

Environmental Assessment for the Minor Boundary Modification of Waccamaw National Wildlife Refuge

Date:

This Environmental Assessment (EA) is being prepared to evaluate the effects associated with the proposed action and complies with the National Environmental Policy Act (NEPA) in accordance with Council on Environmental Quality regulations (40 CFR 1500-1509) and the Department of the Interior (43 CFR 46; 516 DM 8) and U.S. Fish and Wildlife Service (550 FW 3) regulations and policies. NEPA requires examination of the effects of proposed actions on the natural and human environment.

Proposed Action: Minor Boundary Modification

The U.S. Fish and Wildlife Service (Service) is proposing to modify the Waccamaw National Wildlife Refuge (NWR) Approved Acquisition Boundary (AAB) by removing 6,849 acres from the current AAB and adding 6,638 acres (Figure 1). Upon approval of the minor boundary modification, the Refuge would acquire the added acreage from willing sellers only.

Background

National Wildlife Refuges are guided by the mission and goals of the National Wildlife Refuge System (NWRS), the purposes of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act (NWRSAA) of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual.

The Refuge was established pursuant to the Fish and Wildlife Service Coordination Act of 1958 (16 U.S.C 661-667-E), Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b)), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)). The primary purposes of the Refuge are to:

- Protect and manage diverse habitat components within an important coastal river ecosystem for the benefit of threatened and endangered species, freshwater and anadromous fish, migratory birds, and forest wildlife, including a wide array of plants and animals associated with bottomland hardwood habitats;
- Provide compatible wildlife-dependent recreational activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation for present and future generations.

To better meet these objectives, the Refuge has successfully completed two minor expansions in 2001 and 2012; however, large portions of the expansion areas experienced significant

alterations in land use before the land could be acquired. Because of the permanent nature of said alterations, these tracts no longer contain valuable wildlife habitat and are not suitable for wildlife-dependent recreation. In the interim, tracts adjacent to the AAB have been identified as conservation priorities by the Upper Waccamaw and Winyah Bay Focus Area Task Forces and are currently available for acquisition. To preserve biodiversity and restore ecological function, conservation must transcend arbitrary boundaries and focus on landscape-scale initiatives (Network for Landscape Conservation, n.d.). This minor boundary modification would enable the Refuge to respond to a rapidly changing landscape by modifying the AAB to remove acreage that no longer meets the purposes of the Refuge and adding land that contains valuable habitat.

The Refuge utilized the South Atlantic Landscape Conservation Cooperative (SALCC) Blueprint 2.2 to identify conservation priorities based on ecosystem indicator condition and connectivity. The Blueprint is a living spatial plan to conserve natural and cultural resources for future generations (SALCC, 2017). More than 500 people from over 150 organizations were involved in its creation. The Blueprint includes six states and exemplifies a landscape-scale approach to conservation that integrates site-specific management with broader geographic initiatives (SALCC, 2017).

The proposed action area is comprised of five subtraction areas and four addition areas. The proposed subtraction areas consist of land that has been, or is in the process of, being developed or is otherwise unavailable for acