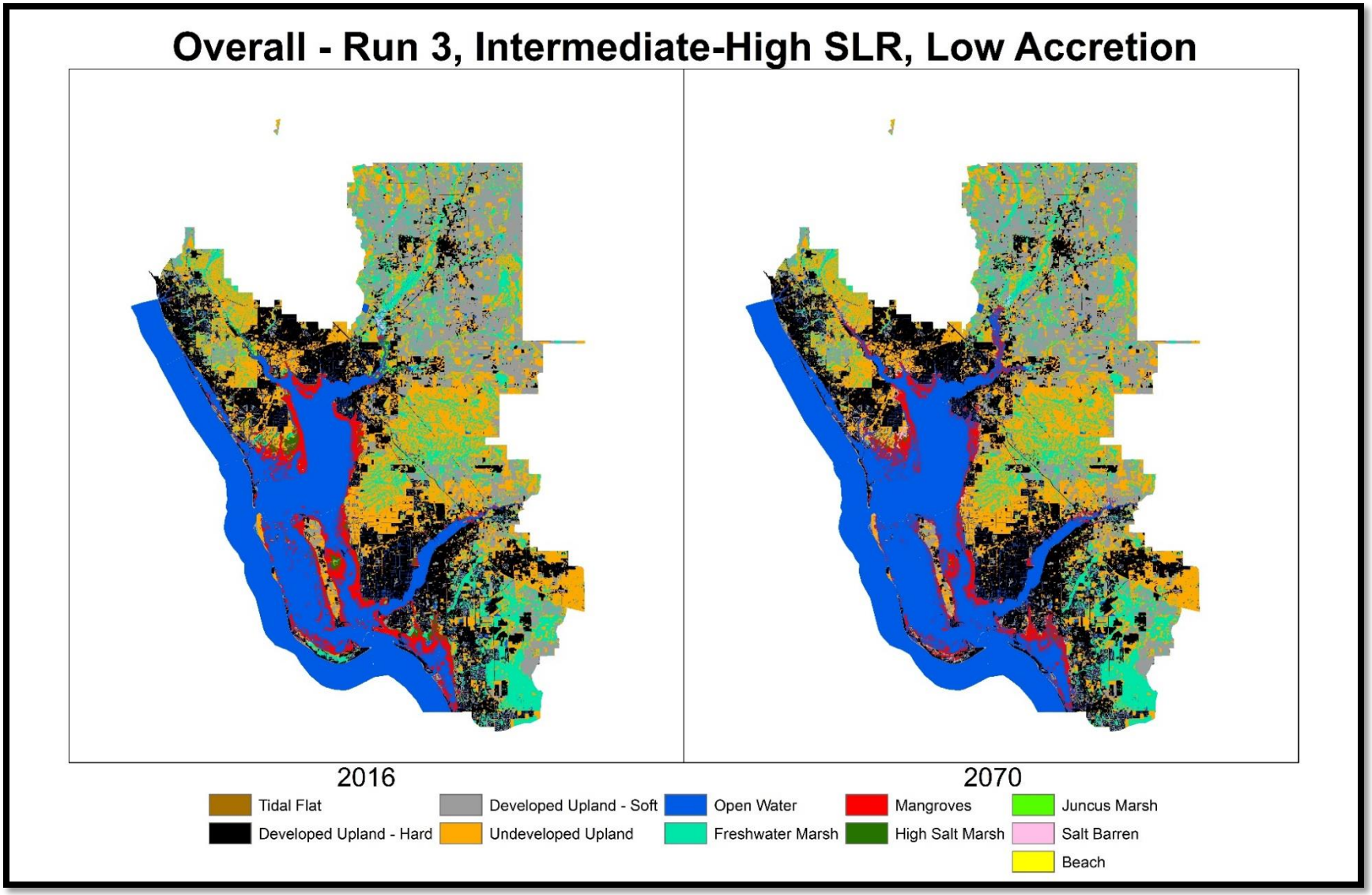


Figure 7. HEM Model Results for the Overall CHNEP Area.

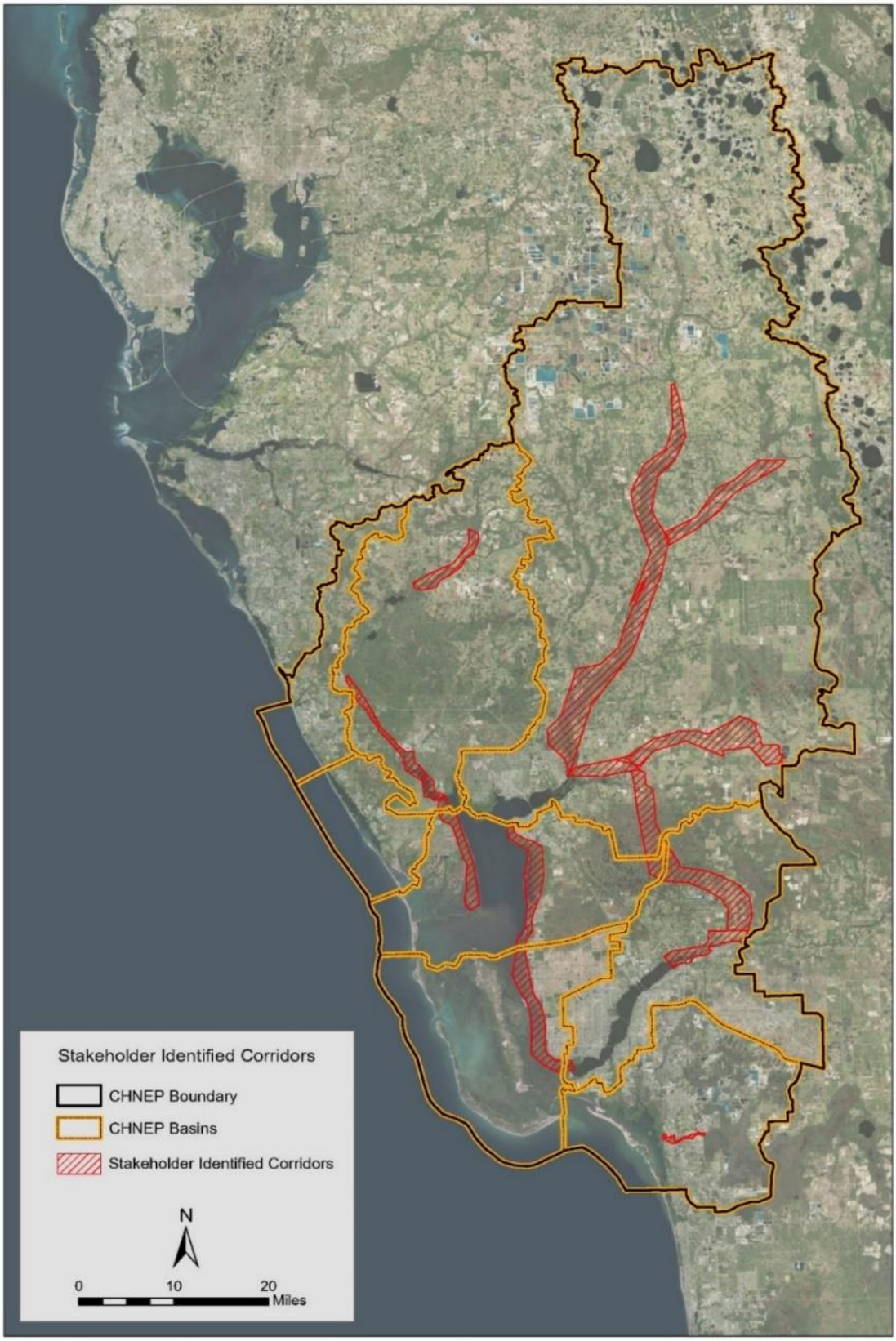


Figure 8. Approximated locations of Stakeholder Identified Corridors for the CHNEP Area.

Dona and Roberts Bay Basin

At 93,325 acres, the Dona & Roberts Bay basin is the second smallest basin within the overall CHNEP area. Significant features within this basin include Dona Bay, Roberts Bay, Cow Pen Slough, The Pinelands Reserve and Heritage Ranch Gopher Tortoise Preserve. This basin was historically altered in the 1960's and 1970's through the channelization of Cow Pen Slough that dramatically increased the size of the basin, and increased the volume of freshwater reaching downstream estuaries. The results for this basin area are presented in the following narrative and in Figures 9 through 11.

Preservation/Conservation Opportunities (PCO)

A total of 10,500 acres was identified as potential PCO, in which 35 percent (3,693 acres) were categorized as non-native and 65 percent (6,807 acres) as native habitat (Table 7; Figure 9). Overall, the acreage identified as potential PCO constitutes 11 percent of the total lands within this basin. The dominant native habitat communities were classified as pine flatwoods (2,104 acres; 20%), and freshwater marshes (1,541 acres; 15%). Cropland and pastureland (2,480 acres; 24%) was identified as the major non-native habitat classification within the overall basin. Appendix E presents the detailed results.

Overall, the potential PCO clustered in the central portion of this basin (Figure 9). The native habitat communities were more dispersed within this basin compared to the non-native (potential future RO or RT) habitats that are predominantly clustered around the central portion of the watershed.

Reservation Opportunities (RO)

A total of 48 acres was identified as potential RO (Table 7; Figure 9). Overall, the acreage identified as potential RO constitutes less than one percent of the total lands within the Dona and Roberts Bay basin. The dominant habitat community was classified as Open Land (35 acres) (Appendix E). The RO were prominent adjacent to Dona and Roberts Bays (Figure 10).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in tidally influenced areas. The Dona and Roberts Bay basin HEM map (Figure 12) illustrates model Run 3 (Intermediate-High Sea Level Rise, Low Accretion) for Years 2016 and 2070. The results illustrate a moderate change in habitat extent as the majority of the basin consists of developed upland.

Management/Enhancement Targets (MET)

A total of 7,590 acres was identified as MET and RT, of which 87 percent (6,580 acres) was categorized as MET. Overall, the acreage identified for MET and RT constitutes 8 percent of the total lands within the overall basin. The dominant native habitat community identified as MET was classified as pine flatwoods which comprised 40 percent (3,066 acres) of all MET and RT acreages.

Cropland and pastureland (668 acres; 9%) was identified as the major non-native habitat classification within the overall basin (Appendix E). MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands to distinguish the types of overall habitats that could be managed or enhanced (Table 7). The vast majority of MET occur at the western limits of the Carlton Reserve within this basin (Figure 11).

Restoration Targets (RT)

A total of 7,590 acres was identified as MET and RT, of which 13 percent (1,010 acres) was categorized as RT (Table 7; Figure 11). Overall, the acreage identified for RT and MET constitutes 8 percent of the total lands within the overall basin. RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be restored (Table 7). There are several instances in which areas identified as non-native (RT) are directly adjacent to native habitats. Identifying areas for strategic restoration could result in the further expansion of restored native habitat communities.

Habitat Status and Trends Analysis

A change analysis was completed for this basin to quantify the gains/losses of habitats between 1995 and 2009/2011 (Table 8). The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitats changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within this basin, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development and agriculture;
- Losses of upland coniferous forest and shrub and brushlands; and
- Salt marshes transitioning to mangroves.

Mapping inconsistencies observed in the change analysis included the following:

- FLUCCS 3000 (Upland Non-Forested) Series Level 2 (Dry Prairie, Shrub and Brushland, Mixed Rangeland) codes were often interchangeably used for the same aerial signature between 1995 and 2009/2011, so gains/losses in the 3000 Series may not all be real changes;
- Slough waters classification was not used in 2009/2011;
- Outer zones of freshwater marshes were mapped as lakes classification in 1995, but were correctly remapped as vegetated non-forested wetlands in 2009/2011; and

- Increases in intermittent pond classification occurred from development between 1995 and 2009/2011. Also, open water ponds that became shallow ponds were re-mapped to intermittent ponds classification in 2009/2011.

Dona and Roberts Bay Basin Summary

Dona and Roberts Bay is the second smallest basin in the overall CHNEP area, with 28% of the basin classified as existing development. The habitat status and trends analysis showed losses in upland habitats. These habitats may be considered a priority for restoration in this basin, and future studies can further identify the assemblage of specific habitat types. Changes in other upland and freshwater wetland habitats were difficult to discern due to mapping inconsistencies. The change analysis showed an increase in the mangrove swamp classification, which is consistent with HEM model projections that salt marshes will transition to mangroves. There are no primary or secondary Florida panther habitat areas in this basin, and CHNEP stakeholders did not identify any wildlife corridors specific to the basin.

PCO are primarily located in the upper basin, and connect with PCO identified in the Myakka River basin which border the Myakka River State Park to the east. RO are primarily identified in the southern coastal portion of the basin, with a small area identified in the Cow Pen Slough region. MET and RT that are also located in the southern coastal portion of the basin, and provide the opportunity to connect with RO to allow this coastal area to provide coastal protection and accommodate habitat migration from projected sea level rise impacts. Other MET and RT areas located in the upper basin include Pineland Reserve and Heritage Ranch conservation lands.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The results presented in the tables and maps below can form the foundation for future studies.

TABLE 7. HRN OPPORTUNITIES AND TARGETS FOR THE DONA AND ROBERTS BAY BAISIN BY MAJOR HABITAT TYPE.

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	3,850	N/A	4,164	786
Freshwater Wetlands	2,954	N/A	2,378	191
Tidal Wetlands	3	N/A	37	32
Non-Native	3,693	N/A	N/A	N/A
Total	10,500	48	6,580	1,009

TABLE 8. HRN CHANGE ANALYSIS GAINS/LOSSES FOR THE DONA AND ROBERTS BAY BASIN BY HABITAT CLASSIFICATION TYPE.

FLUCCS Codes	Primary Classifications	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	88	159	71	80%
3200	Shrub and Brushlands	7,540	2,719	-4,820	-64%
3300	Mixed Rangelands	265	575	309	*
4100	Upland Coniferous Forest	10,997	7,564	-3,432	-31%
4200/4300	Upland Hardwood Forest	2,353	2,040	-313	-13%
5100	Streams and Waterways	160	158	-2	-1%
5200	Lakes	681	27	-654	-96%
5600	Slough Waters	N/A	N/A	N/A	N/A
6100	Wetland Hardwood Forest	3,490	3,361	-129	-4%
6120	Mangrove Swamp	151	172	21	14%
6200	Wetland Coniferous Forest	153	158	4	3%
6300	Wetland Forested Mixed	675	680	5	1%
6400	Vegetated Non-Forested Wetlands	6,390	7,066	677	11%
6420	Saltwater Marsh	67	61	-6	-9%
6530	Intermittent Ponds	5	43	38	*
6600	Salt Flats	N/A	N/A	N/A	N/A

*Differences in mapping methodologies between periods may account for some anomalies in the data.

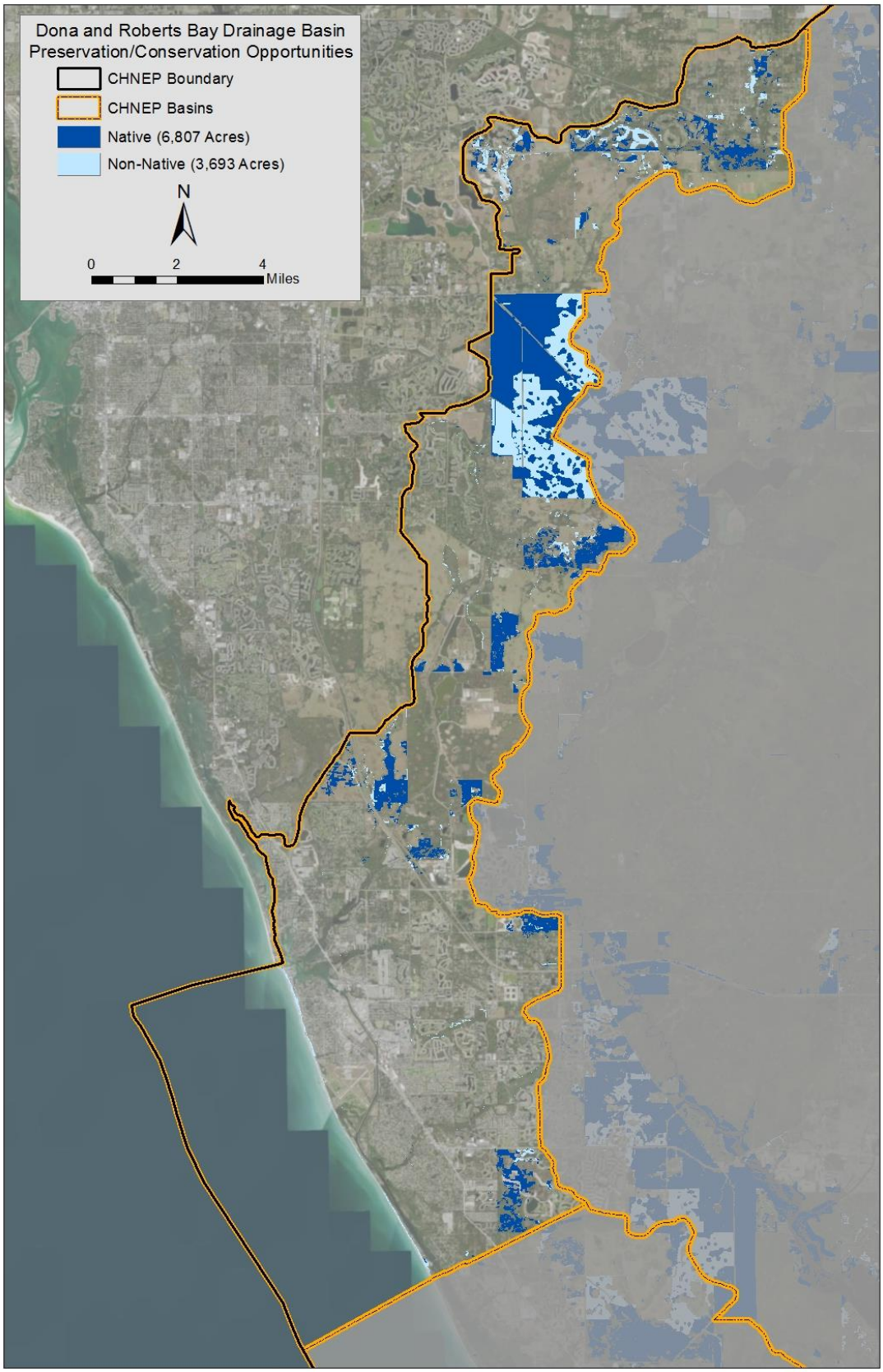


Figure 9. Dona and Roberts Bay Basin PCO.

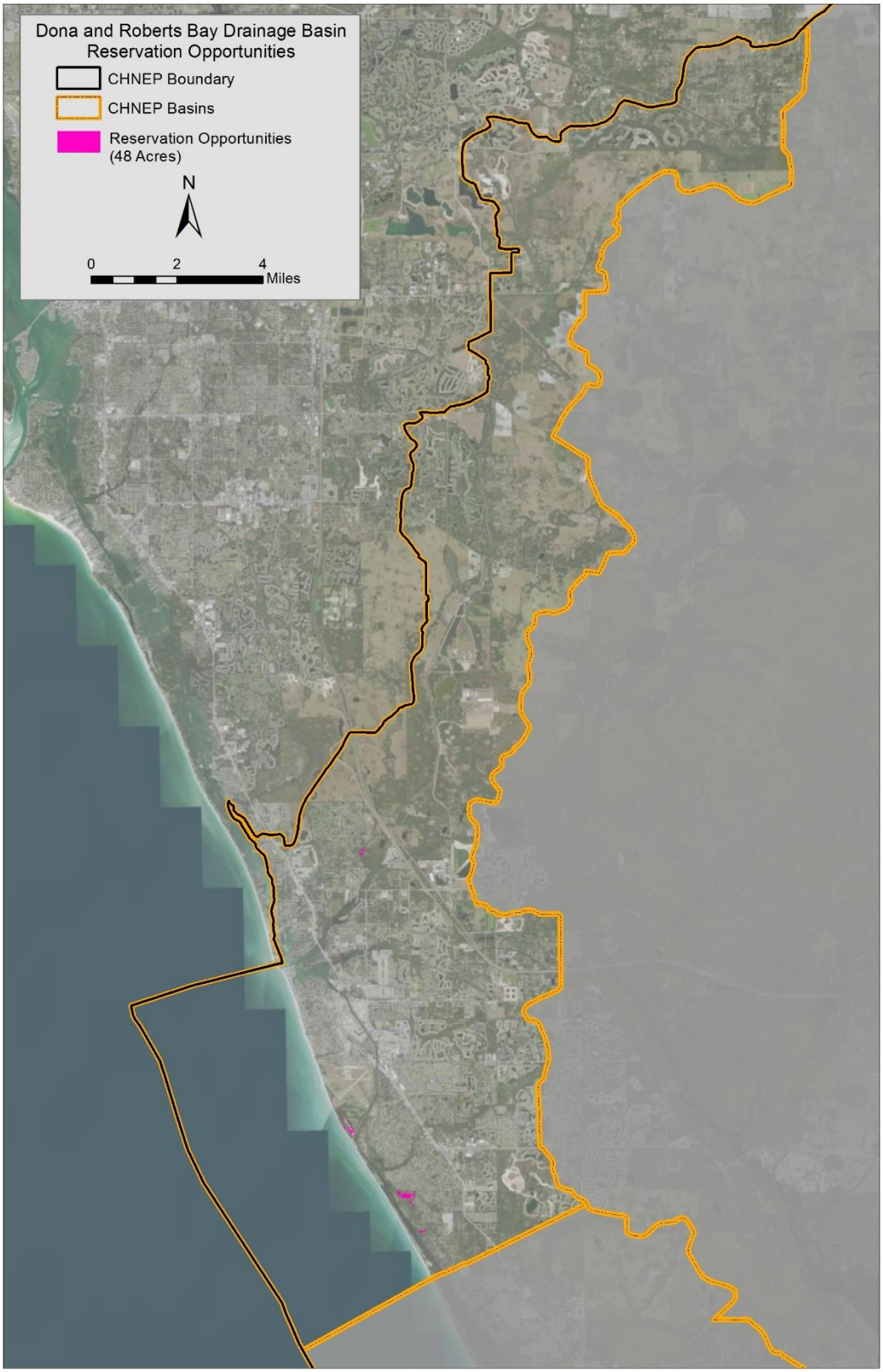


Figure 10. Dona and Roberts Bay Basin RO.

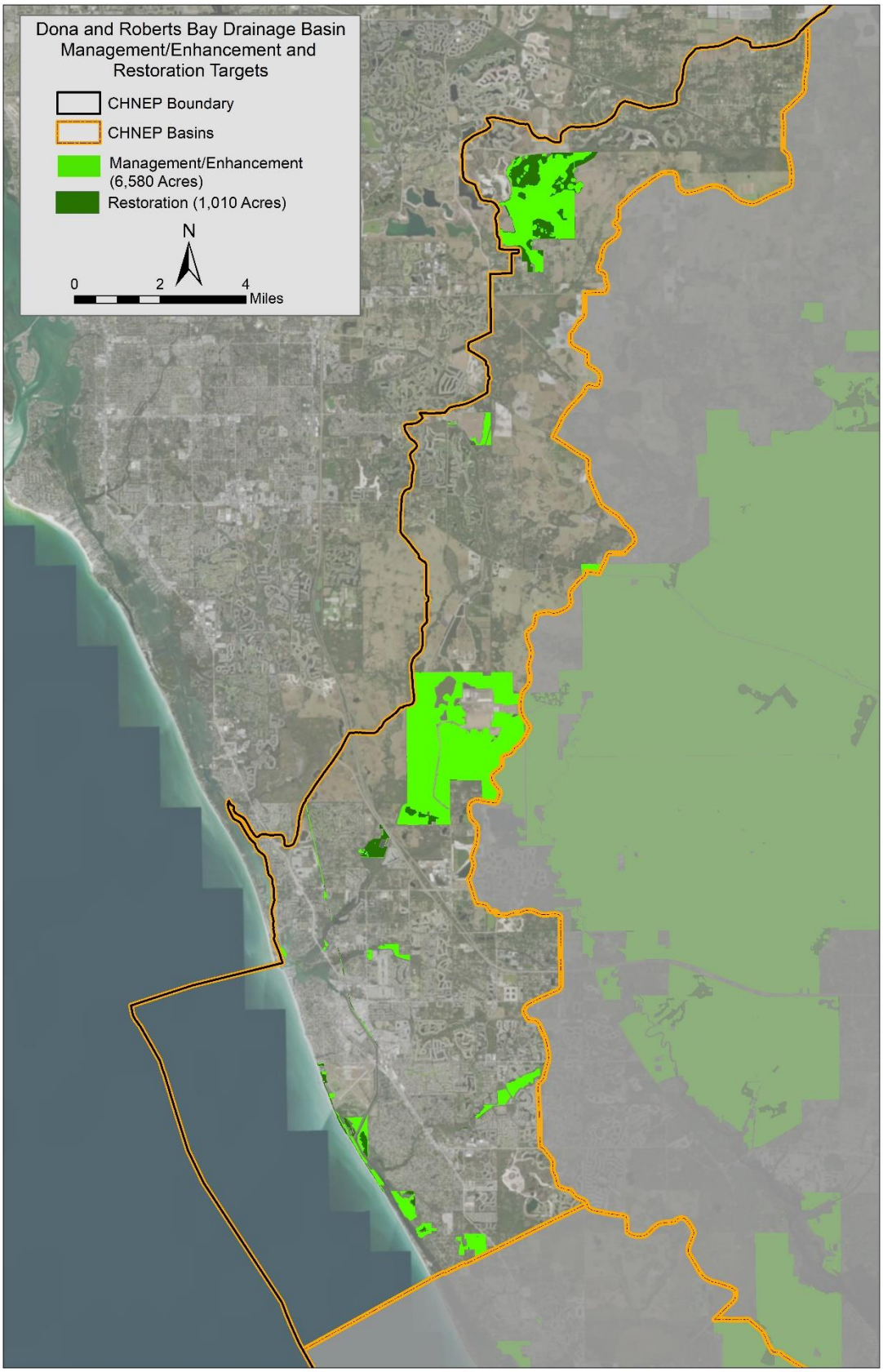


Figure 11. Dona and Roberts Bay Basin MET and RT.

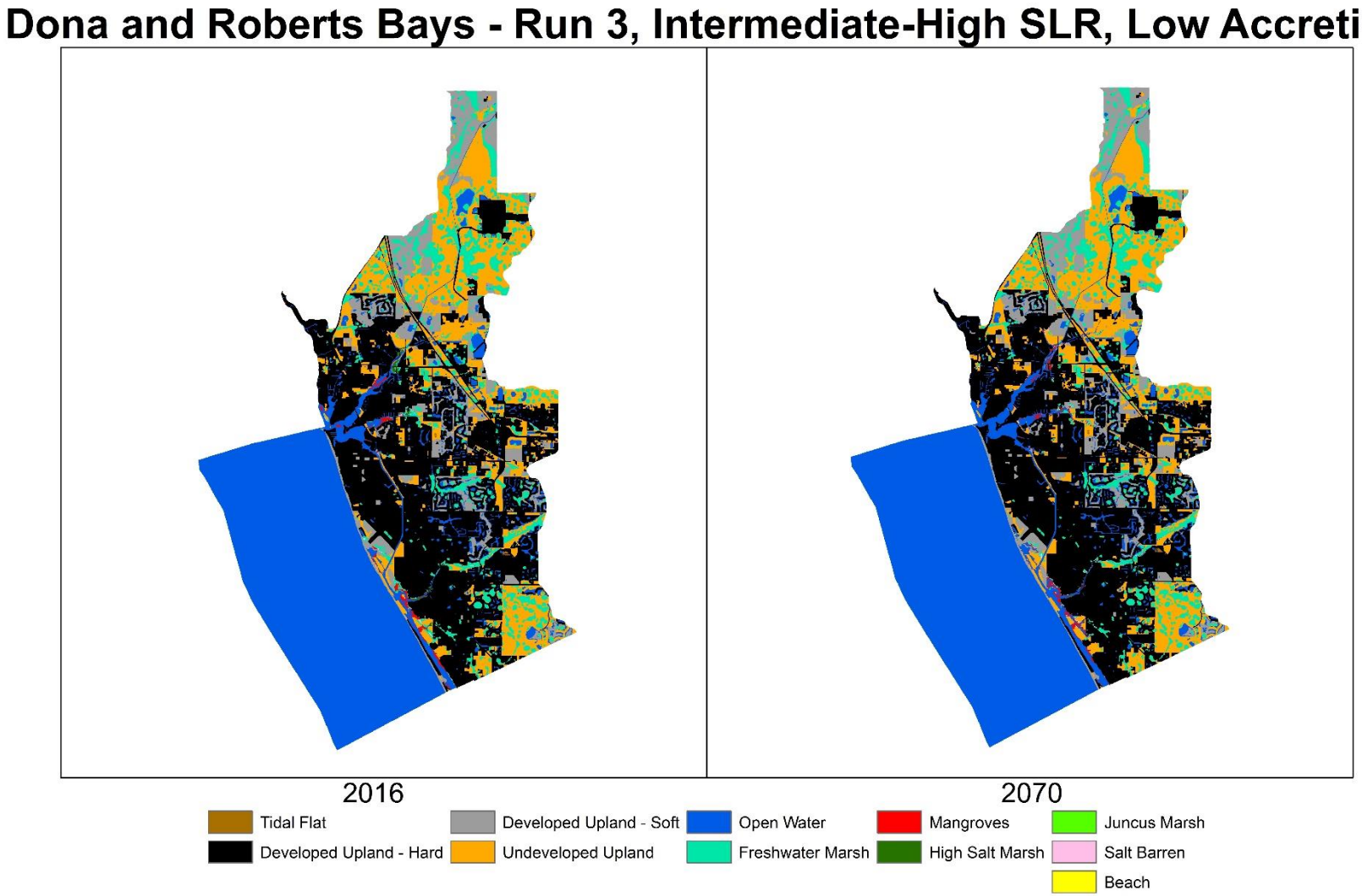


Figure 12. HEM Model Results for the Dona and Roberts Bay basin.

Lemon Bay Basin

At 84,557 acres, the Lemon Bay basin is the smallest basin within the overall CHNEP area. The largest feature within this basin is Lemon Bay, with other significant aquatic features including Ainger and Gottfried Creeks. The southern limits of this basin support portions of the Charlotte Harbor Preserve State Park, the western limits of Myakka River State Forest, and Stump Pass Beach State Park. The results for this basin area are presented in the following narrative and in Figures 13 through 15.

Preservation/Conservation Opportunities (PCO)

A total of 4,474 acres was identified as potential PCO, of which 27 percent (1,227 acres) were categorized as non-native and 73 percent (3,247 acres) as native habitat (Table 9; Figure 13). Overall, the acreage identified as PCO constitutes 5 percent of the total lands within the overall Lemon Bay basin. The dominant native habitat community was classified as shrub and brushland constituting 30 percent (1,347 acres) of all potential PCO acreages. Cropland and pastureland was identified as the major non-native habitat classification with 14 percent (604 acres) classified within the overall basin (Appendix E).

Overall, the potential PCO occurred primarily around the upper limits of Ainger and Gottfried Creeks within this basin (Figure 13). Native habitat communities were primarily found in proximity of the two noted creeks, as well as in the Big Slough area and barrier islands.

Reservation Opportunities (RO)

A total of 150 acres was identified as potential RO (Table 9; Figure 14). Overall, the acreage identified for RO constitutes less than one percent of the total lands within the Lemon Bay basin. The dominant habitat community was classified as Recreational which consists of parks and trails (80 acres; Table 9). Potential RO were prominent near the estuarine complex within Lemon Bay (Figure 14).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in tidally influenced areas. The Lemon Bay Basin HEM map (Figure 16) illustrates model Run 3 (Intermediate-High Sea Level Rise, Low Accretion) for Years 2016 and 2070. The results illustrate an expansion of open water created by projected sea level rise, as well as the loss of mangrove swamp with limited migration higher into the landscape due to constraints with existing development.

Management/Enhancement Targets (MET)

A total of 7,845 acres was identified for MET and RT, of which 95 percent (7,464 acres) was identified for MET (Figure 15; Table 9). Overall, the acreage identified for MET and RT constitutes 9 percent of the total lands within the overall Lemon Bay basin. The dominant native habitat

community identified for MET was classified as pine flatwoods which comprised 33 percent (2,616 acres) of all MET and RT acreages (Appendix E). MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands to distinguish the types of overall habitats that could be managed or enhanced (Table 9). The vast majority of MET were distributed in the eastern portion of this basin and associated with Myakka State Forest, and the southern limits in Big Slough (Figure 15).

Restoration Targets (RT)

A total of 7,845 acres was identified for RT and MET, of which 5 percent (381 acres) was identified as RT (Figure 15; Table 9). Overall, the acreage identified for RT and MET constitutes 9 percent of the total lands within the overall Lemon Bay basin. RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands to distinguish the types of overall habitats that could be restored (Table 9). There are several instances in which areas identified as non-native (RT) are directly adjacent to native habitats. Identifying areas for strategic restoration could result in the further expansion of restored native habitat communities.

Habitat Status and Trends Analysis

A change analysis was completed for this basin to quantify the gains/losses of habitats between 1995 and 2009/2011 (Table 10). The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitats changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within this basin, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development and agriculture
- Salt marshes transitioning to mangroves.

Mapping inconsistencies observed in the change analysis included the following:

- FLUCCS 3000 (Upland Non-Forested) Series Level 2 (Dry Prairie, Shrub and Brushland, Mixed Rangeland) codes were often interchangeably used for the same aerial signature between 1995 and 2009/2011, so gains/losses in the 3000 Series may not all be real changes;
- Outer zones of freshwater marshes were mapped as lakes classification in 1995, but were correctly remapped as vegetated non-forested wetlands in 2009/2011;
- Slough waters classification was not used in 2009/2011;

- Increases in intermittent pond classification occurred from development between 1995 and 2009/2011. Also, open water ponds that became shallow ponds were re-mapped to intermittent ponds classification in 2009/2011; and
- Salt flats were mapped in 2009/2011 at the north end of Don Pedro Island, where they had not previously been mapped.

Lemon Bay Basin Summary

Lemon Bay basin is the smallest basin within the overall CHNEP area, with 21 percent of the basin classified as existing development. The habitat status and trends analysis showed losses in upland habitats. These habitats may be considered a priority for restoration in this basin, and future studies can further identify the assemblage of specific habitat types. Freshwater wetland and changes in other upland and freshwater wetland habitats were difficult to discern due to mapping inconsistencies. Similar to other coastal basins, the change analysis showed an increase in mangrove swamps, which is consistent with HEM projections that salt marshes will transition to mangroves. Similar to neighboring Dona and Roberts Bays basin, there are no primary or secondary Florida panther habitat areas located in this basin, and CHNEP stakeholders did not identify any wildlife corridors specific to the basin.

PCO are primarily located in the upper basin near Ainger and Gottfried Creeks. RO are distributed throughout the coastal portion of the basin, with a small area identified in Rotunda area. MET are primarily located in the east-central and southwestern areas of the basin. The HEM projects salt marsh moving into this area in the future and since these lands are already protected and identified as MET, if combined with the RO, can provide enhanced coastal protection and accommodate habitat migration from projected sea level rise impacts.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The CHNEP Management Conference noted these updates presented below:

- Don Pedro Island State Park lands that are landward of the intracoastal waterway were partially mapped as RO based on existing mapping FLUCCS codes; however, the entirety of the park is under the ownership of the State of Florida and should be reclassified in future HRN studies as MET.
- Wildflower Preserve is included in the RO acreage based on existing mapping FLUCCS codes; however, this 80-acre preserve is now owned by Lemon Bay Conservancy, and should be reclassified Restoration in future HRN studies.
- Coral Creek Peninsula is currently mapped as PCO based on 2009/2011 mapping data, however 56 acres was acquired by the State of Florida during the project period and should be assessed in future HRN studies as potential MET or RT.

The results presented in the tables and maps below can form the foundation for future studies.

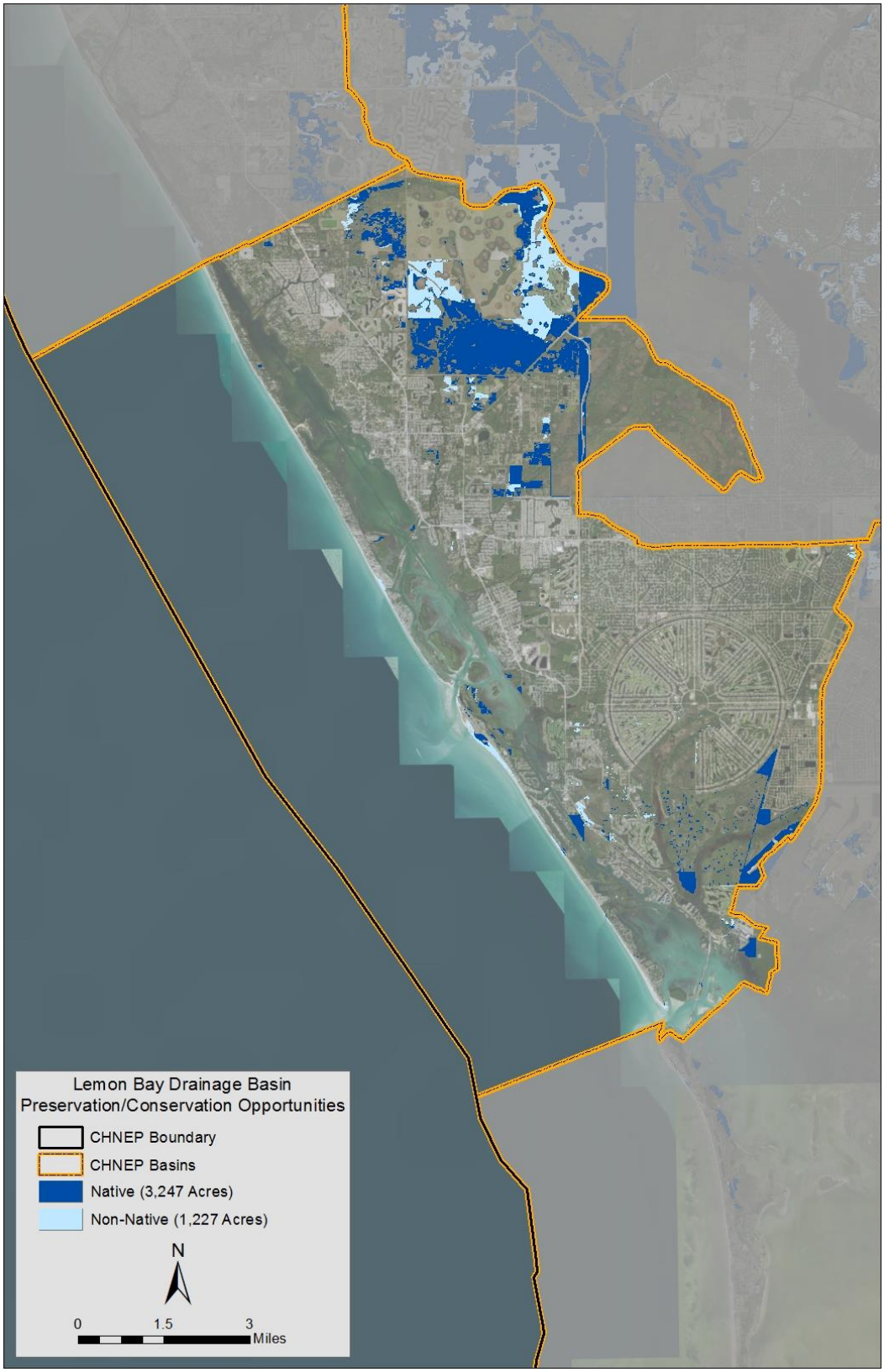
TABLE 9. HRN OPPORTUNITIES AND TARGETS FOR THE LEMON BAY BASIN BY MAJOR HABITAT TYPE

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	2,319	N/A	4,954	263
Freshwater Wetlands	822	N/A	1,453	74
Tidal Wetlands	105	N/A	1,058	44
Non-Native	1,227	150	N/A	N/A
Total	4,474	150	7,464	381

TABLE 10. HRN CHANGE ANALYSIS GAINS AND LOSSES FOR THE LEMON BAY BASIN BY HABITAT CLASSIFICATION TYPE.

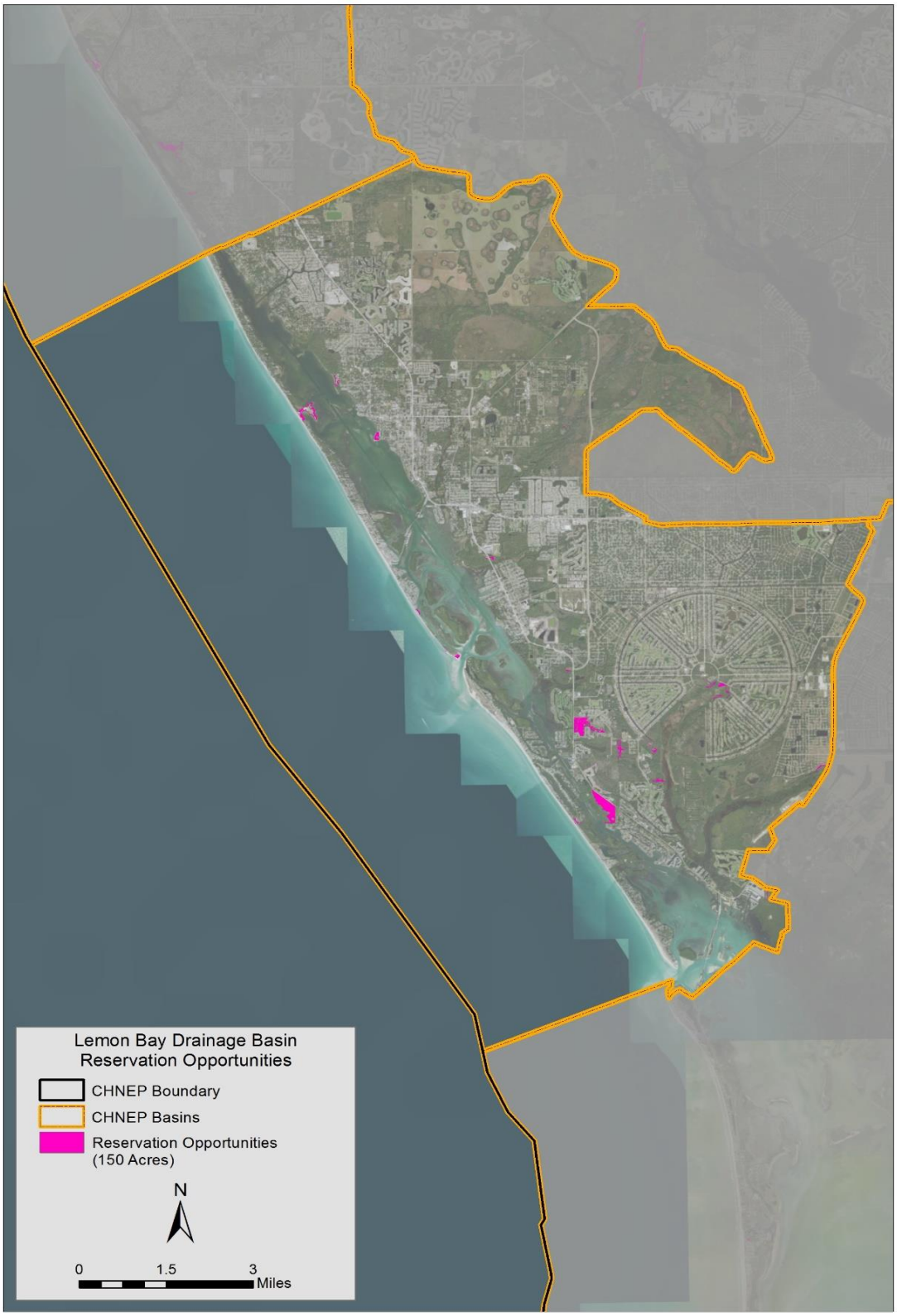
FLUCCS Codes	Primary Classifications	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	N/A	236	236	*
3200	Shrub and Brushlands	4,243	3,243	-999	-24%
3300	Mixed Rangelands	17	402	385	*
4100	Upland Coniferous Forest	5,688	4,438	-1,250	-22%
4200/4300	Upland Hardwood Forest	2,840	1,917	-923	-32%
5100	Streams and Waterways	301	298	-3	-1%
5200	Lakes	491	63	-428	-87%
5600	Slough Waters	N/A	N/A	N/A	N/A
6100	Wetland Hardwood Forest	1,235	932	-302	-24%
6120	Mangrove Swamp	1,125	1,262	137	12%
6200	Wetland Coniferous Forest	40	35	-4	-11%
6300	Wetland Forested Mixed	211	136	-75	-36%
6400	Vegetated Non-Forested Wetlands	2,438	2,897	460	*
6420	Saltwater Marsh	271	332	61	*
6530	Intermittent Ponds	N/A	5	5	*
6600	Salt Flats	N/A	28	28	*

*Differences in mapping methodologies between periods may account for some anomalies in the data.



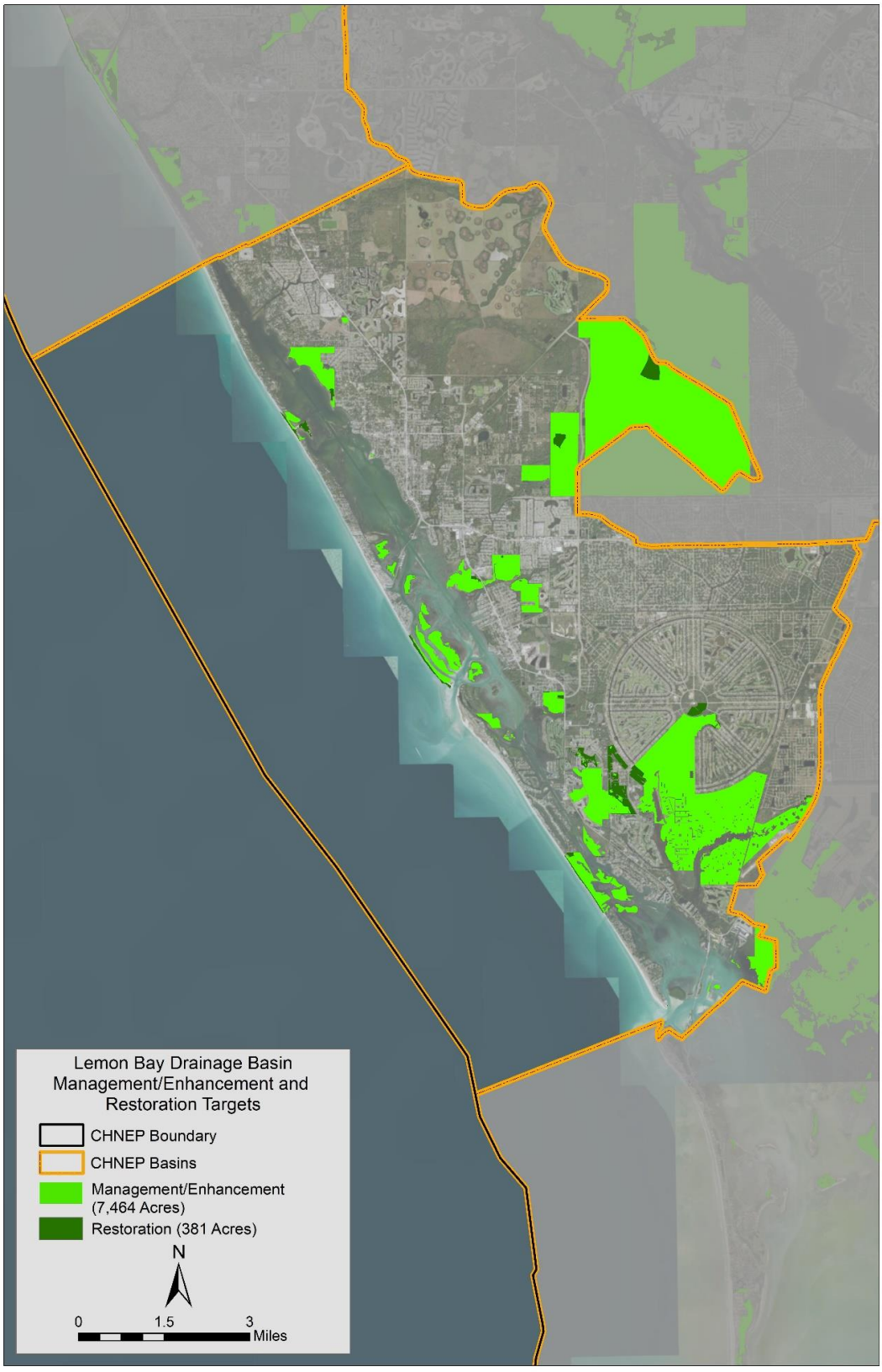
***See narrative for note on mapping classifications.**

Figure 13. Lemon Bay Basin PCO.



***See narrative for note on mapping classifications.**

Figure 14. Lemon Bay Basin RO.



***See narrative for note on mapping classifications.**

Figure 15. Lemon Bay Basin MET and RT.

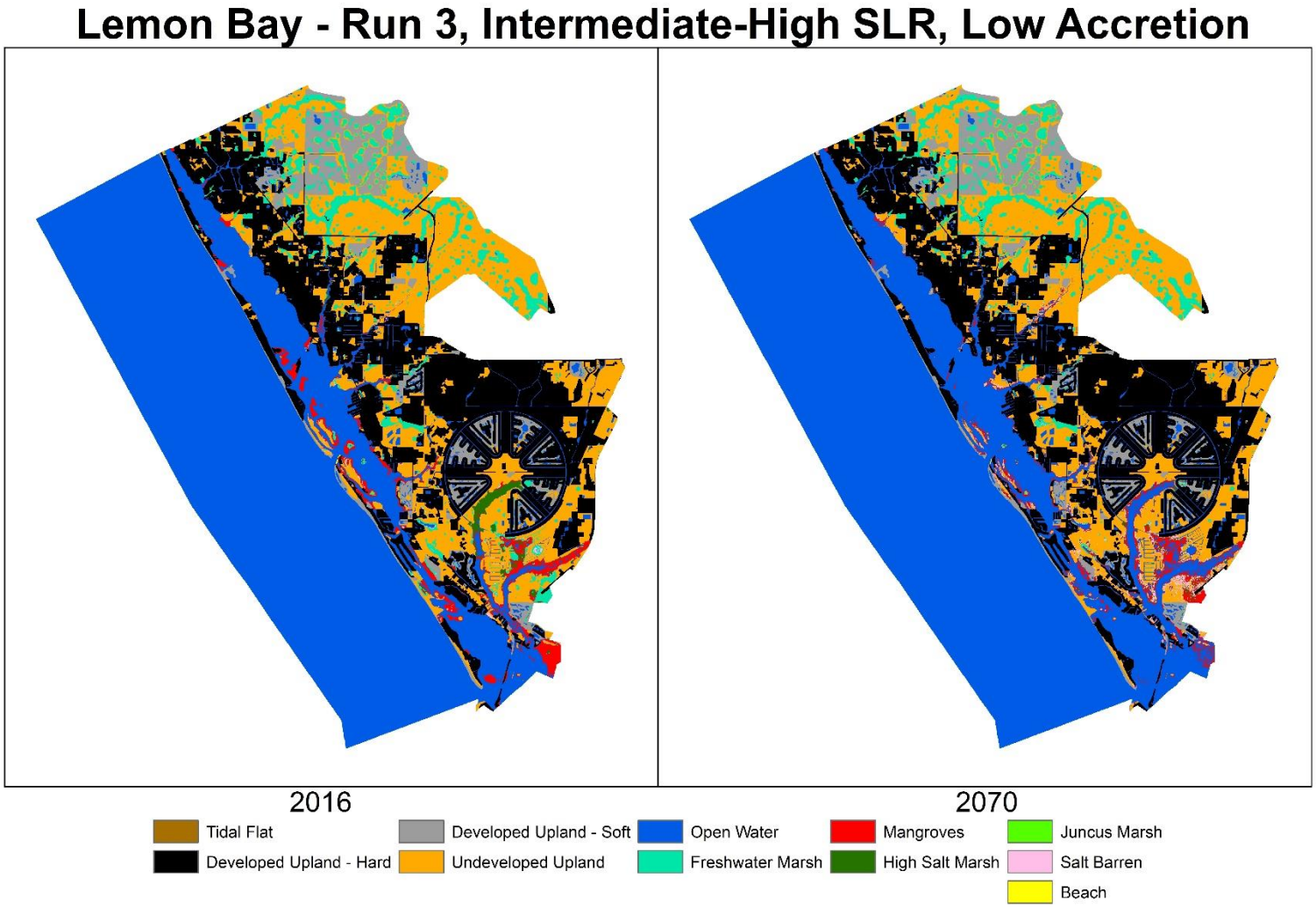


Figure 16. HEM Model Results for the Lemon Bay basin

Peace River Basin

The Peace River basin is the largest basin within the CHNEP limits, and totals 1,494,057 acres. This basin stretches high up into the northern and eastern reaches of the CHNEP boundary, connecting to Charlotte Harbor, and supports the greatest amount of acreage of MET and RT. The health and function of the Peace River basin headwaters have been identified as vitally important to downstream habitats, bays and estuaries for water quality and wildlife movement. The results for this basin area are presented in the following narrative and in Figures 17 through 19.

Preservation/Conservation Opportunities (PCO)

A total of 289,966 acres were identified as potential PCO within the Peace River basin, of which 47 percent (135,691 acres) was categorized as non-native and 53 percent (154,275 acres) as native habitat (Table 11; Figure 17). Overall, the acreage identified as potential PCO constitutes 19 percent of the total lands within the overall Peace River basin. The dominant native habitat communities were classified as shrub and brushland, and stream and lake swamps, which comprised 11 percent (32,241 acres) and 15 percent (43,194 acres), respectively, of all potential PCO acreages (Appendix E). Cropland and pastureland was identified as the major non-native habitat classification within the overall basin with 32 percent (91,981 acres) coverage.

Overall, the potential PCO occurred within the lower portions of the Peace River basin, the southeastern limits of the basin, and the eastern limits of the basin. (Figure 17). The native habitat communities were primarily found within the lower portions of the Peace River and the southeastern limits of the basin. In contrast, the majority of non-native (potential future RO or RT) habitat communities were identified along the eastern portions of the basin.

Reservation Opportunities (RO)

A total of 89 acres was identified as potential RO (Table 11; Figure 18) within this basin. Overall, the acreage identified for potential RO constitutes less than one percent of the total lands within this basin. The dominant habitat community was classified as open lands (72 acres; Table 11). Potential RO were identified in the lower extent of the Peace River (Figure 18).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in tidally influenced areas. The Peace River basin HEM map (Figure 20) illustrates model Run 3 (Intermediate-High Sea Level Rise, Low Accretion) for Years 2016 and 2070. The results illustrate an expansion of open water created by projected sea level rise, as well as the loss of mangroves and its migration higher into the landscape.

Management/Enhancement Targets (MET)

A total of 187,211 acres was identified as MET and RT within the Peace River basin. This includes 70 percent (130,218 acres) categorized for MET (Table 11; Figure 19). Overall, the acreage identified as MET and RT constitutes 13 percent of the total lands within the Peace River basin. The dominant native habitat communities identified as MET were classified as stream and lake swamps (31,188 acres; 17 %), and shrub and brushlands (28,411 acres; 15%;) (Appendix E). MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be managed or enhanced (Table 11). The vast majority of MET are dispersed throughout the basin, with the largest areas being Bright Hour Watershed, Lower Peace River, and Babcock/Webb Wildlife Management Area (Figure 19).

Restoration Targets (RT)

A total of 187,211 acres was identified as MET and RT within the Peace River basin. This includes 30 percent (56,993 acres) categorized as RT (Table 11; Figure 19). Overall, the acreage identified as RT and MET constitutes 13 percent of the total lands within the Peace River basin. RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be restored (Table 11). There are areas identified as non-native (RT) that largely occur in the northwestern section of this basin. Identifying areas for strategic restoration could result in the further expansion of restored native habitat communities.

Habitat Status and Trends Analysis

A change analysis was completed for this basin to quantify the gains/losses of habitats between 1995 and 2009/2011 (Table 12). The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitats changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within this basin, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development, agriculture, and mining;
- Forested freshwater wetlands converting to non-forested freshwater wetlands through silviculture;
- New non-forested freshwater wetlands from mine reclamation; and
- Saltwater marsh transitioning to mangroves.

Mapping inconsistencies observed in the change analysis included the following:

- FLUCCS 3000 (Upland Non-Forested) Series Level 2 (Dry Prairie, Shrub and Brushland, Mixed Rangeland) codes were often interchangeably used for the same aerial signature between 1995 and 2009/2011, so gains/losses in the 3000 Series may not all be real changes;
- Slough waters classification was not used in 2009/2011;
- Increases in intermittent pond occurred from development between 1995 and 2009/2011. Also, open water ponds classification that became shallow ponds was remapped to intermittent ponds in 2009/2011; and
- Vegetated non-forested wetlands classification mapped in 1995 was remapped as saltwater marsh at the eastern limits of Shell Creek.

Peace River Basin Summary

The Peace River basin is the largest of the CHNEP major basins, extending from the Heartlands of Polk County down to Charlotte Harbor. The Peace River is free-flowing; however, the headwaters have been impacted by extensive phosphate mining, with the middle reaches characterized mostly by agricultural land uses. A major surface water withdrawal for potable supply occurs on the lower Peace River.

The habitat status and trends analysis for the Peace River basin showed substantial losses in upland coniferous forest; primarily pine flatwoods which may be considered priority habitat for restoration. In addition, a substantial increase in vegetated non-forested wetland was noted, primarily associated with new wetlands on reclaimed mine lands. Changes in other upland and freshwater wetland habitats were difficult to discern due to mapping inconsistencies. An increase in saltwater marsh was also noted in the tidal portion of the lower Peace River. The latter observation confirms the findings of the HEM which predicts the landward migration of mangroves, and the upstream migration of salt marshes in the tidal rivers and tributaries, in response to sea level rise over the next 100 years. Based on these predictions, ensuring appropriate freshwater inflows and restricting future impoundments in the Peace River will be important to preserving the balance of the primary tidal wetlands which are mangroves and salt marshes in this basin.

The 100-year floodplain of the Peace River constitutes an important fish and wildlife migratory corridor that is still relatively intact, but largely in private ownership. The habitat continuity of the Peace River floodplain could be substantially improved by strategically-located public land acquisition – with almost 290,000 acres of PCO identified by CHNEP stakeholders and other natural resource agencies. Conversely, less than 90 acres were identified for RO, as much of the tidal portion of the Peace River basin is either built out as existing development, or is still in native wetland habitats.

Over 130,000 acres of native habitats occur within existing preservation/conservation lands in the Peace River basin; and these areas allow for extensive opportunities for habitat management activities to ensure optimize functions. In addition, almost 57,000 acres of altered, non-native habitats occur within existing preservation/conservation lands; and these areas allow for extensive opportunities for true habitat restoration, including primarily upland and freshwater wetland

habitats. The majority of the larger habitat restoration areas exist in the upper reaches of the basin, including the south end of Lake Hancock.

MET and RT were developed for the three major native habitat types - tidal wetlands, freshwater wetlands, and uplands, to distinguish the general classes of habitats that could be managed/enhanced or restored. In the Peace River basin, the freshwater wetlands category provides the greatest area for restoration, while the uplands category provided the greatest area for management/enhancement. However, the upper reaches of the Peace River basin provide great restoration potential for headwater streams and riparian wetlands on reclaimed mine impacts. Limited restoration opportunities exist for tidal wetland restoration in this basin.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The CHNEP Management Conference noted the update presented below:

- The southern portion of Lake Hancock was partially mapped as Restoration based on existing mapping non-native FLUCCS codes; however, this area has been undergoing restoration by SWFWMD and should be should be reclassified as Management/Enhancement in future HRN studies.

The results presented in the tables and maps below can form the foundation for future studies.

TABLE 11. HRN OPPORTUNITIES AND TARGETS FOR THE PEACE RIVER BASIN BY MAJOR HABITAT TYPE

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	66,905	N/A	57,661	34,602
Freshwater Wetlands	85,610	N/A	69,501	22,390
Tidal Wetlands	1,761	N/A	3,056	1
Non-Native	135,691	89	N/A	N/A
Total	289,966	89	130,218	56,993

TABLE 12. HRN TARGETS FOR THE PEACE RIVER BASIN BY HABITAT CLASSIFICATION TYPE.

FLUCCS Codes	Primary Classifications	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	4,398	2,819	-1,579	-36%
3200	Shrub and Brushlands	112,653	77,968	-34,685	-31%
3300	Mixed Rangelands	1,260	9,638	8,378	*
4100	Upland Coniferous Forest	78,649	53,161	r	-32%
4200/4300	Upland Hardwood Forest	57,225	33,384	-23,841	-42%
5100	Streams and Waterways	6,749	6,755	6	0.1%
5200	Lakes	30,145	29,827	-318	-1%
5600	Slough Waters	N/A	N/A	N/A	N/A
6100	Wetland Hardwood Forest	110,689	127,769	17,080	15%
6120	Mangrove Swamp	2,941	3,041	101	3%
6200	Wetland Coniferous Forest	10,759	9,586	-1,173	-11%
6300	Wetland Forested Mixed	6,781	7,439	658	10%
6400	Vegetated Non-Forested Wetlands	103,403	141,356	37,953	37%
6420	Saltwater Marsh	2,206	2,484	278	13%
6530	Intermittent Ponds	64	515	451	*
6600	Salt Flats	4	4	0	N/A

* Differences in mapping methodologies between periods may account for some anomalies in the data.

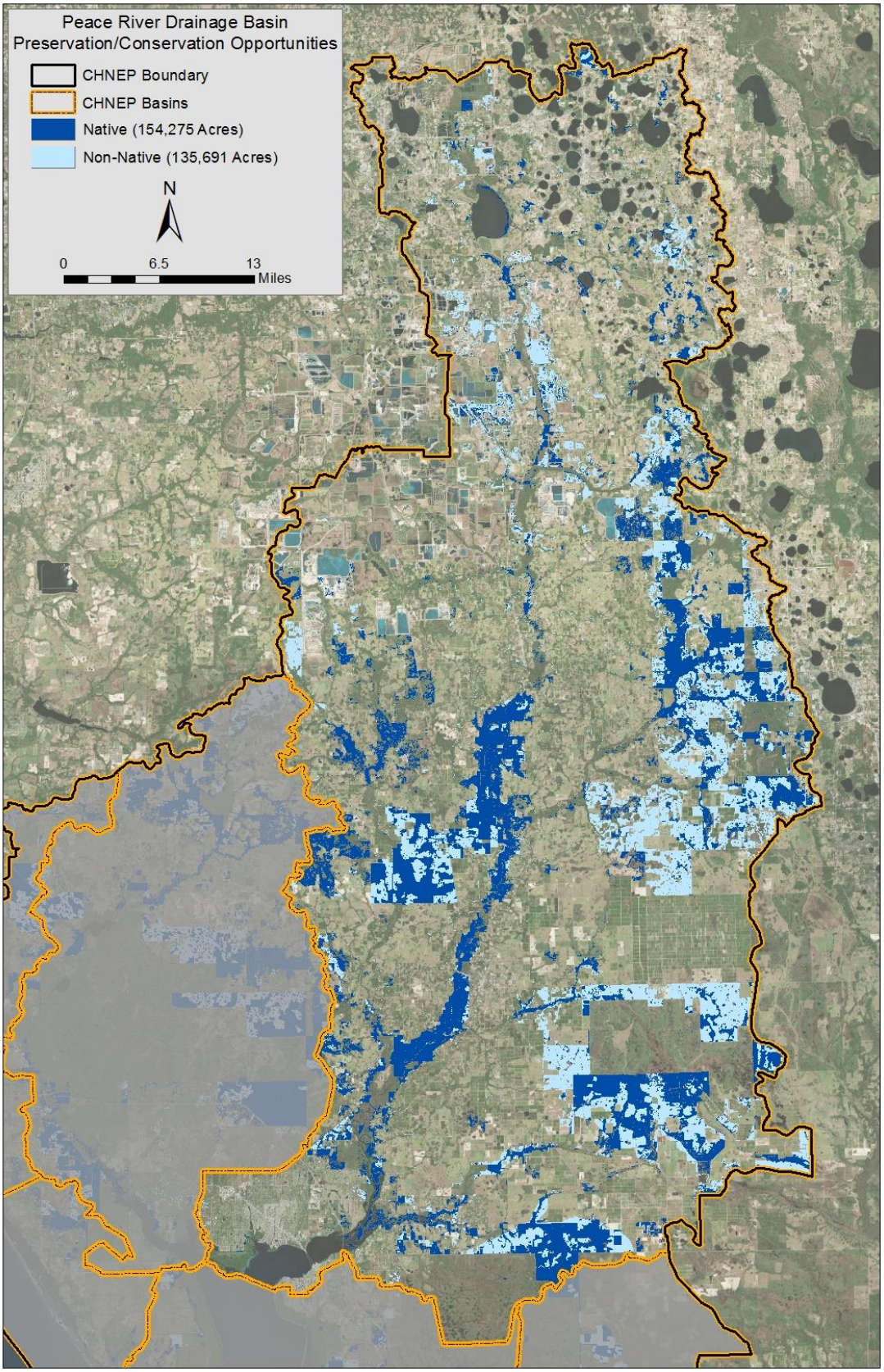


Figure 17. Peace River Basin PCO.

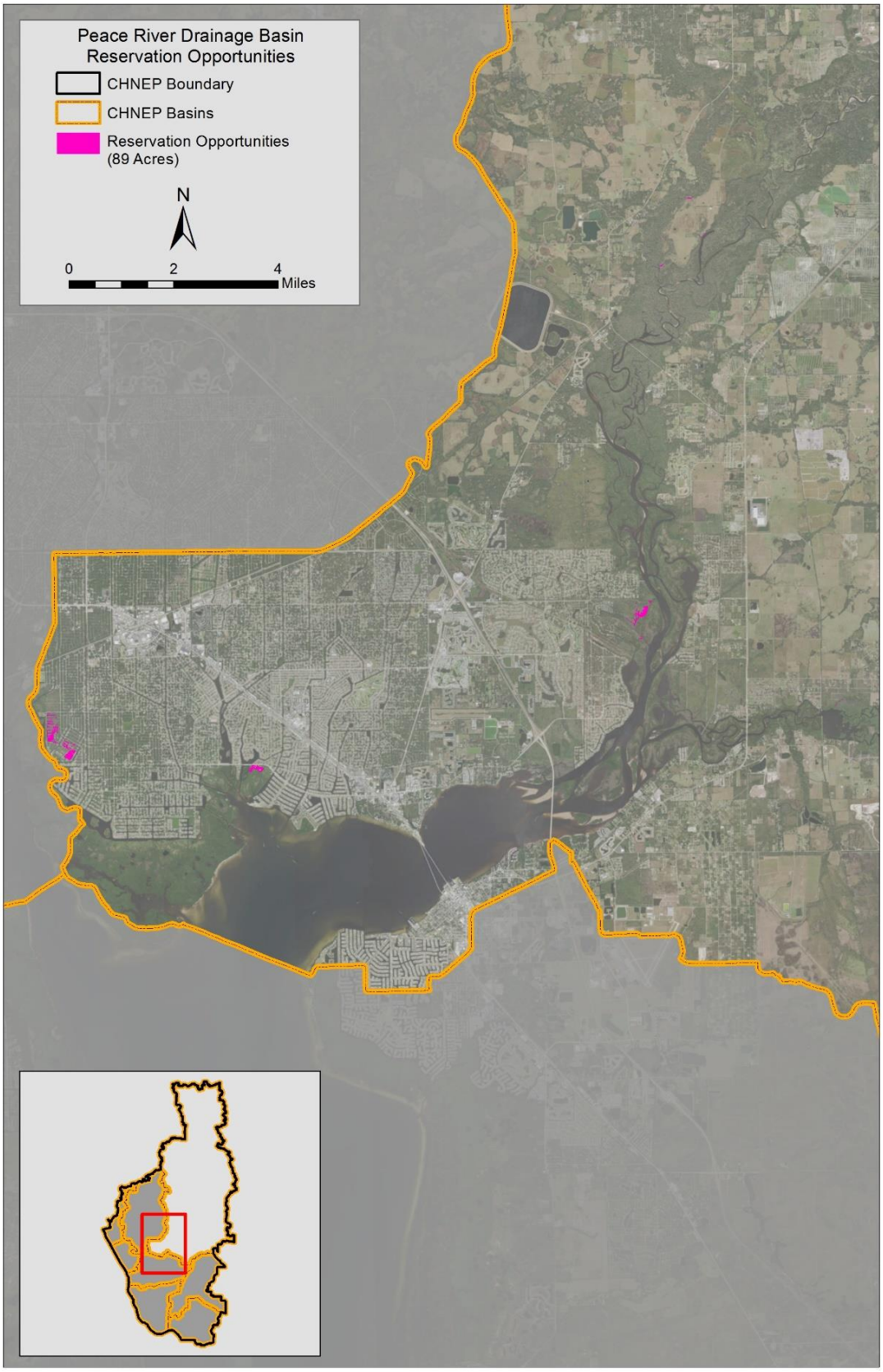
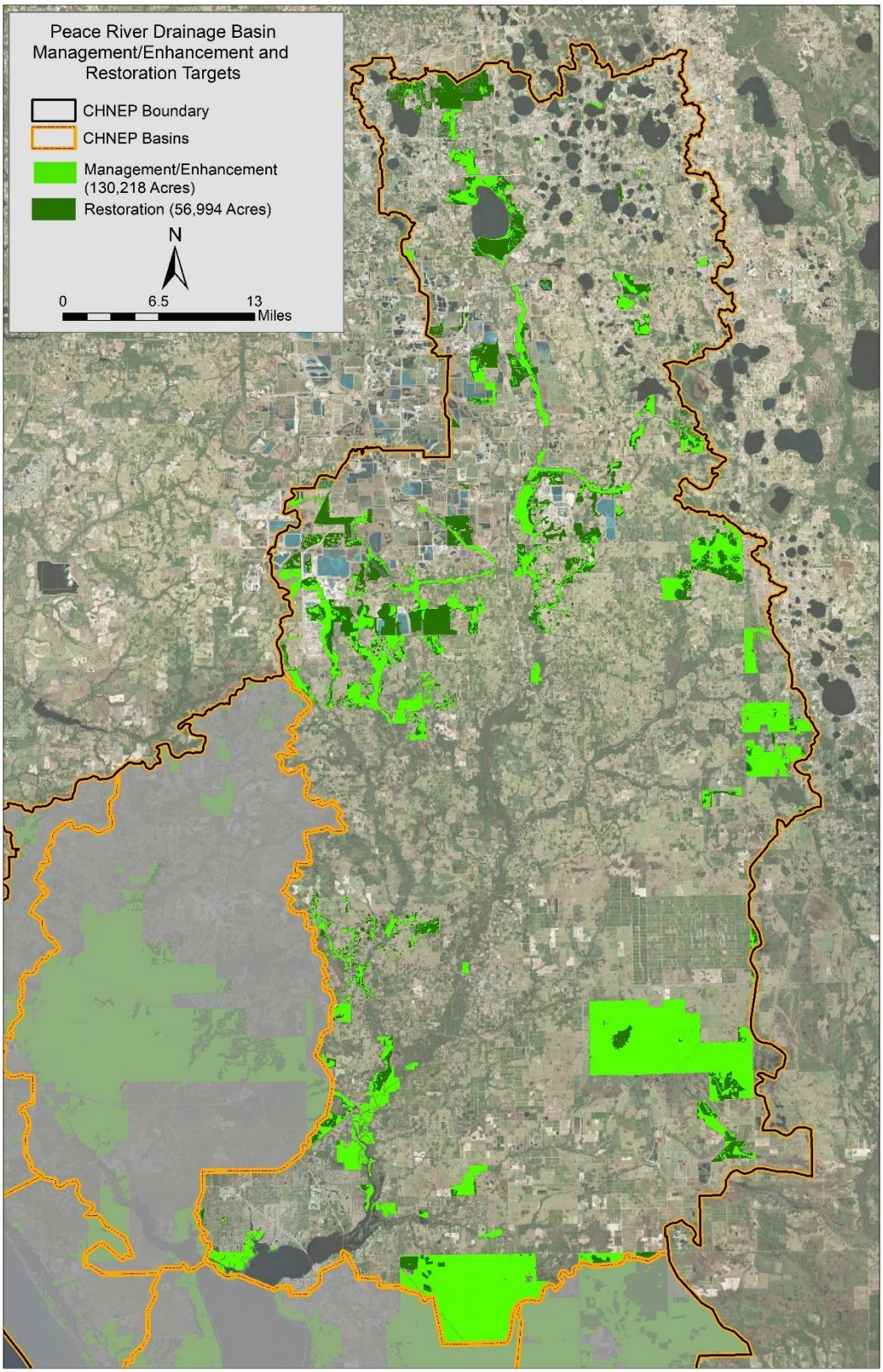


Figure 18. Peace River Basin RO.



***See narrative for note on mapping classifications.**

Figure 19. Peace River Basin MET and RT.

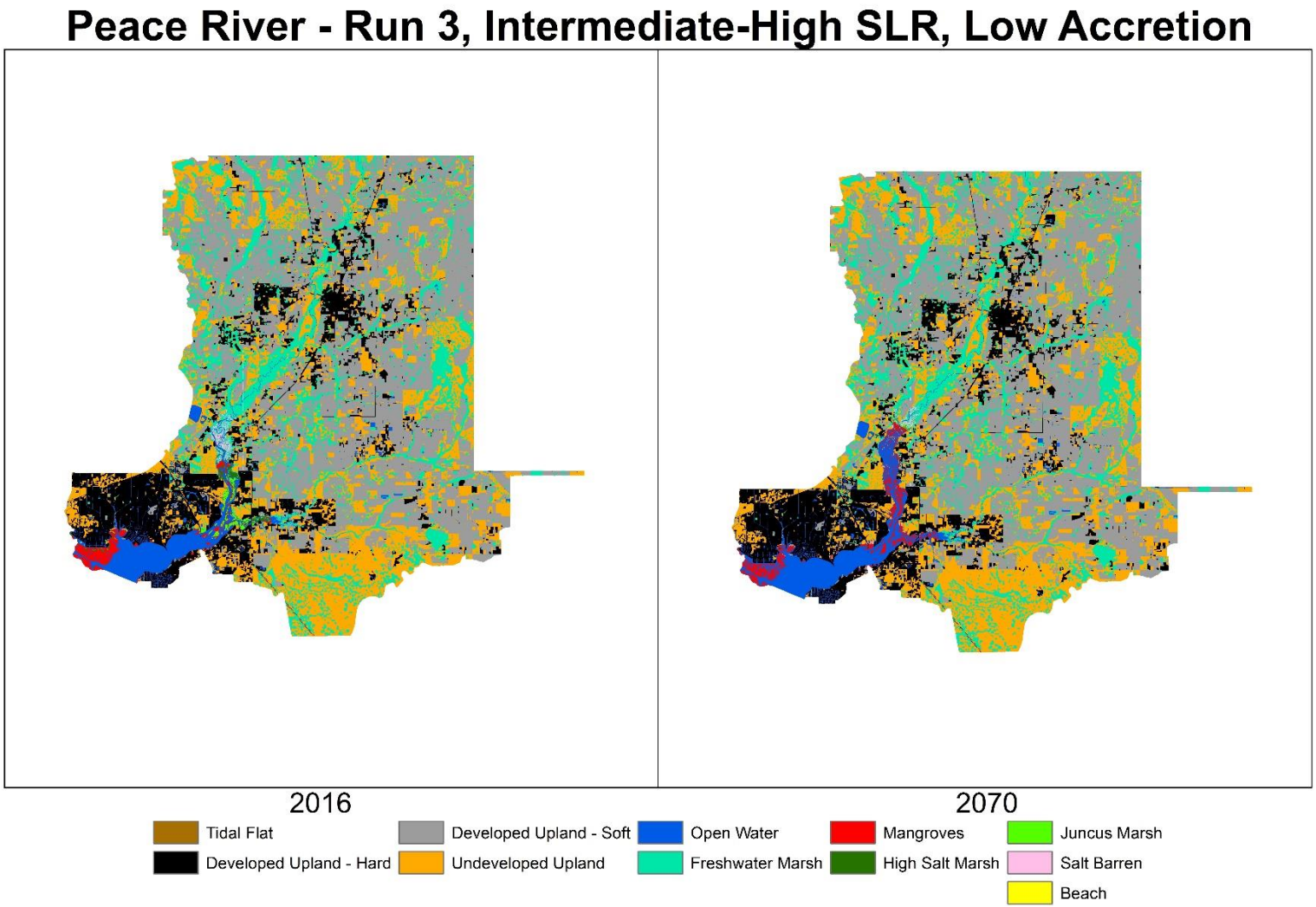


Figure 20. HEM Model Results for the Peace River basin

Myakka River Basin

The Myakka River basin totals 382,772 acres. Proportionally, the Myakka River basin contains the greatest amount of MET and RT, totaling 124,463 acres. This basin contains the Carlton Reserve and Myakka State Forest. The results for this basin area are presented in the following narrative and in Figures 21 through 23.

Preservation/Conservation Opportunities (PCO)

A total of 84,881 acres was identified as potential PCO, of which 30 percent (25,446 acres) was categorized as non-native and 70 percent (59,435 acres) as native habitat (Table 13; Figure 21). Overall, the acreage identified as potential PCO constitutes 22 percent of the total lands within the Myakka River basin. The dominant native habitat communities were classified as shrub and brushland (13,263 acres; 16%), pine flatwoods (11,024 acres; 13%;), and freshwater marshes (11,786 acres; 14%;) (Appendix E). Cropland and pastureland (17,767 acres; 21%) was identified as the major non-native habitat classification within the overall basin.

Overall, the potential PCO were distributed throughout the Myakka River basin (Figure 21). The greatest area of native habitat communities was identified on lands east of the Myakka River State Park/Carlton Reserve, and within the Myakka River and creeks. The majority of non-native (potential future RO or RT) habitat communities were also identified east of the Carlton Reserve.

Reservation Opportunities (RO)

A total of 53 acres was identified as potential RO within the Myakka River basin (Table 13; Figure 22). Overall, the acreages identified constitute less than one percent of the total lands within this basin. The dominant potential RO were classified as open lands (21 acres) and croplands and pasturelands (20 acres) (Appendix E). Potential RO were prominent near the estuarine complex along the Myakka River (Figure 22).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in tidally influenced areas. The Myakka River basin HEM map (Figure 24) illustrates model Run 3 (Intermediate-High Sea Level Rise, Low Accretion) for Years 2016 and 2070. The results illustrate a limited expansion of open water created by projected sea level rise, as well as the loss of mangroves and their migration higher into the landscape.

Management/Enhancement Targets (MET)

A total of 124,463 acres was identified as MET and RT, of which 91% (113,130 acres) was categorized for MET (Table 13; Figure 23). Overall, the acreage identified as MET and RT constitutes 33 percent of the total lands within the Myakka River basin. The dominant native habitat communities identified for MET were classified as shrub and brushland, (29,264 acres; 24%;), pine flatwoods (27,590 acres; 22%;), and freshwater marshes (22,398 acres; 18%) (Appendix E).

MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be managed or enhanced (Table 13). The vast majority of MET occurred within the Myakka River State Park/Carlton Reserve, Deer Prairie Creek and other lands within the Myakka River basin (Figure 23).

Restoration Targets (RT)

A total of 124,463 acres was identified as RT and MET, of which 9% (11,333 acres) was categorized for as RT (Table 13; Figure 23). Overall, the acreage identified as RT and MET constitutes 33 percent of the total lands within the Myakka River basin. RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be restored (Table 13). There are several instances in which areas identified as non-native (RT) are directly adjacent to native habitats. Identifying areas for strategic restoration could result in the further expansion of restored native habitat communities.

Habitat Status and Trends Analysis

A change analysis was completed for this basin to quantify the gains/losses of habitats between 1995 and 2009/2011 (Table 14). The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitats changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within this basin, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development, agriculture, and mining; and
- Forested freshwater wetlands converting to non-forested freshwater wetlands through silviculture.

Mapping inconsistencies observed in the change analysis included the following:

- FLUCCS 3000 (Upland Non-Forested) Series Level 2 (Dry Prairie, Shrub and Brushland, Mixed Rangeland) codes were often interchangeably used for the same aerial signature between 1995 and 2009/2011, so gains/losses in the 3000 series may not all be a changes;

- Slough waters classification was not used in 2009/2011;
- Increases in intermittent pond classification occurred from development between 1995 and 2009/2011. Also, open water ponds that became shallow ponds were re-mapped to intermittent ponds in 2009/2011; and
- Large areas around El Jobean that were mapped as saltwater marsh in 1995 were remapped as freshwater marsh in 2009/2011, although there were no signature changes in the aerial analysis between these two periods.

Myakka River Basin Summary

The Myakka River basin is the second largest of the CHNEP major basins, extending from Manatee County to Charlotte Harbor. The Myakka River is impounded in Myakka State Park, at the south end of Upper Lake Myakka, which has been used as water supply source. The headwaters of the Myakka River have been impacted by intensive row crops, resulting in the over-hydration and associated tree die-off in the Flatford Swamp. The lower reaches of the river are characterized by mostly native habitats, with some residential development.

The habitat status and trends analysis for the Myakka River basin showed losses in upland coniferous forest, primarily pine flatwoods. This may be considered a priority habitat for restoration. In addition, substantial increases in vegetated non-forested wetland and mixed rangelands were noted. Changes in other upland and freshwater wetland habitats were difficult to discern due to mapping inconsistencies. Slight decreases in both mangrove swamp and saltwater marsh were also noted in the tidal portion of the lower Myakka River. The latter observation contradicts the findings of the HEM utilized as part of this project, but mapping inconsistencies were evident in a review of the aerial imagery. The HEM predicts the landward migration of mangroves, and the upstream migration of salt marshes in the tidal rivers and tributaries, in response to sea level rise over the next 100 years. Based on these predictions, ensuring appropriate freshwater inflows, and restricting future impoundments in the Myakka River will be important to preserving the balance of the primary tidal wetlands which are mangroves and salt marshes in this basin.

The 100-year floodplain of the Myakka River constitutes an important fish and wildlife migratory corridor that is still mostly intact. Myakka River State Park encompasses a large portion of the 100-year floodplain, but most of the remaining floodplain is in private ownership. The habitat continuity of the Myakka River floodplain and watershed area could be substantially improved by strategically-located public land acquisition, with almost 85,000 acres of PCO identified by CHNEP stakeholders and other natural resource agencies. Large tracts of potential preservation and conservation lands were identified on the eastern edge of Myakka River State Park, which if acquired would consolidate a very large proportion of the overall basin area. Conversely, only 53 acres were identified as RO, as much of the tidal portion of the Myakka River basin is either still in native wetland habitats, or built out as existing development.

Over 113,000 acres of native habitats occur within existing preservation and conservation lands in the Myakka River basin; and these areas allow for habitat management activities to optimize functions. In addition, over 11,000 acres of altered, non-native habitats occur within existing

preservation and conservation lands; and these areas allow for opportunities for true habitat restoration, including primarily upland and freshwater wetland habitats. The majority of the larger habitat restoration areas exist on the east side of Myakka River State Park.

MET and RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the general classes of habitats that could be managed/enhanced or restored. In the Myakka River basin, the uplands category provides the greatest area for both management/enhancement and restoration activities, followed by freshwater wetlands. Limited restoration opportunities exist for tidal wetland restoration in this basin.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The CHNEP Management Conference noted these updates presented below:

- Portions of land along the shoreline of Big Slough waterway in North Port were partially mapped as PCO based on existing mapping FLUCCS codes; however, these areas have been purchased and preserved by the City of North Port and should now fall into the MET (lands mapped as native) and RT (lands mapped as non-native) categories and should be reclassified in future HRN studies.

- Parcels of land at the intersection of Toledo Blade and Price Boulevard in North Port were partially mapped as PCO based on existing mapping FLUCCS codes; however, these areas have been zoned for commercial use and are currently being developed and should be reclassified in future HRN studies as Existing Development.

- All maps and tables in this basin are based on 2011 SWFWMD habitat mapping data.

The results presented in the tables and maps below can form the foundation for future studies.

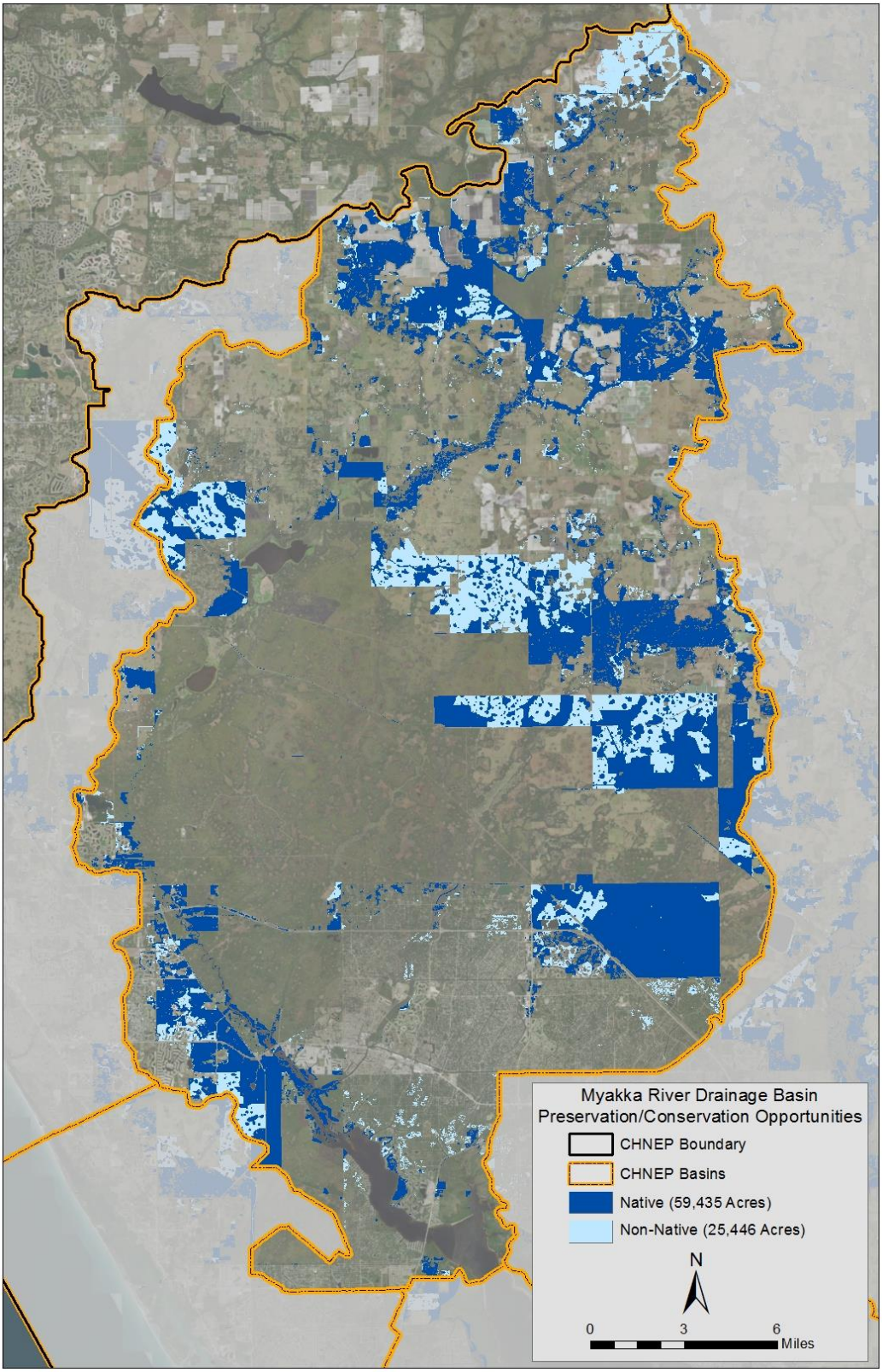
TABLE 13. HRN OPPORTUNITIES AND TARGETS FOR THE MYAKKA RIVER BASIN BY MAJOR HABITAT TYPE

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	34,074	N/A	66,808	8,466
Freshwater Wetlands	24,470	N/A	44,957	2,865
Tidal Wetlands	891	N/A	1,364	2
Non-Native	25,446	53	N/A	N/A
Total	84,881	53	113,130	11,333

TABLE 14. HRN CHANGE ANALYSIS GAINS AND LOSSES FOR THE MYAKKA RIVER BASIN BY HABITAT CLASSIFICATION TYPE.

FLUCCS Codes	Primary Classifications	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	1,503	1,035	-468	-31%
3200	Shrub and Brushlands	60,288	46,323	-13,965	-23%
3300	Mixed Rangelands	2,148	4,455	2,307	107%
4100	Upland Coniferous Forest	51,168	44,331	-6,837	-13%
4200/4300	Upland Hardwood Forest	17,960	18,434	474	3%
5100	Streams and Waterways	1,295	1,226	-69	-5%
5200	Lakes	2,236	1,392	-844	-38%
5600	Slough Waters	N/A	N/A	N/A	N/A
6100	Wetland Hardwood Forest	29,016	28,702	-314	-1%
6120	Mangrove Swamp	827	806	-21	-2%
6200	Wetland Coniferous Forest	1,441	1,436	-5	-0.3%
6300	Wetland Forested Mixed	696	873	177	25%
6400	Vegetated Non-Forested Wetlands	48,371	53,845	5,474	11%
6420	Saltwater Marsh	1,701	1,574	-127	-7%
6530	Intermittent Ponds	23	72	49	*
6600	Salt Flats	N/A	47	47	*

*Differences in mapping methodologies between periods may account for some anomalies in the data.



***See narrative for note on mapping classifications.**

Figure 21. Myakka River Basin PCO.

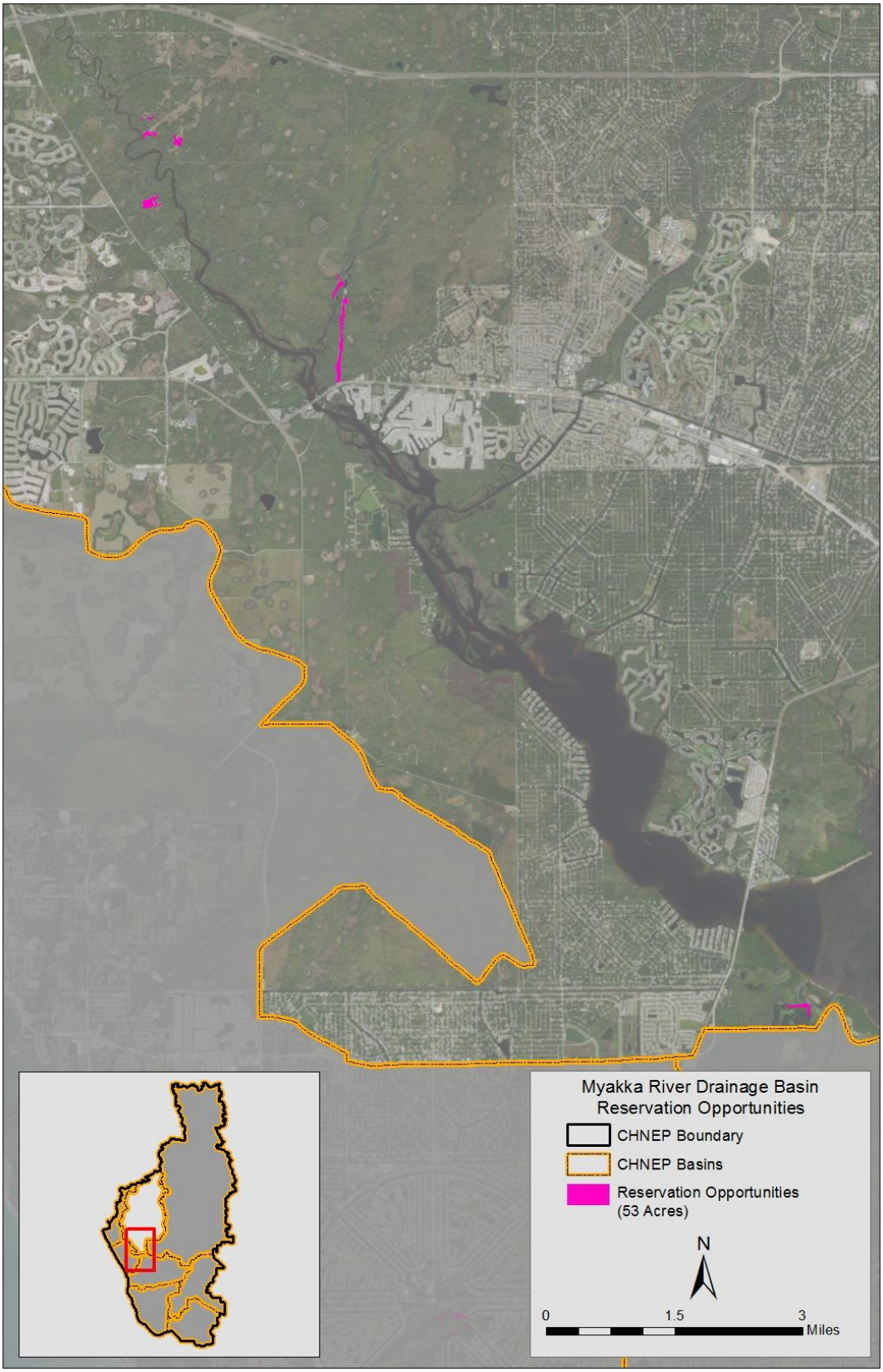
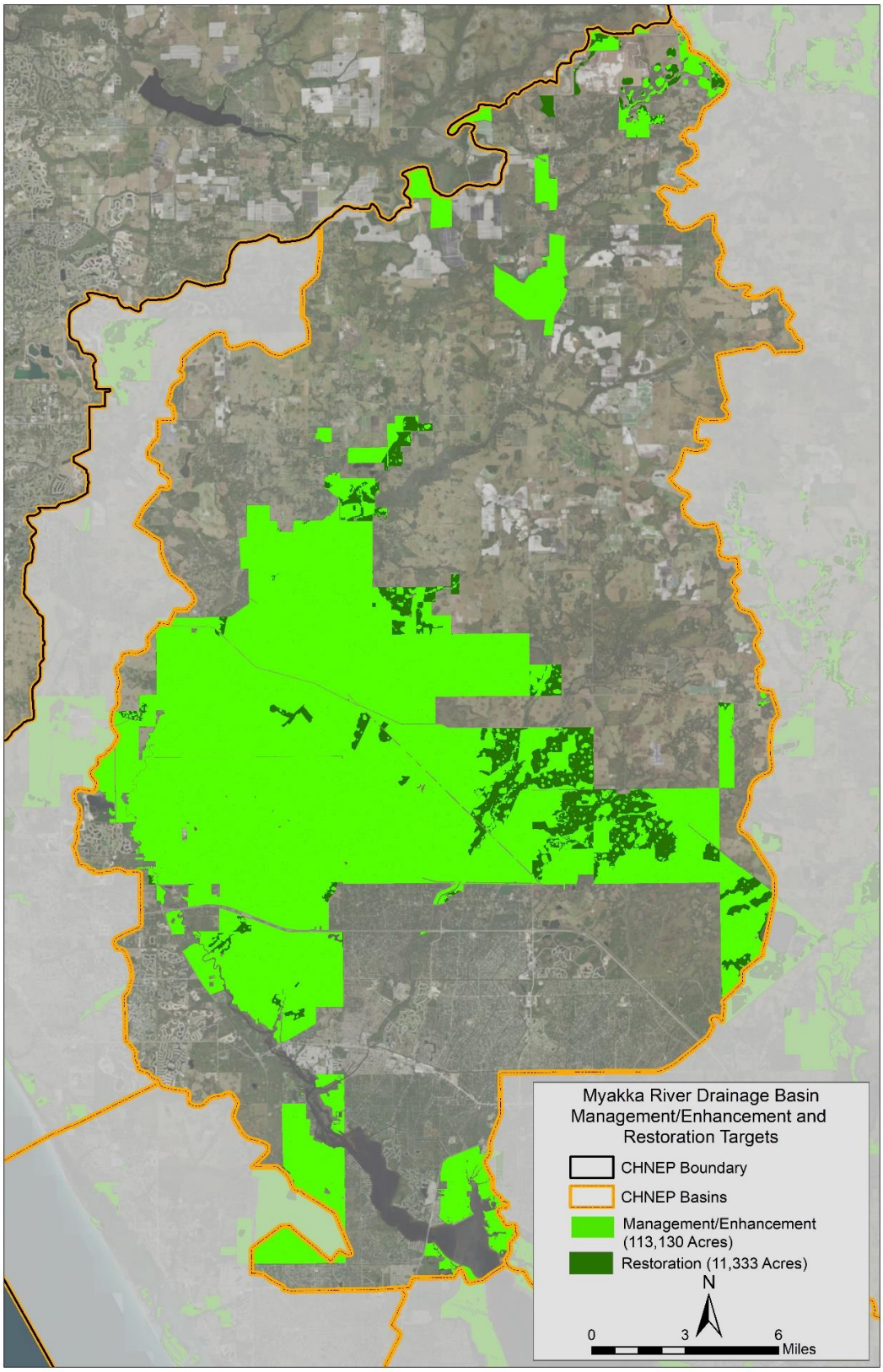


Figure 22. Myakka River Basin RO.



***See narrative for note on mapping classifications.**

Figure 23. Myakka River Basin MET and RT.

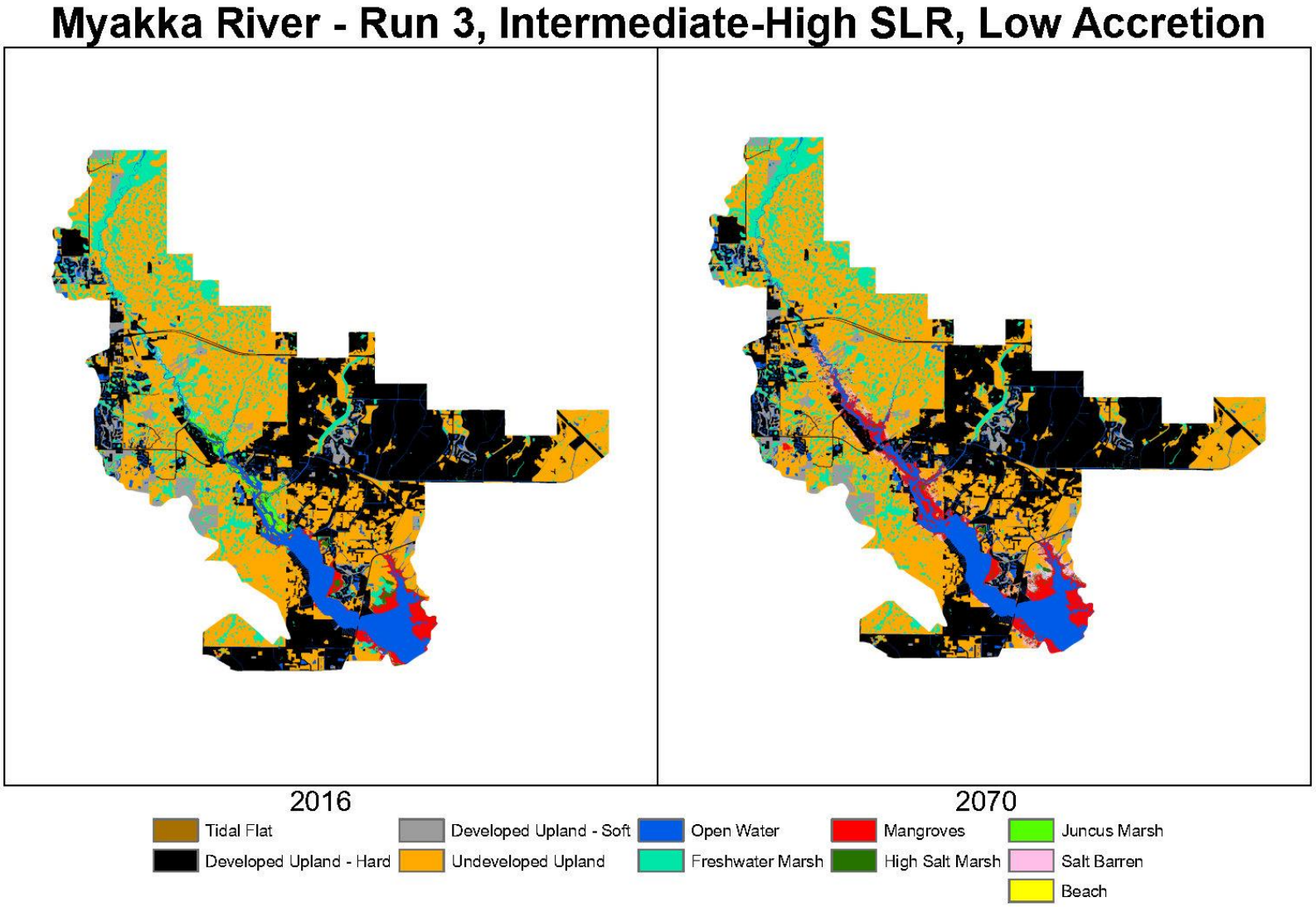


Figure 24. HEM Model Results for the Myakka River basin

Charlotte Harbor Basin

The Charlotte Harbor basin consists of 224,073 acres, and its major features include Charlotte Harbor, Charlotte Harbor State Park, and the western portions of Babcock/Webb Wildlife Management Area. The Peace and Myakka Rivers flow into this basin. The results for this basin area are presented in the following narrative and in Figures 25 through 27.

Preservation/Conservation Opportunities (PCO)

A total of 18,897 acres was identified as potential PCO, of which 22 percent (4,079 acres) were categorized as non-native and 78 percent (14,818 acres) as native habitat (Table 15; Figure 25). Overall, the acreages identified as potential PCO constitutes 8 percent of the total lands within this basin. The dominant native habitat community was classified as pine flatwoods (4,988 acres; 26%). Cropland and pastureland (1,627 acres; 9%) was identified as the major non-native classification within the overall basin (Appendix E).

Overall, the potential PCO were identified to the east of Charlotte Harbor's east wall and west of Interstate 75 within this basin (Figure 25). The native habitat communities were primarily found in association with Charlotte Harbor. In contrast, the majority of non-native (potential future RO or RT) habitat communities were identified farther from the Harbor.

Reservation Opportunities (RO)

A total of 69 acres was identified as potential RO (Table 15; Figure 26) within this basin. Overall, the acreage identified constitutes one percent of the total lands within this basin. The dominant habitat community was classified as other open lands (34 acres; Table 15). Potential RO were prominent along the East Wall of Charlotte Harbor (Figure 26).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in tidally influenced areas. The Charlotte Harbor basin HEM map (Figure 28) illustrates model Run 3 (Intermediate-High Sea Level Rise, Low Accretion) for Years 2016 and 2070. The results illustrate an expansion of open water created by projected sea level rise, as well as the loss of mangroves and their migration higher into the landscape.

Management/Enhancement Targets (MET)

A total of 60,801 acres was identified as MET and RT, of which 60,457 acres was categorized for MET (99%) (Table 15; Figure 27). Overall, the acreage identified for MET and RT constitutes 27 percent of the total lands within the Charlotte Harbor basin. The dominant native habitat community identified for MET was classified as pine flatwoods (18,059 acres; 30%) (Appendix E). MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be managed or enhanced (Table 15). The vast

majority of MET are associated with the western limits of Cecil B. Webb and Babcock Ranch Wildlife Management Area, Yucca Pens, and the West Wall of Charlotte Harbor within this basin (Figure 27).

Restoration Targets (RT)

A total of 60,801 acres was identified as RT and MET, of which 1,344 acres (1%) was categorized as RT (Table 15; Figure 27). Overall, the acreage identified for RT and MET constitutes 27 percent of the total lands within the Charlotte Harbor basin. The dominant native habitat community identified for Management was classified as pine flatwoods (18,059 acres; 30%) (Appendix E). RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be restored (Table 15). There are several instances in which areas identified as non-native (RT) are directly adjacent to native habitats. Identifying areas for strategic restoration could result in the further expansion of restored native habitat communities.

Habitat Status and Trends Analysis

A change analysis was completed for this basin to quantify the gains/losses of habitats between 1995 and 2009/2011 (Table 16). The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitats changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within this basin, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development, agriculture, and mining; and
- Salt marshes transitioning to mangroves.

Mapping inconsistencies observed in the change analysis included the following:

- FLUCCS 3000 (Upland Non-Forested) Series Level 2 (Dry Prairie, Shrub and Brushland, Mixed Rangeland) codes were often interchangeably used for the same aerial signature between 1995 and 2009/2011, so gains/losses in the 3000 series may not all be real changes;
- Some pre-platted lands were mapped as FLUCSS 3100 dry prairie codes for 2009/2011; however, these lands may be developable and future HRN studies should look at updating these classifications;
- Slough Waters classification was not used in 2009/2011;

- Increases in intermittent pond classification occurred from development between 1995 and 2009/2011. Also, open water ponds that became shallow ponds were remapped to intermittent ponds in 2009/2011; and
- Salt flats were mapped in 2009/2011 within Charlotte Harbor State Park (at the southern limits of the Cape Haze Peninsula, around Cattle Dock Point and the "West Wall"), where they had previously not been mapped.

Charlotte Harbor Basin Summary

With just 9% of the basin classified as existing development, the Charlotte Harbor basin contains a large proportion of publically owned lands. The habitat status and trends analysis for this basin showed losses in wetland hardwood forest and mixed wetland forested mixed. However, changes in these, and other upland and freshwater wetland habitats were difficult to discern due to mapping inconsistencies; and therefore priority habitats for restoration could not be identified. Future studies may verify habitat changes and the specific assemblage of habitats for restoration.

Similar to other coastal basins, the change analysis showed an increase in mangrove swamps, which is consistent with HEM projections that salt marshes will transition to mangroves. There are no primary or secondary Florida panther habitat areas located in this basin, however, CHNEP stakeholders identified publicly owned areas along the West Wall and East Wall of Charlotte Harbor as important wildlife corridors; as well as a small portion of the far eastern edge of the basin (Figure 8).

PCO are primarily located in the eastern portion of the basin for connectivity with Yucca Pens and Babcock/Webb Wildlife Management Areas. RO were limited, and occurred on both the West Wall and East Wall of Charlotte Harbor, and provide the opportunity to connect with existing publicly owned lands. MET areas along the West Wall and East Wall of Charlotte Harbor are part of Charlotte Harbor State Park, and can accommodate projected sea level rise and provide coastal protection.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The CHNEP Management Conference noted the update presented below:

- The area east of Winegourd Creek along Charlotte Harbor's East Wall was partially mapped as non-native PCO based on existing mapping FLUCCS codes. However, this area is now under development and should be reclassified as existing development in future HRN studies.

- SFWMD and Lee Conservation 20/20 worked with landowners to identify the Stolle ranch property (2,064 acres in Charlotte County and 691 acres in Lee County) as important for preservation and eventually hydrological restoration as part of the Charlotte Harbor Flatwoods Initiative, a multi-phased regional hydrologic restoration effort coordinated by

the SFWMD, CHNEP, and Florida Fish and Wildlife Conservation Commission (FWC). Portions of this area are included as PCO (Figure 25), and as additional lands are acquired these may be included in future HRN studies.

The results presented in the tables and maps below can form the foundation for future studies.

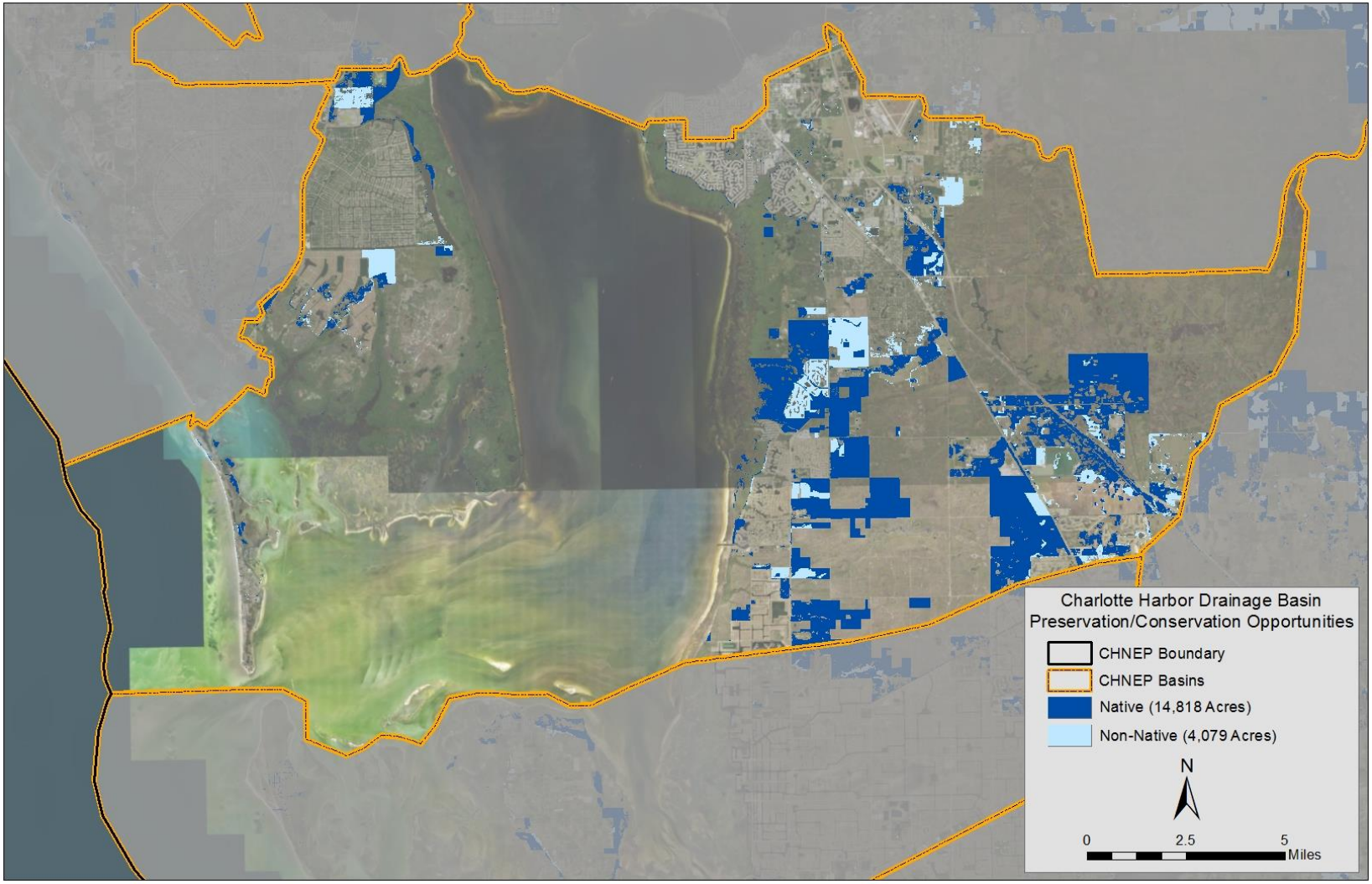
TABLE 15. HRN OPPORTUNITIES AND TARGETS FOR THE CHARLOTTE HARBOR BASIN BY MAJOR HABITAT TYPE

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	8,746	N/A	26,171	642
Freshwater Wetlands	4,888	N/A	16,538	701
Tidal Wetlands	1,184	N/A	17,748	1
Non-Native	4,079	69	N/A	N/A
Total	18,897	69	60,457	1,344

TABLE 16. HRN CHANGE ANALYSIS GAINS/LOSSES FOR THE CHARLOTTE HARBOR BASIN BY HABITAT CLASSIFICATION TYPE.

FLUCCS Codes	Primary Classifications	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	509	1,959	1,450	*
3200	Shrub and Brushlands	12,372	9,422	-2,941	-24%
3300	Mixed Rangelands	1,311	1,111	-200	-15%
4100	Upland Coniferous Forest	28,976	25,365	-3,611	-12%
4200/4300	Upland Hardwood Forest	1,068	1,600	532	50%
5100	Streams and Waterways	1,927	1,951	24	1%
5200	Lakes	53	94	41	77%
5600	Slough Waters	N/A	N/A	N/A	N/A
6100	Wetland Hardwood Forest	3,404	1,809	-1,595	-47%
6120	Mangrove Swamp	14,266	15,981	1,715	12%
6200	Wetland Coniferous Forest	5,960	5,860	-100	-2%
6300	Wetland Forested Mixed	448	171	-277	-62%
6400	Vegetated Non-Forested Wetlands	12,550	15,385	2,835	23%
6420	Saltwater Marsh	4,361	3,184	-1,177	-27%
6530	Intermittent Ponds	5	17	12	2%
6600	Salt Flats	N/A	484	484	*

*Difference in mapping methodologies between periods may account for some anomalies in the data.



***See narrative for note on mapping classifications.**

Figure 25. Charlotte Harbor Basin PCO.

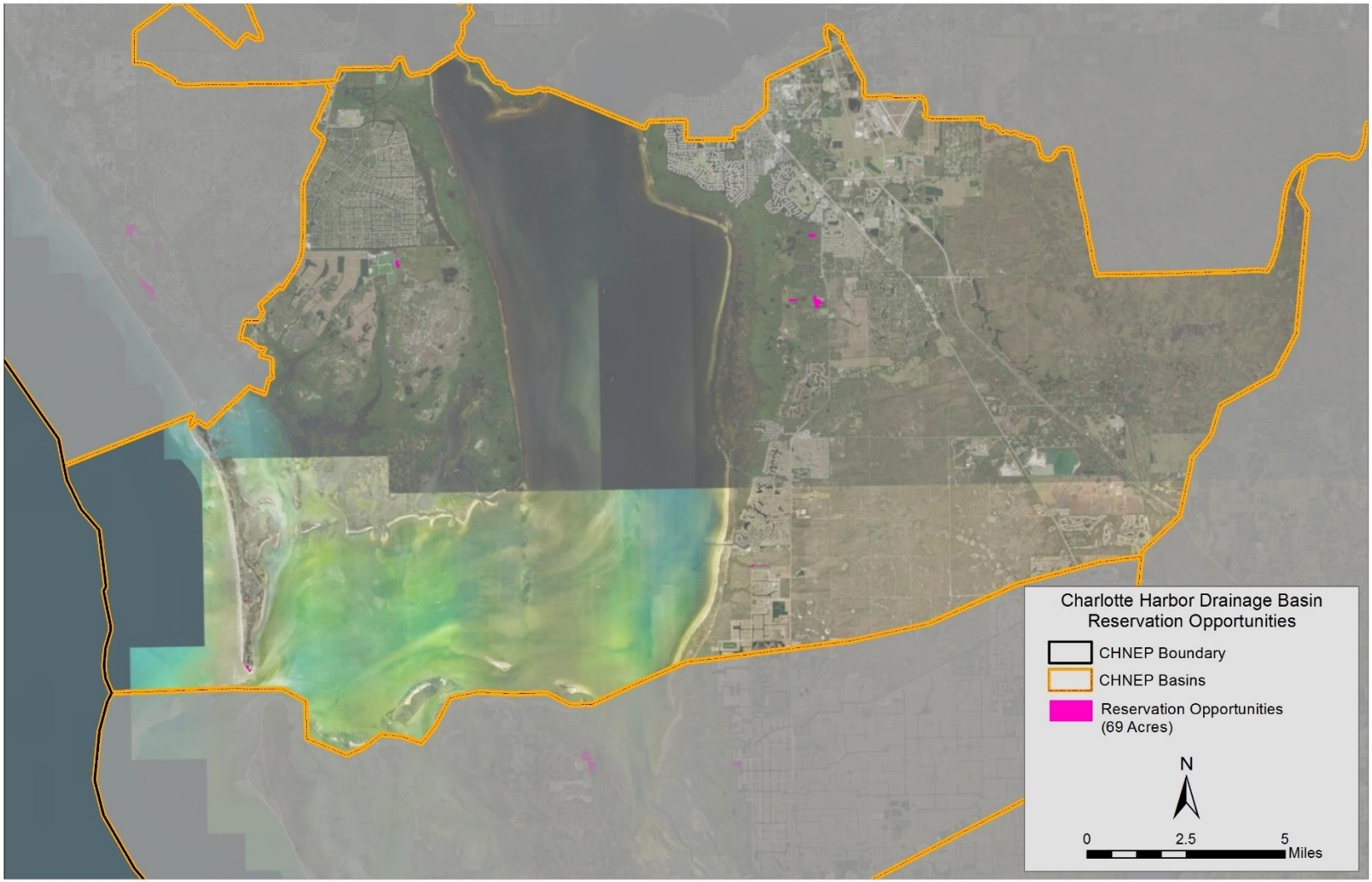


Figure 26. Charlotte Harbor Basin RO.

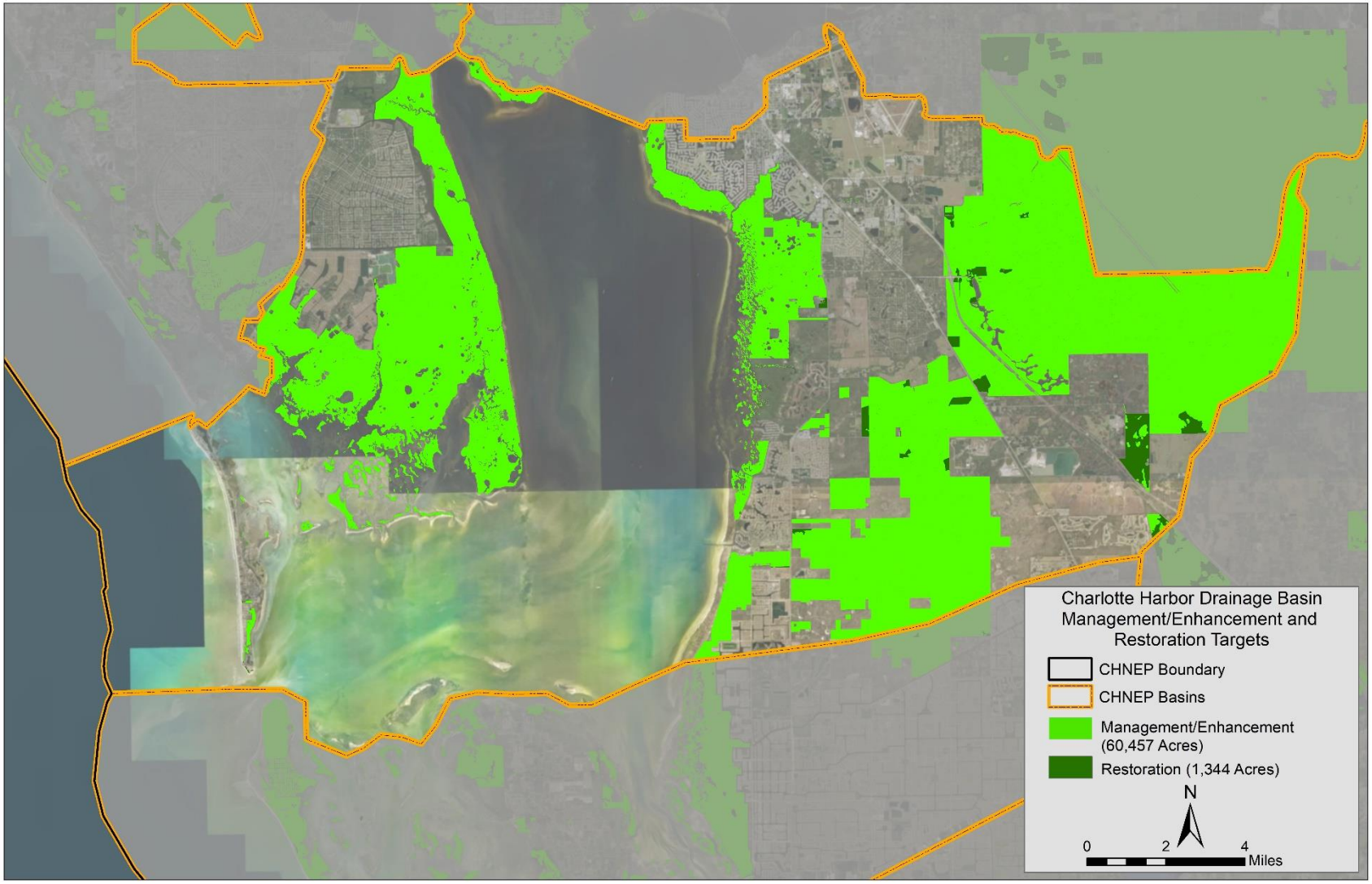


Figure 27. Charlotte Harbor Basin MET and RT.

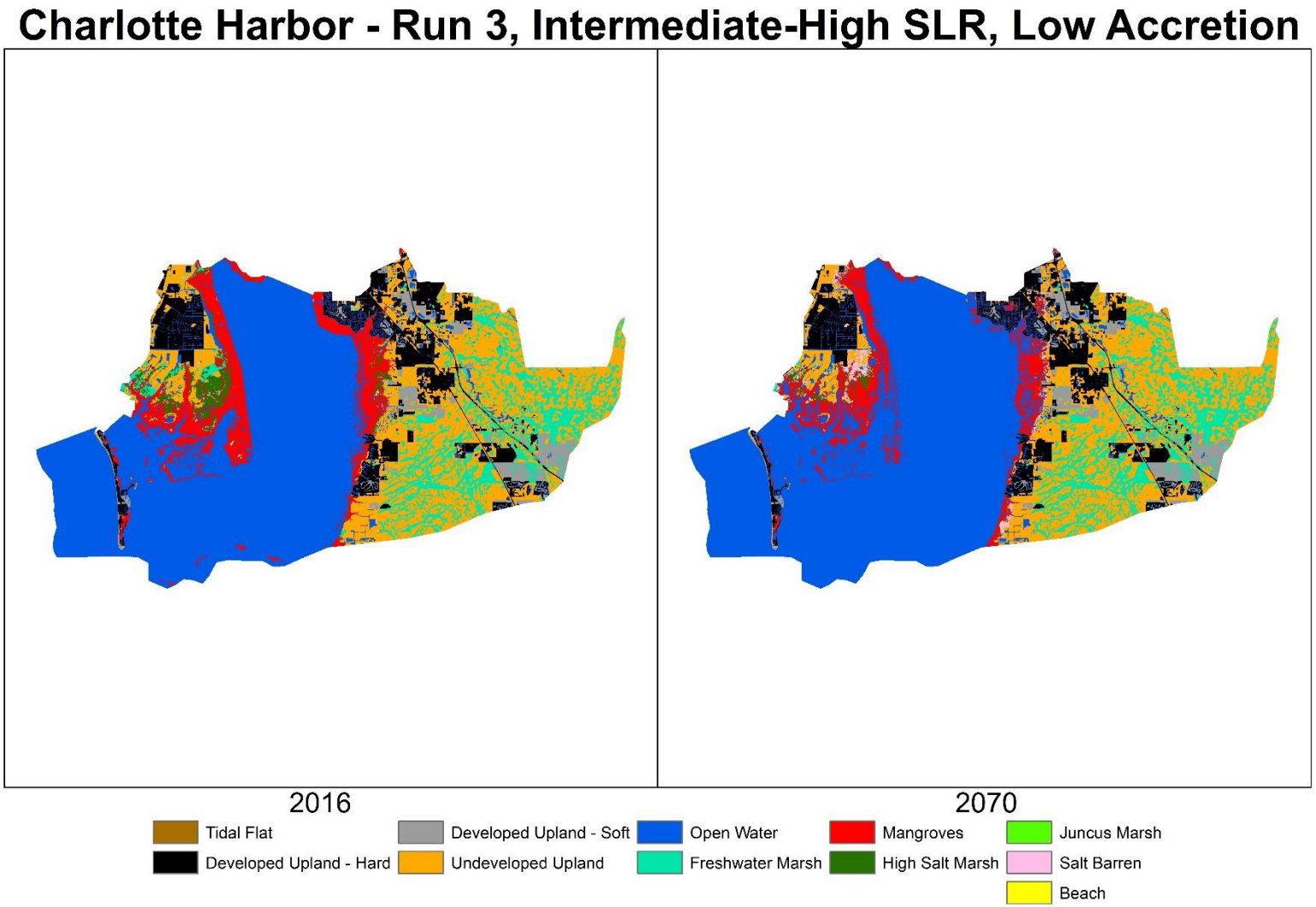


Figure 28. HEM Model Results for the Charlotte Harbor basin.

Tidal Caloosahatchee River Basin

The Tidal Caloosahatchee River basin totals 271,995 acres, and contains the tidal portion of the Caloosahatchee River and significant portions of Babcock/Webb Wildlife Management Area. The southeastern limits of this basin contain secondary Florida panther habitat. The lower reaches of this basin are largely residential development. The results for this basin area are presented in the following narrative and in Figures 29 through 31.

Preservation/Conservation Opportunities (PCO)

A total of 41,869 acres was identified as potential PCO, of which 66 percent (27,810 acres) was categorized as native habitat and 34 percent (14,059 acres) as non-native and (Table 17; Figure 29). Overall, the acreage identified constitutes 15 percent of the total lands within the Tidal Caloosahatchee River Basin. The dominant native habitat community was classified as pine flatwoods which comprised 25 percent (10,402 acres) of all potential PCO acreages within this basin. Cropland and pastureland (9,991 acres; 24%) was identified as the major non-native (RT) habitat classification within this basin with (Appendix E).

Overall, the potential PCO were concentrated in the eastern limits of the basin, north of the Tidal Caloosahatchee River, and some areas to the south of the river (Figure 29). There were 3,819 acres of potential PCO located within secondary panther habitat located in the southeast portion of this basin. The panther habitat acreages presented in Figure 29 are an overlay on the other areas and that acreage is included in the overall PCO acreages.

Reservation Opportunities (RO)

A total of 115 acres was identified as potential RO within this basin (Table 17; Figure 30). Overall, the acreages identified constitute less than one percent of the total lands within the overall basin. The dominant habitat community was classified as exotic species (101 acres; 88%), which consists of Brazilian pepper, Australian pine, and melaleuca; which could be recommended for invasive exotic removal programs. The potential RO are prominent near the estuarine areas of the Tidal Caloosahatchee River (Figure 30).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in tidally influenced areas. The Tidal Caloosahatchee River basin HEM map (Figure 32) illustrates model Run 3 (Intermediate-High Sea Level Rise Low Accretion) for Years 2016 and 2070. The results illustrate an expansion of open water near the riverine mouth created by projected sea level rise, as well as the loss of mangrove swamp and its migration higher in the landscape.

Management/Enhancement Targets (MET)

A total of 75,018 acres was identified as MET and RT, of which 60,321 acres was categorized for MET (80 percent) (Table 17; Figure 31). Overall, the acreages identified for MET and RT constitutes 28 percent of the total lands within the overall Tidal Caloosahatchee River basin. The dominant native habitat community identified for MET was classified as pine flatwoods which comprised 32 percent (23,985 acres) of all MET and RT acreages (Appendix E). MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be restored or managed (Table 17). The majority of MET occur at the northern limits of this basin (Figure 31). A large portion of Cecil B. Webb and Babcock Ranch Wildlife Management Areas occur within this basin.

Restoration Targets (RT)

A total of 75,018 acres was identified as RT and MET, of which 14,697 acres (20 percent) was categorized for RT (Table 17; Figure 31). Overall, the acreages identified for RT and MET constitutes 28 percent of the total lands within the overall Tidal Caloosahatchee River basin. The dominant native habitat community identified for MET was classified as pine flatwoods, which comprised 32 percent (23,985 acres) of all RT and MET acreages (Appendix E). RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be restored (Table 17). There are several instances in which areas identified as non-native (RT) are directly adjacent to native habitats. Identifying areas for strategic restoration could result in the further expansion of restored native habitat communities.

Habitat Status and Trends Analysis

A change analysis was completed for this basin to quantify the gains/losses of habitats between 1995 and 2009/2011 (Table 18). The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitats changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within this basin, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development and agriculture; and
- Salt marshes transitioning to mangroves.

Mapping inconsistencies observed in the change analysis included the following:

- FLUCCS 3000 (Upland Non-Forested) Series Level 2 (Dry Prairie, Shrub and Brushland, Mixed Rangeland) codes were often interchangeably used for the same aerial signature between 1995 and 2009/2011, so gains/losses in the 3000 series may not all be real changes.
- 1995 Existing Development lands were re-mapped as Dry Prairie for Cape Coral and Lehigh Acres in 2009/2011;
- Slough Waters classification was not used in 2009/2011; and
- Increases in Intermittent Pond occurred from development between 1995 and 2009/2011. Also, Open Water Ponds that became Shallow Ponds were re-mapped to Intermittent Ponds in 2009/2011.

Tidal Caloosahatchee Basin Summary

The Tidal Caloosahatchee River basin totals 271,995 acres, of which 25% is developed. This basin is significantly altered by the Franklin Lock at the eastern limits of the basin, which has restricted the normal tidal intermixing of salt and fresh waters within a typical riverine system. This basin is comprised of the tidal portion of the Caloosahatchee River up to the Franklin Lock, native freshwater wetlands and uplands within Babcock/Webb Wildlife Management Area, and dense development including Cape Coral and Lehigh Acres. Upland coniferous forests are the prominent upland habitat type, and vegetated non-forested wetlands are the predominant wetland habitat type. Disproportionate losses mapped within this basin area include wetland hardwood forest and wetland forested mixed, both are freshwater wetlands. However, changes in these, and other upland and freshwater wetland habitats were difficult to discern due to mapping inconsistencies; and therefore priority habitats for restoration could not be identified. Future studies may verify habitat changes and the specific assemblage of habitats for restoration. Mixed rangelands showed losses, however, since the FLUCCS Level 2 of the 3000 series codes were frequently mapped interchangeably these could not be verified.

Stakeholder identified corridors include areas that parallel the Caloosahatchee River connecting to Pine Island/Matlacha Pass and Estero Bay basins to the west, and to Babcock/Webb corridors to the east and north. Areas to the south of the river corridor contain lands identified as primary and secondary Florida panther habitats through Lehigh Acres connecting to preservation and conservation lands to the south and east.

PCO within the Tidal Caloosahatchee River basin were identified as lands abutting the southern limits of Babcock/Webb, small areas at the mouth of the Caloosahatchee River, and parcels within Lehigh Acres that are primary and secondary Florida panther habitats. Areas where primary and secondary Florida panther habitats occur should be a priority in the 19,333 acres of upland PCO. Because of the heavy development along the Caloosahatchee River, particularly towards the mouth, there has been a loss of mangroves. The mangrove loss is consistent with the HEM results, where mangroves are pinched out in locations where the waterfront is armored. The RO total 115 acres, and are located at the southern shoreline of the river mouth.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and

current and future research and analysis may support additional opportunities and targets not currently represented here. The CHNEP Management Conference noted the updates presented below:

- Some parcels were identified for inclusion on the Restoration/Management map by Lee County and should be added in future HRN studies:
  - Area adjacent to Calusa Creeks Preserve (Morse Shores Preserve);
  - Deep Lagoon, southern parcels/portions of nomination 116 and western portion of nomination 78; and
  - Olga Shores area on map only shows some areas of southern boundary.
- SFWMD and Lee Conservation 20/20 worked with landowners to identify the Stolle ranch property (2,064 acres in Charlotte County and 691 acres in Lee County) as important for preservation and eventually hydrological restoration as part of the Charlotte Harbor Flatwoods Initiative, a multi-phased regional hydrologic restoration effort coordinated by the SFWMD, CHNEP, and Florida Fish and Wildlife Conservation Commission (FWC). Portions of this area are included as PCO (Figure 29), and as additional lands are acquired these may be included in future HRN studies.

The results presented in the tables and maps below can form the foundation for future studies.

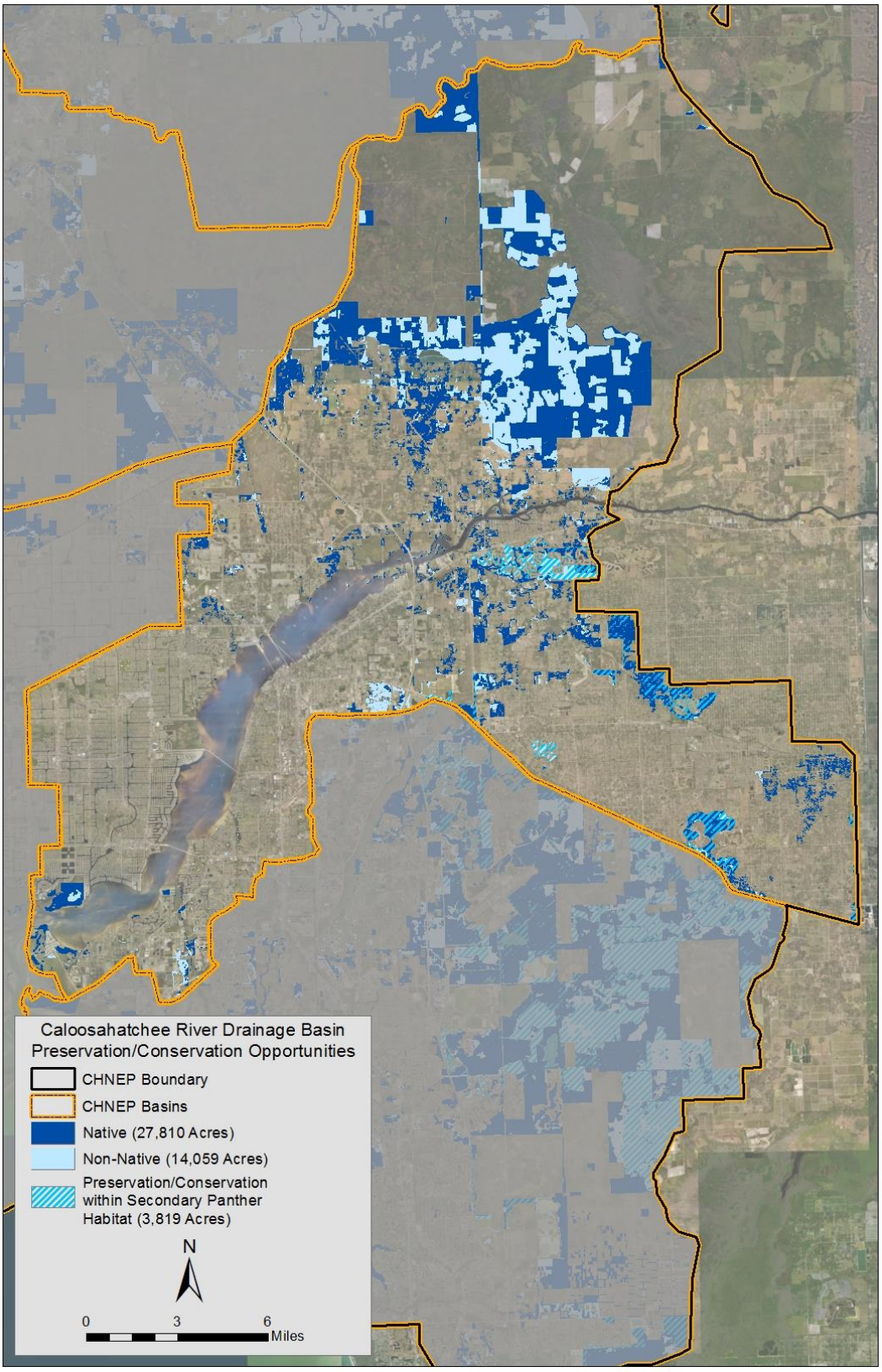
TABLE 17. HRN OPPORTUNITIES AND TARGETS FOR THE TIDAL CALOOSAHATCHEE RIVER BASIN BY MAJOR HABITAT TYPE

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	19,333	N/A	39,018	10,117
Freshwater Wetlands	7,630	N/A	19,633	4,578
Tidal Wetlands	846	N/A	1,670	2
Non-Native	14,059	115	N/A	N/A
Total	41,869	115	60,321	14,697

TABLE 18. HRN CHANGE ANALYSIS GAINS/LOSSES FOR THE TIDAL CALOOSAHATCHEE RIVER BASIN BY HABITAT CLASSIFICATION TYPE.

FLUCCS Codes	Primary Classifications	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	1,018	15,694	14,676	*
3200	Shrub and Brushlands	12,337	23,584	11,247	91%
3300	Mixed Rangelands	5,085	2,047	-3,038	-60%
4100	Upland Coniferous Forest	47,873	46,263	-1,610	-3%
4200/4300	Upland Hardwood Forest	1,775	8,402	6,627	*
5100	Streams and Waterways	16,323	16,536	213	1%
5200	Lakes	26	33	7	25%
5600	Slough Waters	96	N/A	N/A	N/A
6100	Wetland Hardwood Forest	10,078	7,081	-2,997	-30%
6120	Mangrove Swamp	3,602	3,467	-135	-4%
6200	Wetland Coniferous Forest	9,061	9,267	206	2%
6300	Wetland Forested Mixed	1,456	560	-896	-62%
6400	Vegetated Non-Forested Wetlands	14,247	14,409	162	1%
6420	Saltwater Marsh	338	395	57	17%
6530	Intermittent Ponds	N/A	N/A	N/A	N/A
6600	Salt Flats	N/A	N/A	N/A	N/A

* Differences in mapping methodologies between periods may account for anomalies in the data.



***See narrative for note on mapping classifications.**

Figure 29. Tidal Caloosahatchee Basin PCO.

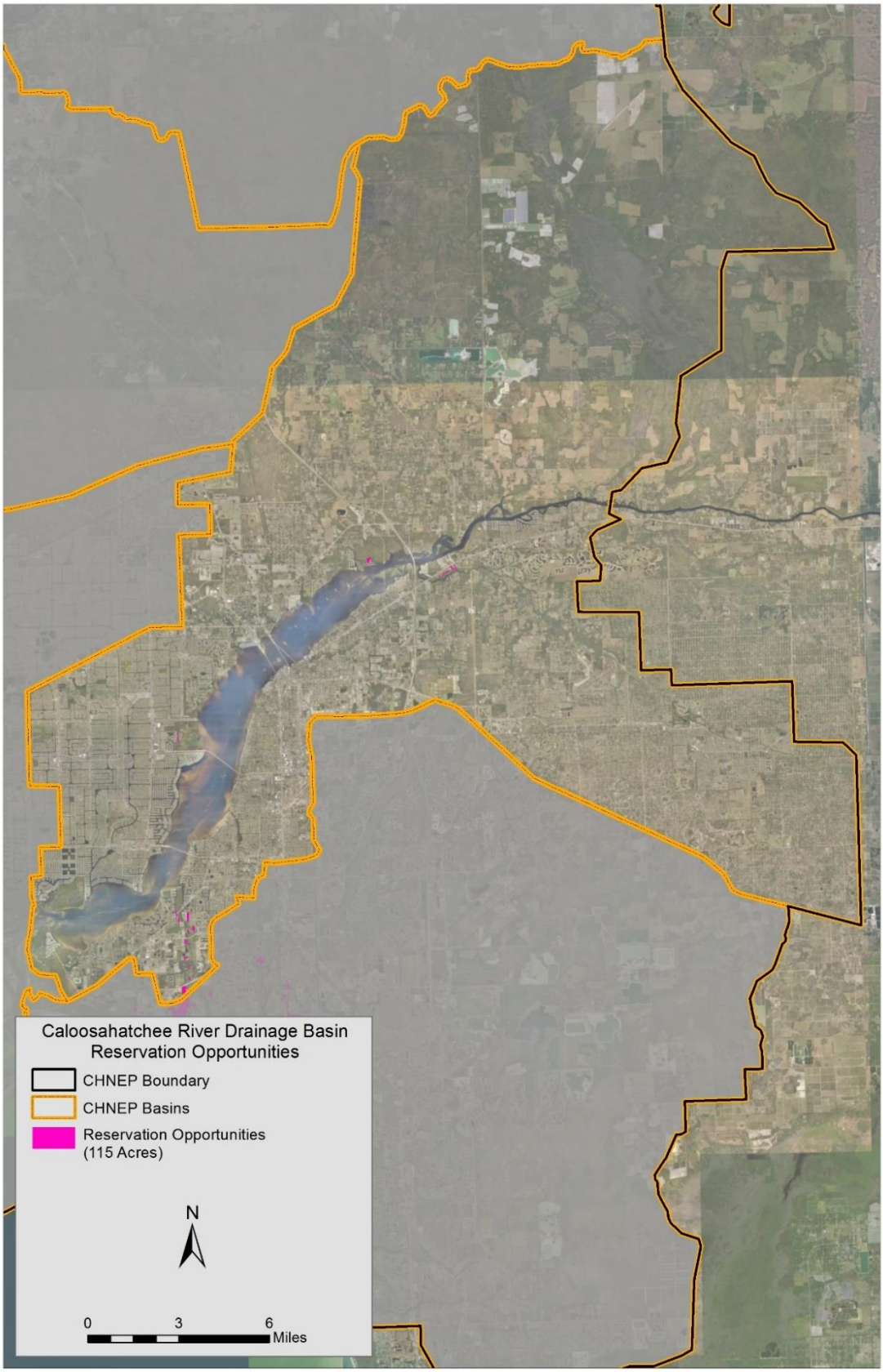
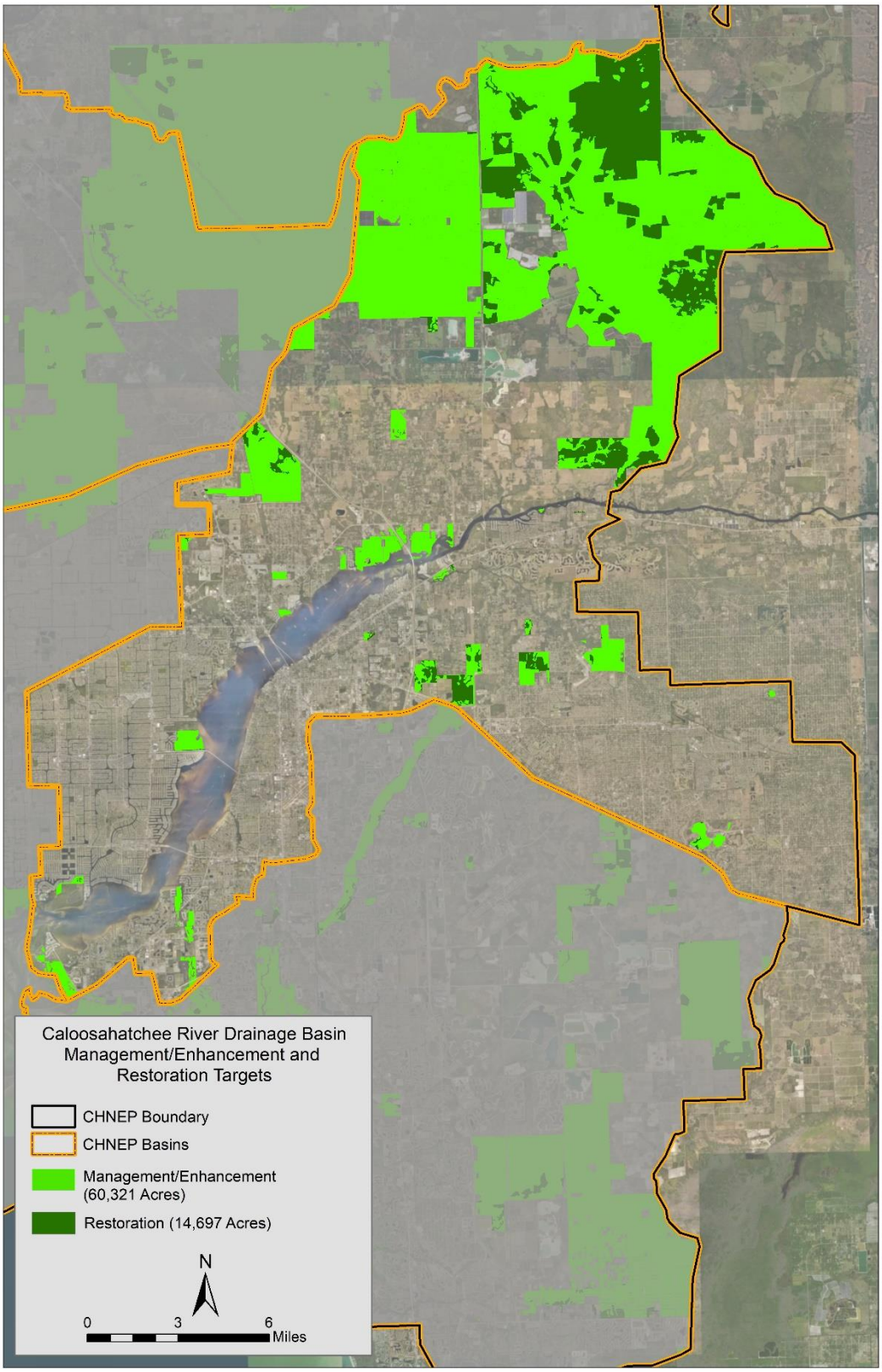


Figure 30. Tidal Caloosahatchee River Basin RO.



***See narrative for note on mapping classifications.**

Figure 31. Tidal Caloosahatchee Basin MET and RT.

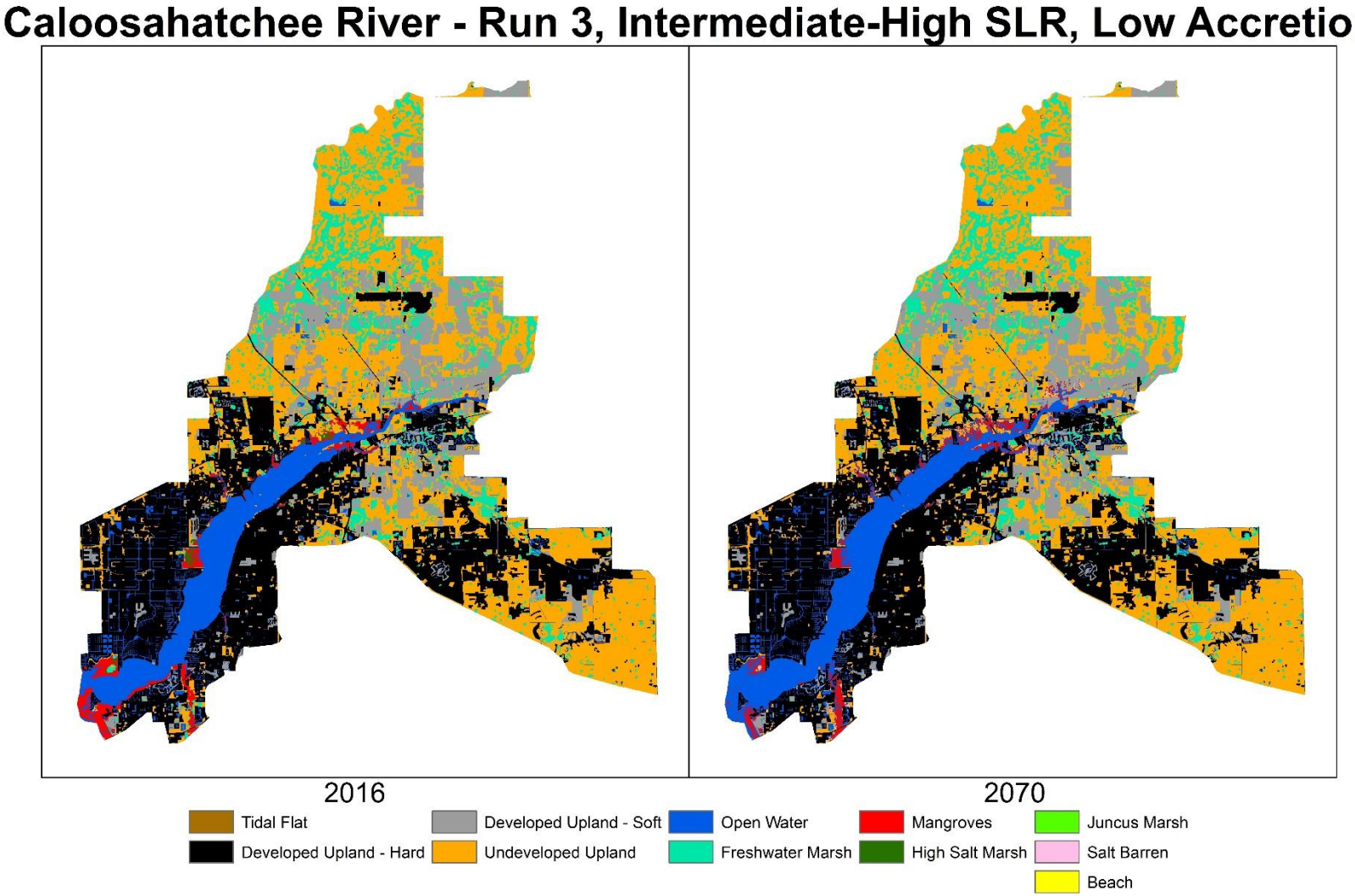


Figure 32. HEM Model Results for the Tidal Caloosahatchee River basin.

Pine Island/Matlacha Pass Basin

The Pine Island/Matlacha Pass basin totals 239,923 acres, and is primarily estuary and tidal areas including Pine Island Sound and Matlacha Pass. This basin also contains the southern limits of the Charlotte Harbor Preserve State Park (i.e. East Wall), Ding Darling Wildlife Management Area, Pine Island Mitigation Bank, Pine Island Flatwood Preserve, and Cayo Costa State Park. The results for this basin area are presented in the following narrative and in Figures 33 through 35.

Preservation/Conservation Opportunities (PCO)

A total of 5,326 acres was identified for potential PCO within this basin. Twelve percent (634 acres) were categorized as non-native and 88 percent (4,691 acres) as native habitat (Table 19; Figure 33). Overall, the acreages identified constitute 2 percent of the total lands within the Pine Island/Matlacha Pass basin. The dominant native habitat community was classified as mangrove swamp which comprised 46 percent (2,435 acres) of all potential PCO acreages. Exotic species (285 acres; 5%) was identified as the major non-native habitat classification within the overall basin (Appendix E). Overall, the potential PCO were distributed around Pine Island for this basin (Figure 33).

Reservation Opportunities (RO)

A total of 530 acres was identified for potential RO (Table 19; Figure 34) within this basin. Overall, the acreages identified constitute less than one percent of the total lands within this basin. The dominant habitat community was classified as exotic species (416 acres; 79%) which consists of Brazilian pepper, Australian pine, and melaleuca; which could be recommended for invasive exotic removal programs (Appendix E). Potential RO were identified on Pine and Sanibel Islands (Figure 34).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in tidally influenced areas. The Pine Island/Matlacha Pass basin HEM map (Figure 36) illustrates model Run 3 (Intermediate-High Sea Level Rise, Low Accretion) for Years 2016 and 2070. The results illustrate an expansion of open water created by sea level rise, as well as the loss of mangroves and their migration higher in the landscape. Additionally, nearly all freshwater marsh predicted to be lost by 2070.

Management/Enhancement Targets (MET)

A total of 29,720 acres was identified as MET and RT within the Pine Island/Matlacha Pass basin. This includes 29,414 acres categorized for MET (99%) (Table 19; Figure 35). Overall, the acreages identified for MET and RT constitutes 12 percent of the total lands within the Pine Island/Matlacha Pass basin (Appendix E). MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be managed or enhanced (Table 19). The vast majority of MET within this basin are associated

with the Charlotte Harbor Preserve State Park and Ding Darling Wildlife Management Area (Figure 35).

Restoration Targets (RT)

A total of 29,720 acres was identified as RT and MET within the Pine Island/Matlacha Pass basin. This includes 306 acres (1%) identified as RT (Table 19; Figure 35). Overall, the acreages identified for RT and MET constitutes 12 percent of the total lands within the Pine Island/Matlacha Pass basin (Appendix E). RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be restored (Table 19). There are areas on Pine Island identified as non-native (RT) that are directly adjacent to native habitats. Identifying areas for strategic restoration could result in the further expansion of restored native habitat communities.

Habitat Status and Trends Analysis

A change analysis was completed for this basin to quantify the gains/losses of habitats between 1995 and 2009/2011 (Table 20). The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitats changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within this basin, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development and agriculture; and
- Freshwater marsh transitioning to mangrove on Little Pine Island.

Mapping inconsistencies observed in the change analysis included the following:

- FLUCCS 3000 (Upland Non-Forested) Series Level 2 (Dry Prairie, Shrub and Brushland, Mixed Rangeland) codes were often interchangeably used for the same aerial signature between 1995 and 2009/2011, so gains/losses in the 3000 series may not all be real changes;
- Slough waters classification was not used in 2009/2011;
- Slight decreases in both mangrove swamp and saltwater marsh were also noted in the tidal portion of the lower Myakka River. The latter observation contradicts the findings of the HEM utilized as part of this project, but mapping inconsistencies were evident in a review of the aerial imagery; and
- Increases in intermittent pond classification occurred from development between 1995 and 2009/2011. Also, open water ponds that became shallow ponds were re-mapped to intermittent ponds classification in 2009/2011.

Pine Island/Matlacha Basin Summary

The Pine Island/Matlacha Pass basin totals 239,923 acres, of which only 10% is developed. Mangrove Swamps are the predominant native habitat within this basin. Native habitats that experienced the largest disproportionate losses include upland coniferous forests and all freshwater wetland habitats, excluding wetland hardwood forest. Upland habitats may be considered priority habitats for restoration. The gains shown for wetland hardwood forest within this basin appear to largely be a remapping of the forested habitats, including mangrove swamps and other freshwater forested wetlands between 1995 and 2009/2011. Stakeholder identified corridors include the southern limits of Charlotte Harbor Preserve State Park within this basin. These lands connect to areas north to the Caloosahatchee River, and south to Estero Bay.

PCO are generally limited in this basin due to existing development, the extent of MET and RT lands, and the extent of open water within this basin. The bulk of the identified PCO occur on Pine Island, and are predominantly tidal wetlands. RO are largely focused around Pine Island. The HEM shows dramatic migration and losses resulting from projected sea level rise including the loss of freshwater marsh areas within Ding Darling Wildlife Management Area, and open water areas expanded throughout Pine Island Sounds and Matlacha Pass. This basin supports relative large Restoration/Management lands relative to its size. The MET and RT include Little Pine Island, the southern limits of Charlotte Harbor Preserve State Park, and Ding Darling Wildlife Management Area. In total, there is 29,414 acres of MET, and a relatively small 305 acres of RT that are predominantly uplands.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The CHNEP Management Conference noted the updates presented below:

- Some pre-platted lands were mapped as 3100 Dry Prairie FLUCSS codes for 2009/2011; however, these lands may be developable and future HRN studies should look at updating these classifications; and
- Some parcels were identified for inclusion on the Restoration/Management map by Lee County and should be added in future HRN studies:
    - Heron Pond (Conservation Lands adjacent to Buttonwood Preserve);
    - Southern portion of Galt Preserve adjacent to borrow pond;
    - Middle of Pine Island Flatwoods Bayside;
    - Western portion of the northern Smokehouse parcel;
    - Charlotte Harbor nomination 262 and 280;
    - Area abutting Ding Darling National Wildlife Refuge (nomination parcel 551 and 503); and

- Buttonwood preserve nomination 276 is included on the maps, but total area is not shaded.

The results presented in the tables and maps below can form the foundation for future studies.

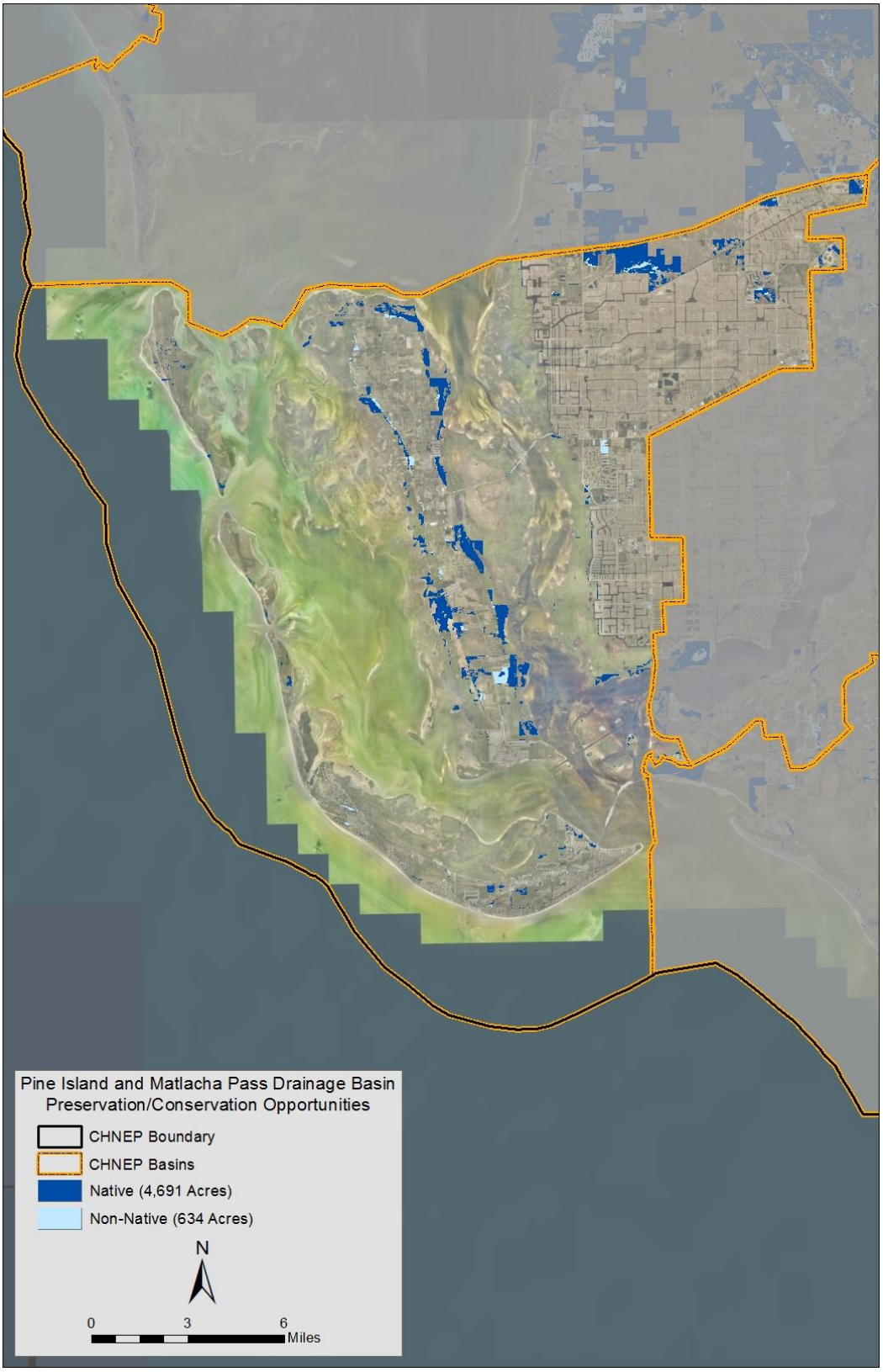
TABLE 19. HRN OPPORTUNITIES AND TARGETS FOR THE PINE ISLAND/MATLACHA PASS BASIN BY MAJOR HABITAT TYPE

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	1,636	N/A	4,258	264
Freshwater Wetlands	551	N/A	2,595	39
Tidal Wetlands	2,505	N/A	22,562	2
Non-Native	634	530	N/A	N/A
Total	5,326	530	29,414	305

TABLE 20. HRN CHANGE ANALYSIS GAINS AND LOSSES FOR THE PINE ISLAND / MATLACHA PASS BASIN BY HABITAT CLASSIFICATION TYPE.

FLUCCS Codes	Primary Classifications	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	N/A	15,861	15,861	*
3200	Shrub and Brushlands	1,838	2,821	983	53%
3300	Mixed Rangelands	746	480	-266	-36%
4100	Upland Coniferous Forest	8,996	4,708	-4,288	-48%
4200/4300	Upland Hardwood Forest	556	2,414	1,858	*
5100	Streams and Waterways	85	548	463	*
5200	Lakes	291	2	-289	-99%
5600	Slough Waters	111	N/A	N/A	N/A
6100	Wetland Hardwood Forest	1,107	2,927	1,821	*
6120	Mangrove Swamp	26,371	25,577	-794	-3%
6200	Wetland Coniferous Forest	1,079	161	-918	-85%
6300	Wetland Forested Mixed	235	5	-230	-98%
6400	Vegetated Non-Forested Wetlands	1,205	618	-587	-49%
6420	Saltwater Marsh	1,277	2,152	875	69%
6500	Intermittent Ponds	N/A	N/A	N/A	N/A
6600	Salt Flats	N/A	N/A	N/A	N/A

*Differences in mapping methodologies between periods may account for some anomalies in the data.



***See narrative for note on mapping classifications.**

Figure 33. Pine Island/Matlacha Pass Basin PCO.

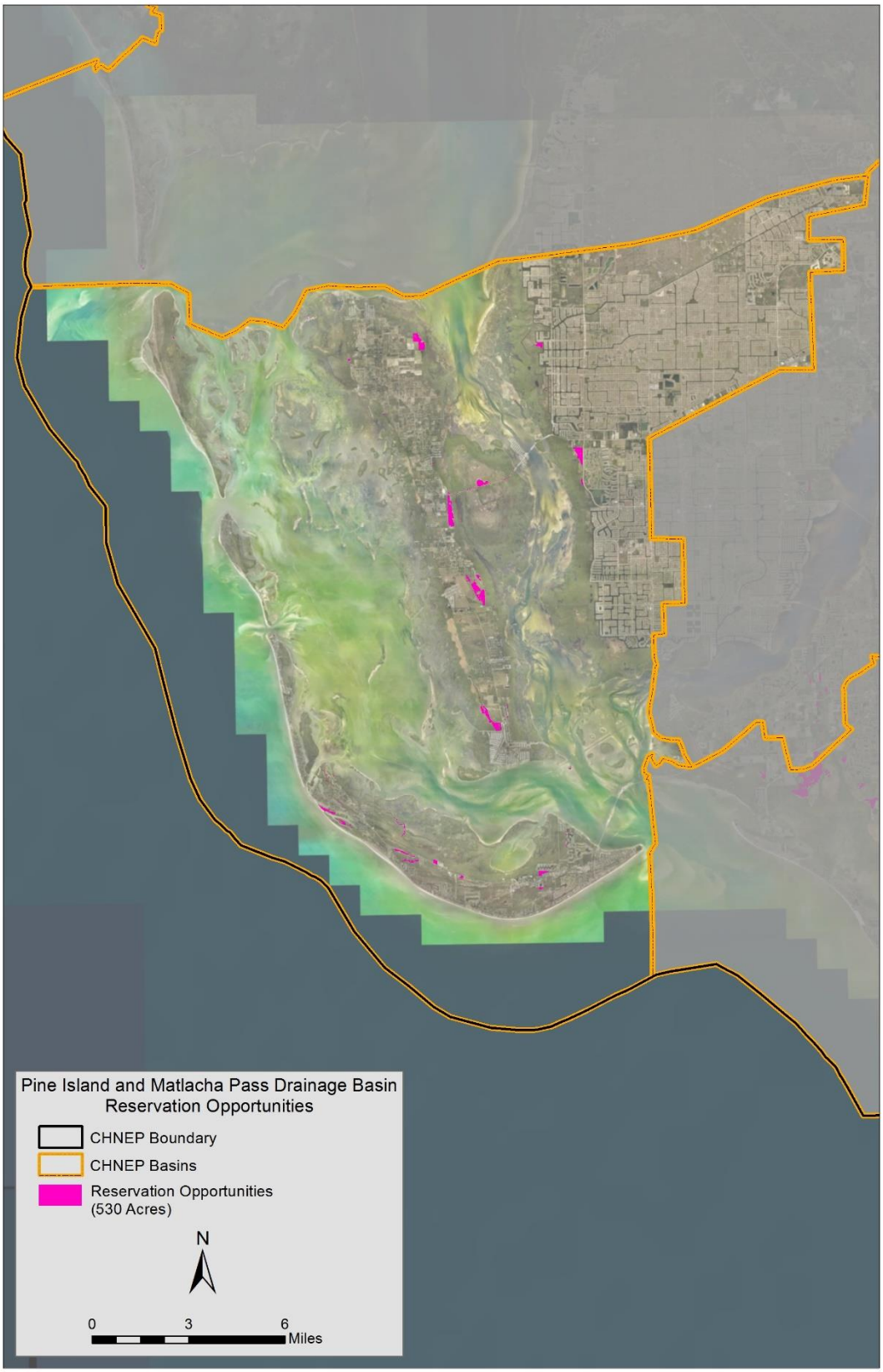
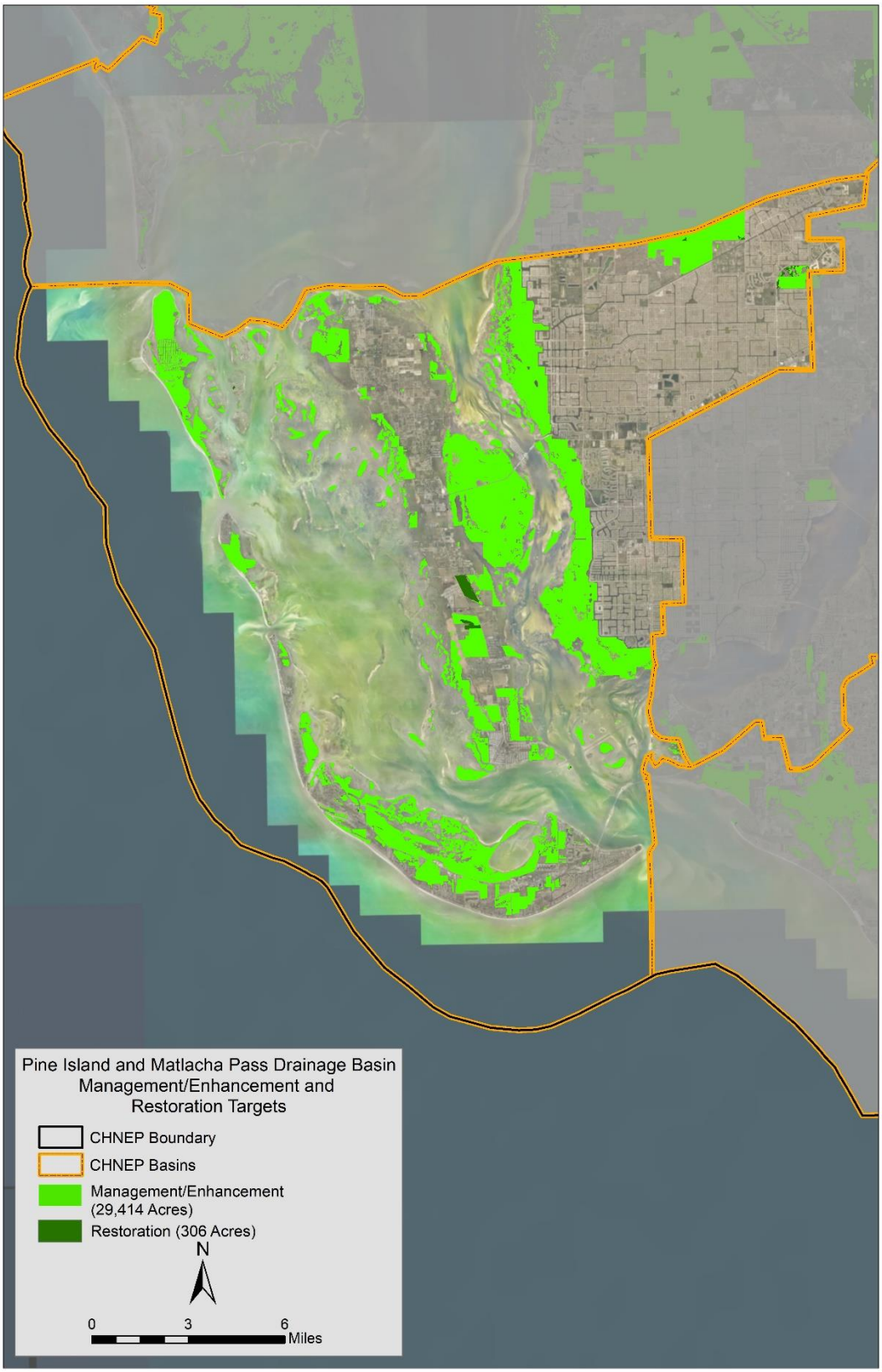


Figure 34. Pine Island/Matlacha Pass Basin RO.



***See narrative for note on mapping classifications.**

Figure 35. Pine Island/Matlacha Pass Basin MET and RT.

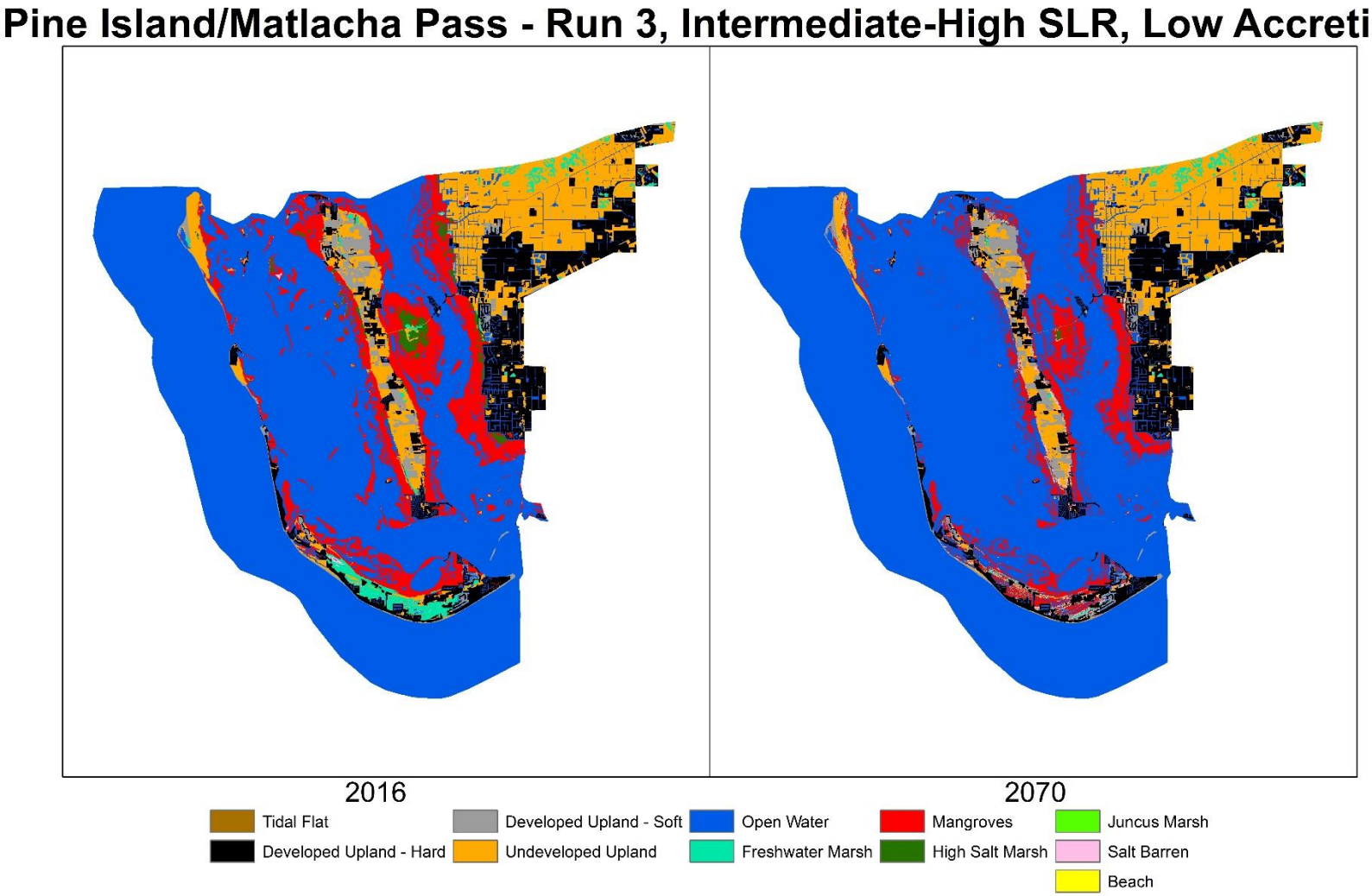


Figure 36. HEM Model Results for the Pine Island/Matlacha Pass basin.

Estero Bay Basin

The Estero Bay basin totals 230,086 acres, and contains significant areas of Florida panther primary and secondary habitat in the eastern and northern limits of this basin. These lands connect with other identified primary and secondary habitat lands within the Tidal Caloosahatchee River basin. Estero Bay within this basin is a large estuarine and tidal system. Other significant areas within this basin include Edison Farms Preserve and Estero Bay Preserve State Park. The results for this basin area are presented in the following narrative and in Figures 37 through 39.

Preservation/Conservation Opportunities (PCO)

A total of 61,863 acres was identified as PCO, of which 39 percent (23,951 acres) were categorized as non-native and 61 percent (37,912 acres) as native habitat (Table 21; Figure 37). Overall, the acreage identified constitutes 27 percent of the total lands within this basin. The dominant native habitat communities were classified as pine flatwoods (7,531 acres; 12%) and hydric pine flatwoods (6,086 acres; 10%). Cropland and pastureland (13,047 acres; 21%) was identified as the major non-native habitat classification within the overall basin. (Appendix E).

Overall, the potential PCO within this basin are associated with Edison Farms and Corkscrew Regional Ecosystem Watershed (CREW) (Figure 37). There were 22,715 acres of potential PCO located within primary and secondary panther habitat in the central and eastern limits of this basin. The panther habitat acreages presented in Figure 37 are an overlay on the other areas and that acreage is included in the overall PCO acreages.

Reservation Opportunities (RO)

A total of 537 acres was identified as potential RO (Table 21; Figure 38). Overall, the acreage identified is less than one percent of the total lands within the Estero Bay basin. The dominant habitat community was classified as exotic species (505 acres; 94%), which consists of Brazilian pepper, Australian pine, and melaleuca; which could be recommended for invasive exotic removal programs (Appendix E). Potential RO were prominent in the northwest corner of the basin (Figure 38).

The concept of reservation areas is to support potential tidal habitat migration caused by increased tidal flooding and inundation from projected sea level rise. As presented in Section 3 and Appendix B, a model was developed to project potential habitat migration in tidally influenced areas. The Estero Bay Basin HEM map (Figure 40) illustrates model Run 3 (Intermediate-High Sea Level Rise, Low Accretion) for Years 2016 and 2070. The results illustrate an expansion of open water created by sea level rise, as well as the loss of mangroves with limited migration higher in the landscape due to constraints with developed land.

Management/Enhancement Targets (MET)

A total of 42,165 acres was identified as MET and RT, of which 40,100 acres was categorized for Management (95%) (Table 21; Figure 39). Overall, the acreage identified for MET and RT constitutes 18 percent of the total lands within this basin. The dominant native habitat communities identified for MET were classified as mangrove swamp (9,481 acres; 22%) and cypress (10,594 acres; 25%) (Appendix E). MET were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be managed or enhanced (Table 21). The vast majority of MET were distributed within Edison Farms/CREW and landward of the northeaster portion of Estero Bay within this basin (Figure 39).

Restoration Targets (RT)

A total of 42,165 acres was identified as RT and MET, of which 2,065 acres (5%) was identified as RT (Table 21; Figure 39). Overall, the acreage identified for RT and MET constitutes 18 percent of the total lands within this basin. RT were developed for the three major native habitat types: tidal wetlands, freshwater wetlands, and uplands, to distinguish the types of overall habitats that could be restored (Table 21). There are several instances in which areas identified as non-native (RT) are directly adjacent to native habitats. Identifying areas for strategic restoration could result in the further expansion of restored native habitat communities.

Habitat Status and Trends Analysis

A change analysis was completed for this basin to quantify the gains/losses of habitats between 1995 and 2009/2011 (Table 22). The objectives of this change analysis were to determine: which habitats may be in actual decline, or experiencing disproportionate losses; which habitats may be increasing; and what stressors may be driving these changes. Data limitations and mapping inconsistencies between the two time periods did not always support these objectives. For example, conversions between various classes of freshwater wetlands were often found to be ambiguous and unverifiable; however, conversions from native habitats to developed urban land uses were more easily discernable through a review of the aerial imagery. Those habitats changes that could be verified through the review of the aerial imagery were used to identify priority habitats.

Within this basin, substantial acreage gains in native habitats could not be verified through a review of the aerial imagery. However, discernable habitat losses and changes are noted below:

- Upland habitats being converted to development and agriculture; and
- Salt marshes transitioning to mangroves.

Mapping inconsistencies observed in the change analysis included the following:

- FLUCCS 3000 (Upland Non-Forested) Series Level 2 (Dry Prairie, Shrub and Brushland, Mixed Rangeland) codes were often interchangeably used for the same aerial signature between 1995 and 2009/2011, so gains/losses in the 3000 Series may not all be real changes;
- Slough waters classification was not used in 2009/2011;

- Increases in intermittent pond classification occurred from development between 1995 and 2009/2011. Also, open water ponds that became shallow ponds were re-mapped to intermittent ponds classification in 2009/2011; and
- Wetland forested mixed and wetland coniferous forested habitat types showed an increase of 37% from 1995 to 2009/2011. This was mainly due to wetland forested mixed in 1995 being remapped to wetland coniferous forest, mainly within the CREW and Edison Farm lands.

Estero Bay Basin Summary

The Estero Bay basin totals 230,086 acres, of which 21 percent is developed. The Estero Bay basin contains significant areas of primary and secondary Florida panther habitat in the eastern and northern limits of this basin. Predominant native habitats within this basin include: wetland coniferous forest, upland coniferous forest, and mangrove swamps.

The habitat status and trends analysis showed losses in upland habitats, and these habitats may be a priority for restoration. Upland coniferous forest experienced the greatest loss of habitat within this basin. RO (537 acres) occur in the northwestern limits of this basin. The HEM illustrates losses of salt marsh habitat around the northwestern bay and the mouth of the Estero River. The existing MET include Estero Bay Preserve State Park, which is already in public ownership and may accommodate projected sea level rise in this basin. There are 40,100 acres of MET that largely occur within Edison Farms and CREW. The 2,065 acres of RT areas are primarily located in the Airport Mitigation Bank and Corkscrew Regional Mitigation Bank. These lands are also located within primary and secondary Florida panther habitat areas.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The results presented in the tables and maps below can form the foundation for future studies.

The HRN results reflect priorities outlined from the HRN project methodology and are based on the best available data at the time of development. There may be other habitats of importance; and current and future research and analysis may support additional opportunities and targets not currently represented here. The CHNEP Management Conference noted these updates presented below:

- Portions of native habitat-salt flats within Estero Bay Preserve State Park were not mapped as habitat based on existing mapping FLUCCS codes, they appear as submerged lands based on topographical maps used and submerged lands were not part of this study; however, these areas are under the ownership of the state and are native habitat and should be mapped in future HRN studies as MET.

TABLE 21. HRN OPPORTUNITIES AND TARGETS FOR THE ESTERO BAY BASIN BY MAJOR HABITAT TYPE

Major Habitat Type	Opportunities		Targets	
	PCO	RO	MET	RT
Uplands	14,217	N/A	4,734	990
Freshwater Wetlands	21,856	N/A	24,158	1,075
Tidal Wetlands	1,839	N/A	11,208	1
Non-Native	23,951	537	N/A	N/A
Total	61,863	537	40,100	2,065

TABLE 22. HRN CHANGE ANALYSIS GAINS AND LOSSES FOR THE ESTERO BAY BASIN BY HABITAT CLASSIFICATION TYPE.

FLUCCS Codes	Primary Classifications	Acres		Change Analysis	
		1995	2009/2011	Acres	Percent
3100	Dry Prairie	147	9,311	9,164	*
3200	Shrub and Brushlands	1,277	3,463	2,187	*
3300	Mixed Rangelands	1,225	1,448	223	18%
4100	Upland Coniferous Forest	34,885	12,505	-22,380	-64%
4200/4300	Upland Hardwood Forest	1,139	1,496	357	31%
5100	Streams and Waterways	571	841	270	47%
5200	Lakes	162	14	-148	-92%
5600	Slough Waters	390	N/A	N/A	N/A
6100	Wetland Hardwood Forest	5,405	6,237	832	15%
6120	Mangrove Swamp	11,708	11,587	-121	-1%
6200	Wetland Coniferous Forest	24,909	34,170	9,261	37%
6300	Wetland Forested Mixed	5,420	2,953	-2,467	-46%
6400	Vegetated Non-Forested Wetlands	8,326	6,948	-1,378	-17%
6420	Saltwater Marsh	2,215	2,025	-189	-9%
6530	Intermittent Ponds	N/A	N/A	N/A	N/A
6600	Salt Flats	N/A	N/A	N/A	N/A

* Differences in mapping methodologies between periods may account for some anomalies in the data.

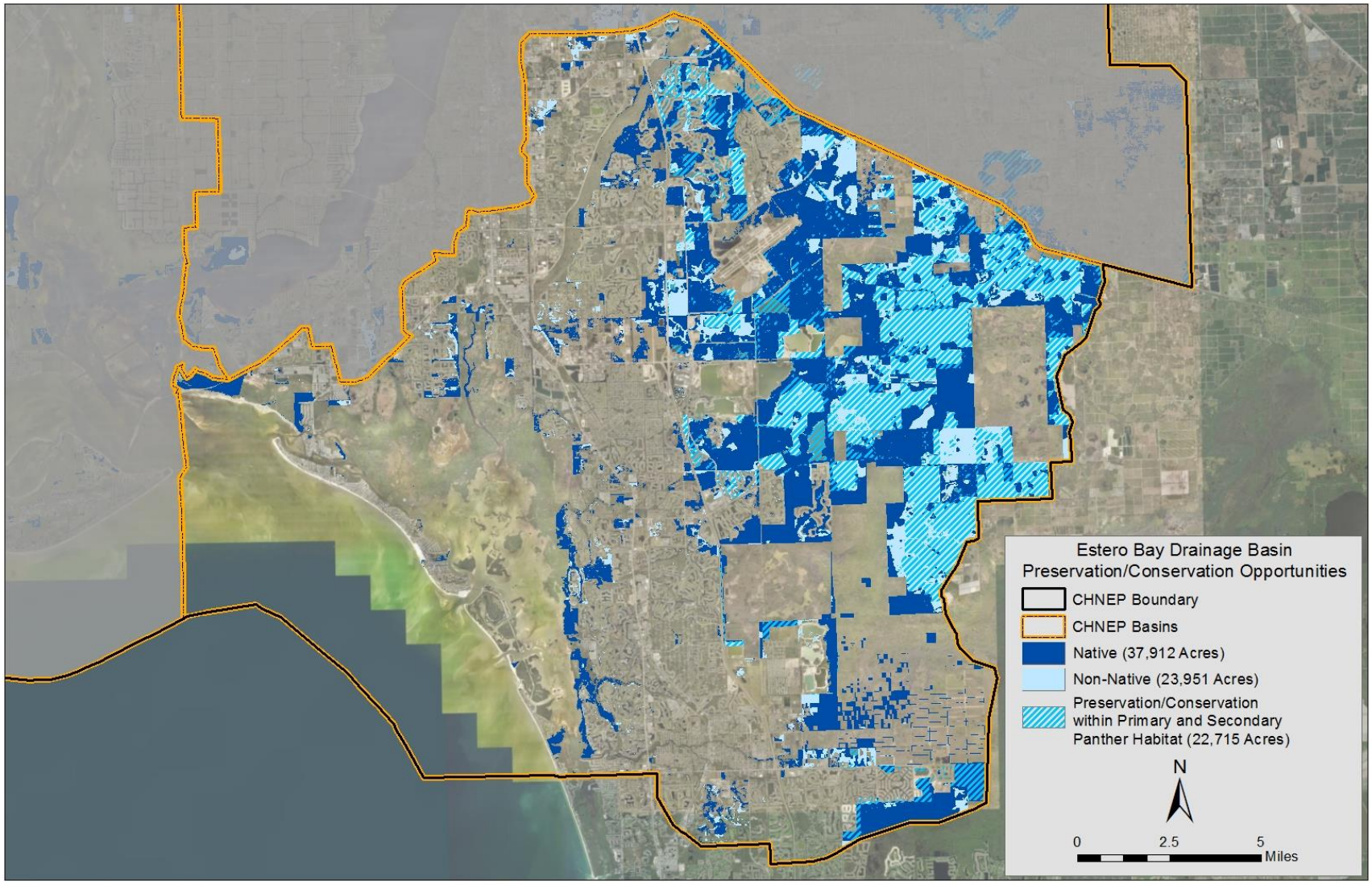


Figure 37. Estero Bay Basin PCO.

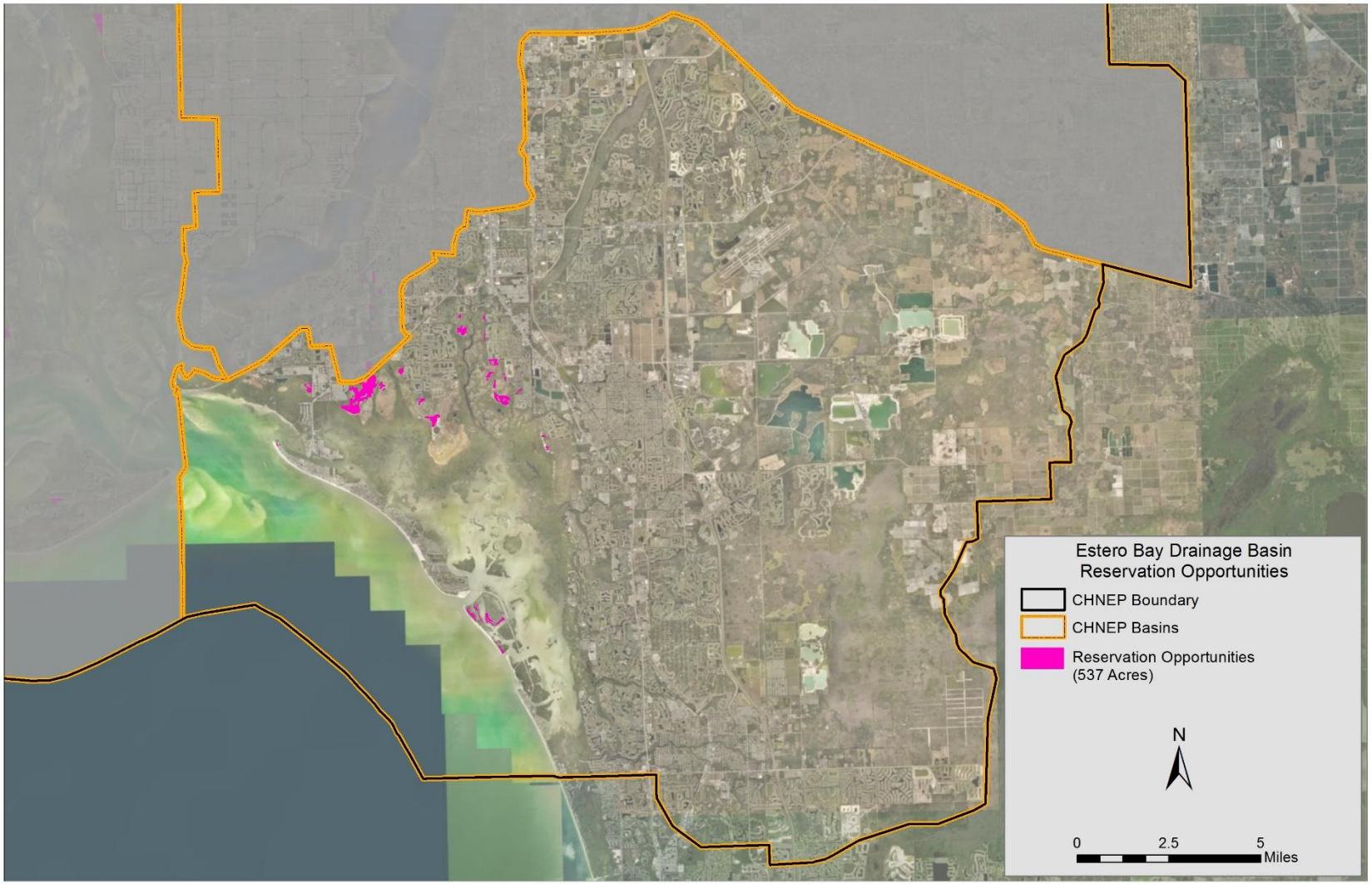
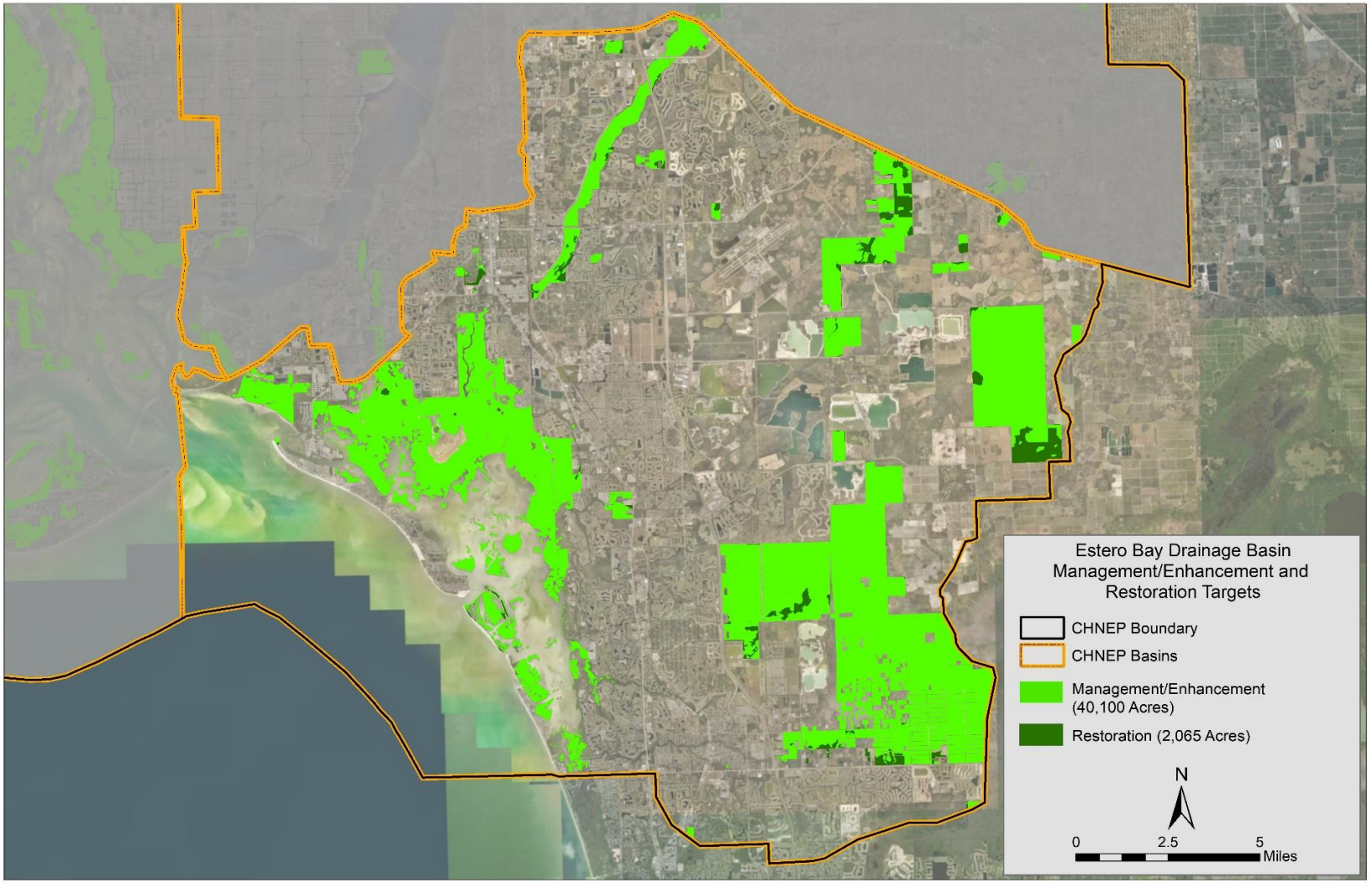


Figure 38. Estero Bay Basin RO.



***See narrative for note on mapping classifications.**

Figure 39. Estero Bay Basin MET and RT.

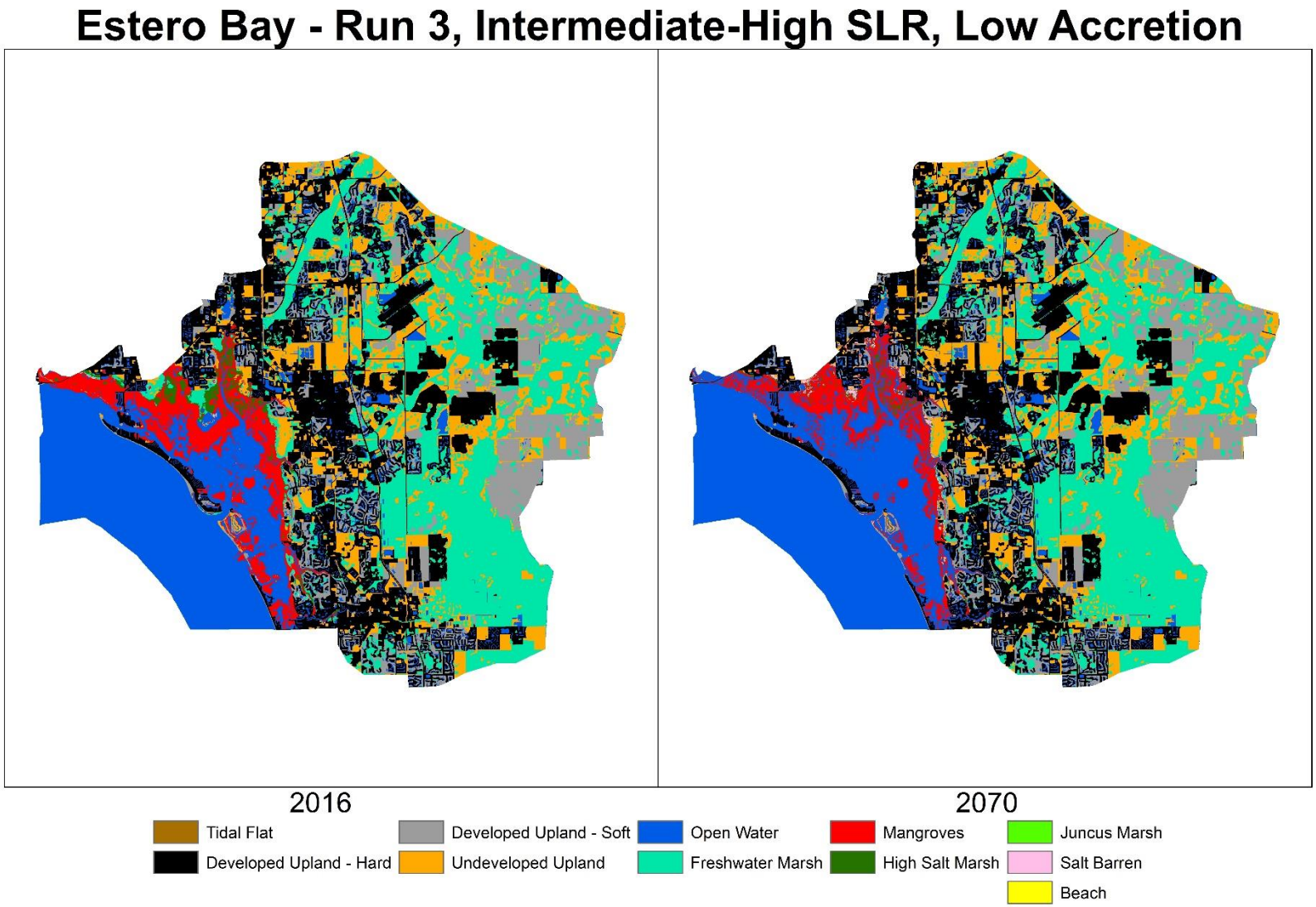


Figure 40. HEM Model Results for the Estero Bay basin.

Recommendations

The overall project objective was to establish the restoration vision and goals for the entire program area, and to identify specific preservation/conservation and reservation opportunities and management/enhancement and restoration targets for each basin within the CHNEP boundary. The status and trends were based on past and current conditions and analyzed by habitat type and by basin, incorporating stakeholder input, and using the best data available during the project. The resultant recommendations for the four types of habitat opportunities and targets, as well as the three spatial strata, are described below.

Opportunities

Opportunities were derived from the analysis of privately-owned native and non-native habitats not currently in preservation or conservation within all three strata: coastal, river floodplains and uplands. The analysis resulted in the identification of opportunities for reservation or preservation/conservation that are summarized in the following sections. While these categories do not have specific targets, they both present opportunities for future restoration as tidal wetlands, freshwater wetlands, or uplands, should they be acquired or preserved. These opportunities are based upon the best available data at the time of this analysis.

Preservation/Conservation Opportunities (PCO)

PCO have been derived from private lands that should be first considered for public acquisition or conservation, and then investigated for RO, MET, or RT. A total of **517,776 acres** of PCO have been mapped, which constitutes only **17 percent** of the total lands within the overall CHNEP area (Figure 4). Of this total, 60 percent (308,995 acres mapped as dark blue areas) was classified as native habitats, while 40 percent (208,781 acres mapped as light blue areas) was classified as non-native land use/land cover types.

The PCO for each habitat type are provided in Table 5, and constitute the acreage distribution of native habitats and non-native habitats that currently exist within the 517,776 acres of PCO lands. The native habitat opportunities derived from this analysis represent natural lands that could potentially be preserved or conserved, and if these lands are publicly acquired or otherwise protected they could be future MET. The non-native habitat opportunities derived from this analysis represent potential future RO areas that may be maintained in a non-natural state to accommodate potential habitat migration from projected sea level rise, and potential RT that could benefit from more intensive restoration activities (e.g., regrading/planting) once these lands are publicly acquired or otherwise protected. These potential land areas are presented in Figure 41 below.

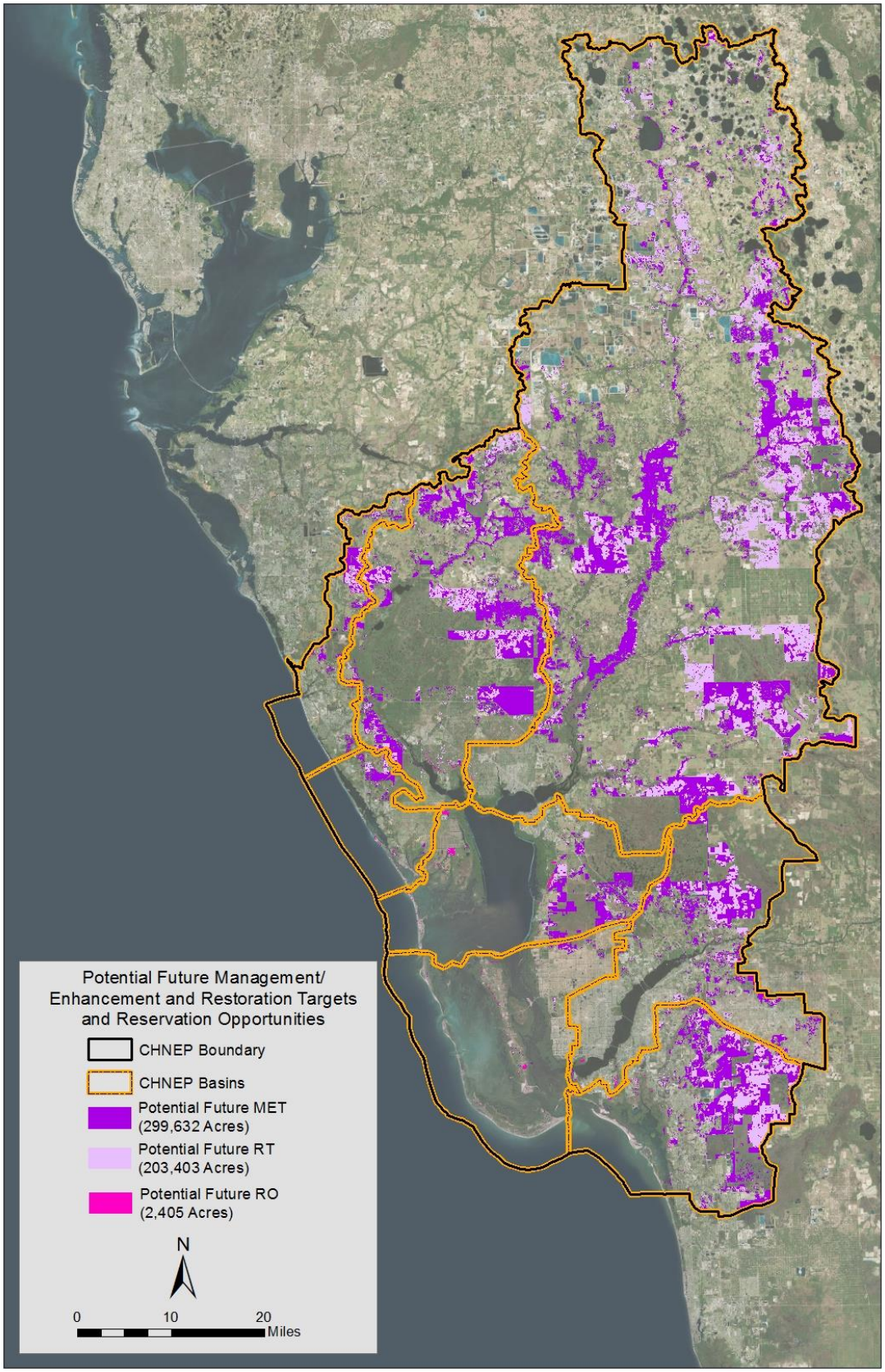


Figure 41. Potential Future RT and RO.

Reservation Opportunities (RO)

RO have been derived from non-native habitats on publicly-owned lands, or privately-owned lands under conservation easement. These opportunities only apply to lands within the coastal stratum as these are the areas that are expected to experience increased tidal flooding or inundation due to projected sea level rise, and that could potentially accommodate tidal habitat migration in the future. A total of **1,590 acres** of RO have been mapped, which constitute less than one percent of the total lands within the CHNEP area (Table 5; Figure 5).

Targets

Targets were derived from the analysis of publicly-owned preservation or conservation lands, and private lands under conservation easement, that need varying degrees of management/enhancement or restoration to achieve desired natural habitats. These resulted in numeric targets that are summarized in the following sections. For areas that are currently in native habitat, MET represent the targets for ongoing improvements to increase these habitats to their greatest ecological function potential. Where there are currently non-native habitats, the targets derived from RT analysis represent potentially restorable areas that could benefit from restoration activities. Both categories contain numeric targets for the three major native habitat types (tidal wetlands, freshwater wetlands, and uplands) based upon the best available data at the time of this analysis.

Management/Enhancement Targets (MET)

MET have been derived from publicly-owned preservation and conservation lands, and private mitigation banks under conservation easement, that need varying degrees of management/enhancement for native lands. A total of **535,812 acres** of MET and RT lands have been mapped, which constitutes **18 percent** of the total lands within the overall CHNEP area (see Figure 6). Of this total, 84 percent (447,683 acres mapped as light green) was classified as native habitats (MET). The MET for each habitat type provided in Table 5 constitute the acreage distribution of native habitats that currently exist within the 535,812 acres of MET and RT lands. The native habitat targets derived from this analysis represent natural lands that may need ongoing management activities (e.g., prescribed burning), or larger scale restoration activities (e.g., hydrologic restoration).

Restoration Targets (RT)

RT have been derived from publicly-owned preservation and conservation lands, and private mitigation banks under conservation easement, that need restoration for non-native lands. A total of 535,812 acres of RT and MET lands have been mapped, which constitutes 18 percent of the total lands within the overall CHNEP area (see Figure 6). Of this total, 16 percent (88,129 acres mapped as dark green) was classified as non-native land use/land cover types (RT). The RT for each habitat type provided in Table 5 constitute the acreage distribution of non-native habitats that currently exist within the 535,812 acres of RT and MET lands. The non-native habitat targets derived from this analysis represent potentially restorable areas that could benefit from more intensive restoration activities (e.g., regrading/planting).

It is recommended that implementation of PCO, RO, MET, and RT activities be implemented within the entire CHNEP area; however, the focus of these activities will be different in the three spatial strata defined in the additive hybrid approach.

Strata

Consistent with the four categories (PCO, RO, MET, and RT) of native and non-native habitats described above, three spatial strata were defined as focus areas for identifying habitat opportunity and target setting. These three strata encompass the entire CHNEP area, and have unique characteristics that lead to the development of recommendations summarized in the following section.

Coastal Stratum

The coastal stratum includes existing tidal wetland habitats, as well as nearshore coastal upland areas that are expected to experience increased tidal inundation in the future as a result of sea level rise.

As revealed in the habitat status and trends analysis tidal wetlands have not changed substantially over the 15-year study period. However, the study results do show that mangroves are overtaking salt marshes, a trend that has been observed in other southwest Florida estuaries, and even in the northern Gulf of Mexico (McKee 2018). In addition, the results of the HEM analysis indicate that projected sea level rise will put significant stress on tidal wetlands over the next 50 years. Nearshore upland buffers will be need to accommodate landward migration of tidal wetlands, thus emphasizing the need for implementing the recommended reservation opportunities. In addition, sea level rise will influence habitat distributions in the tidal rivers and streams in the CHNEP area, so it will be important to maintain appropriate freshwater inflows to sustain salinity gradients that support the upstream migration of salt marshes as sea level rise advances.

Therefore, it is recommended that the focus in the coastal stratum be on the acquisition and reservation of nearshore upland buffers, as well as restoration projects that prioritize increases in salt marsh habitats. The results of this HRN project show that there are extensive publicly-owned preservation and conservation lands in appropriate locations in the CHNEP area where tidal wetland creation and restoration projects could be implemented. Where technically feasible (e.g., the establishment and maintenance of an appropriate salinity regime), it is recommended that these projects should focus primarily on increasing salt marsh habitats to offset the projected landward advancement of mangroves over the next several decades.

River Floodplain Stratum

As defined in this study, the river floodplain stratum includes all areas within the FEMA (1996) mapped 100-year floodplains for large rivers in the CHNEP area. The 100-year floodplains of the Peace River, Myakka River, Tidal Caloosahatchee River, and their respective tributaries typically include forested and herbaceous freshwater wetlands and native riparian upland communities. River floodplains are the “kidneys” of the estuary, and these areas provide a wide range of ecosystem services including: flood storage and attenuation; water quality treatment; structural fish

and wildlife habitat and migratory corridors; and the production of organic matter that serves as the basis of the estuarine food web. Protecting, and where feasible, restoring the hydrological and ecological integrity of the river floodplains in the CHNEP area are essential to meeting the vision and goals of this HRN project.

Native habitats in the river floodplain corridor have historically been impacted by clearing and draining for agriculture uses, silviculture and forestry operations, phosphate mining, and land development. However, the habitat status and trends analysis conducted indicate that wetland regulations have been effective in preventing further significant losses in floodplain wetlands, at least over the 15-year study period. The results of this HRN project also indicate that there are extensive privately-owned lands in the river floodplain stratum that could be acquired or conserved to further protect the integrity of the floodplains. In addition, there are also a substantial acreage of existing publicly-owned and privately-owned preservation and conservation lands that could support restoration of natural floodplain habitats and functions.

It is important to recognize that the hydrology and alluvial habitat surfaces of these larger complex stream valleys depend on the cumulative delivery of flow and sediment from headwater streams. Because headwater streams are in the most extensive and most direct contact with land use activities, healthy headwaters are typically required for healthy downstream rivers. The potential exists to work with major landowners to create incentives for establishing conservation easements and managing lands to maintain the natural integrity and functions of the floodplain to the greatest extent possible.

It is recommended that the key focus in the river floodplain stratum be on the hydrologic restoration of over-drained historic wetlands, including such actions as ditch blocks as water control structures. Conversely, there are over-inundated systems (e.g. Flatford Swamp) that may need hydrologic reductions to restore historical hydroperiods to these wetlands. The Natural Resources Conservation Service (NRCS) Wetland Reserve Program was a model for this approach, but it is no longer in effect, so a new incentive program needs to be established to work with large land owners to set aside lands which could maintain floodplain integrity (e.g., less productive agricultural lands that will ultimately provide riparian or coastal buffer lands). Additional opportunities exist to work with Water Management Districts to ensure that MFL are being attained to ensure appropriate freshwater flows to the CHNEP area.

A specific focus of recommended habitat preservation, conservation, and restoration activities in the river floodplain stratum is headwater stream restoration. Priority project locations should be selected both strategically and opportunistically in concert with determining priority named stream corridors. Recommended steps for the developing a detailed headwater stream restoration plan include the following.

- Conserve named stream corridors in relatively good condition with damaged headwaters and develop a master plan to restore and conserve the headwater systems before adverse adjustments can develop in the named streams.
- Restore systems with both damaged named streams and headwaters. This scenario offers opportunities where permitting agencies may wish to negotiate restoration set-asides or

onsite mitigation to promote headwater restoration on a timely basis that may be otherwise precluded once the development occurs and lateral encroachment prevents sufficient width of restoration activities along the drainage system. This scenario may also represent the most time sensitive needs for protecting and improving water delivery to downstream estuarine ecosystems. Headwater stream restoration is recommended as the top priority in the river floodplain stratum, and in general should be conducted in advance of other downstream floodplain restoration to achieve a critical mass of headwater restoration. This is especially true if hydrologic modifications are causing erosion in the named stream, or land use is causing excessive sediment delivery.

- Restore damaged named stream corridors with intact headwater systems and simultaneously work toward conserving the intact headwater stream corridors. This should be prioritized where it is observed in areas subject to planned urban development in the headwaters.

In summary, headwater streams should be viewed as essential appurtenant structures of their downstream named creeks and rivers. Thus, restoration of the 100-year floodplain of named stream corridors patently includes considerations of the departures of their headwaters from a natural condition and a mechanism for addressing them.

Upland Stratum

As defined in this study, the upland stratum includes areas landward of the coastal stratum and outside of the 100-year floodplain. Upland habitats also provide important ecosystem services including aquifer recharge and wildlife habitat. Rare or highly threatened upland habitats include sand pine scrub, longleaf pine, wet pine flatwoods, and hydrologically isolated forested and herbaceous wetlands. These are wetlands with no apparent surface water connection to perennial rivers and streams, estuaries, or the Gulf of Mexico. In addition, the upland stratum includes documented priority habitats and wildlife corridors for mega fauna, including the Florida panther.

The results of the habitat status and trends analysis indicated that upland coniferous forests, predominantly pine flatwoods, have suffered enormous losses - approximately 45,000 acres - over the 15-year study period. Upland habitats are not protected by wetland regulations and are targeted for both agricultural and urban land development activities.

The results of this HRN project also indicate that there are extensive privately-owned lands in the upland stratum that could be acquired or conserved to further protect the integrity of the upland habitats. The most important tracts have been identified and recommended for public acquisition by several natural resource agencies. In addition, there are also a substantial acreage of existing publicly-owned and privately-owned preservation/conservation lands that could support restoration of natural upland habitats.

It is recommended that the key focus for habitat preservation, conservation and restoration activities in the upland stratum be on public acquisition of remaining large tracts of upland coniferous forest habitats, including native pine flatwoods and sand pine scrub. Priority acquisitions should be

selected both strategically and opportunistically in concert other natural resource agencies, with a particular focus on support the habitat needs of key listed species in the CHNEP area.

As presented in previous sections and Figure 8, CHNEP stakeholders have identified the following areas as high priority for preservation/conservation, reservation, management/enhancement, and/or restoration:

- Peace River Corridor
- Myakka River Corridor
- Charlotte Harbor to Lake Okeechobee Corridor (through Webb and Babcock Ranch areas)
- Publicly owned areas along the "western wall" and "eastern wall" of Charlotte Harbor proper
- Estero Bay to Corkscrew Swamp Sanctuary Corridor

Conclusions

The HRN project utilized a "weight of evidence" process to derive numeric opportunities and targets. Several ancillary work products supported the development of numeric opportunities and targets, and contributed to other project conclusions and recommendations.

As part of the HRN study, a habitat change analysis was conducted for the period 1995-2009/11 for the CHNEP area utilizing land use/cover geospatial data provided by the SWFWMD and the SFWMD. This change analysis encompassed a period of time during which modern environmental regulations were in place (e.g., Clean Water Act; Environmental Resource Permitting). The results and conclusions from this analysis are summarized below.

- The total acreage of tidal wetlands was relatively stable over the change analysis period; however, the acreage of mangroves increased while the acreage of salt marsh decreased, suggesting that sea level rise is driving an ecological shift in the relative distribution of tidal wetland types.
- There were significant changes in various types of native freshwater wetlands, in particular the conversion of forested wetlands to non-forested wetlands; however, due to mapping inconsistencies it was not possible to determine a net loss or gain.
- The total acreage native upland habitat types declined significantly over the change analysis period, primarily through conversions to agriculture and developed land uses. Coniferous forests (pine flatwoods) were most impacted, suggesting that greater protection of upland native habitats is needed.

Another work product conducted a part of the HRCC was the development and execution of the HEM (see Appendix B). The HEM evaluated various sea level rise projections and modeled tidal wetland migration in response to sea level rise. The HEM predicts the continued increase in tidal inundation of the coastal stratum and the landward migration of mangroves, and the upstream migration of salt marshes in the tidal rivers and tributaries. In addition, the model predicts that

mangrove acreage will increase, while salt marsh acreage will decline and be limited to the lower reaches of the tidal rivers.

A third important ancillary work product was the evaluation of potential restoration opportunities on reclaimed mined lands, which are extensive in the upper reaches of the Peace River watershed. This analysis showed that headwater stream restoration, and the restoration of river floodplain integrity, will be critical to ensuring a sustainable delivery of freshwater inflows to the Charlotte Harbor estuarine system.

Based on the analyses summarized above the following management recommendations for the three spatial strata are proposed (see Section 3 for strata definitions).

- **Coastal Stratum** - The continued maintenance of appropriate freshwater inflows in the tidal rivers and tributaries within the CHNEP area will be critical to the sustainability of salt marsh habitats, which are projected to migrate upstream with increasing sea level rise. Appropriate freshwater inflows will also be needed to maintain mesohaline and oligohaline salinity gradients that support nursery areas for economically important fish species. Continued coordination with both the SWFMWD and the SFWMD will be needed to ensure that MFLs are being attained, and adequately addressing these resource management concerns. In addition, the reservation of pervious coastal uplands will be critical to ensuring that tidal wetland habitats have the space to migrate landward with increasing sea level rise.

- **River Floodplain Stratum** – The native forested river floodplain habitats function as the "kidneys" of the Charlotte Harbor estuarine system by storing and slowing releasing flood flows, removing sediments and other pollutants, and delivering complex organic matter that drives the food web of the estuary. In addition, contiguous river floodplains provide migratory corridors to a wide range of fish and wildlife species. For these reasons, the restoration and maintenance of river floodplain integrity is a high priority in the CHNEP area. In particular, there is extensive opportunities for headwater stream and riparian wetland restoration in the Peace River watershed on reclaimed mined lands.

- **Upland Stratum:** Native upland habitats, primarily pine flatwoods, have suffered disproportionate losses. This stratum includes rare or highly threatened upland habitats including sand pine scrub, longleaf pine, and hydric flatwoods; and includes wildlife corridors for the Florida panther. This stratum includes hydrologically isolated forested and herbaceous wetlands that are interspersed throughout the landscape. These wetlands occur outside the coastal stratum and 100-year floodplain. Given the disproportionate losses of native upland habitats in the CHNEP area, greater preservation/conservation, and perhaps more stringent regulatory protection, of these areas should be a clear priority. In addition, for areas that are already under a conservation easement, the restoration upland habitats should be prioritized, as supported by native soil types.

Implementation of the habitat preservation/conservation, management, and restoration targets and recommendations identified in this report are expected to result in the long-term sustainability of

the spectrum of native habitats in the CHNEP area, as well as viability of animal populations that depend on these habitats.

The results presented in this report represent a "snapshot" of what is currently possible with the data provided. The areas analyzed in this report only represent those lands that were identified during the completion of this study for potential preservation/conservation and reservation opportunities, or for habitat management and restoration target setting. It should be noted that the identification of new environmental lands; and the ability to acquire, manage, enhance and/or restore such lands by local, state and federal agencies or conservation organizations within the overall CHNEP area, can change on a regular basis. These changes are dependent on current funding availability, administrative priorities, and economic conditions. There continue to be emerging needs and opportunities (with willing land owners) that have yet to be explored that will possibly identify additional areas for conservation or restoration that are not addressed here. Accordingly, the opportunities and targets defined in this HRN document should be periodically reevaluated based on current information. It should also be noted that this report is geared specifically toward habitat restoration, but does not preclude other plans that are more focused on other goals such as hydrologic restoration.

SECTION 5
Next Steps

This section presents the next steps that will build on the efforts of this current HRN effort and move forward with supporting and implementing the vision and goals developed in this plan.

Access and Use of the HRN Project Database Online Through the CHNEP Water Atlas

Data from this HRN project will be made readily available to the public and any interested stakeholders though the CHNEP Water Atlas. It is anticipated that the HRN data will be integrated into the CHNEP Water Atlas Advanced Mapping Application. This web-based application is capable of presenting habitat and other data in a GIS based platform for easy viewing. Users will be able to access the full set of spatial data by simply clicking on the list of layers on the mapping application and will be able to interactively view the results of the HRN project.

Strategy for Regularly Updating and Using the Goals, Databases, and Tools

Habitat protection and restoration requires an iterative approach driven by the identified goals implemented by stakeholders. In order to make effective progress, the following recommendations are presented:

- Share goals, opportunities, targets, and restoration methodologies developed in the project with resource managers throughout the CHNEP area to manage and plan habitat restoration
- Update the land use change analysis as new data are available to track changes and inform goals
- Continue to poll existing stakeholders and reach out to partner agencies to periodically update their habitat restoration projects and conservations lands database
- Evaluate progress on the goals developed as part of the this HRN project
- Periodically assess restoration opportunities and targets as new land use data becomes available

Future Studies

This current HRN study looked at setting restoration goals and opportunity and targets at the larger CHNEP area and basin level. A “HRN Phase II” will be undertaken to conduct a similar analysis as used in this report to address the expansion of the CHNEP service area to include the freshwater Caloosahatchee River basin. Including the upstream freshwater portion of the river will provide an opportunity for the program to better protect and restore the downstream Caloosahatchee estuary.

Appendices
(on separate disk)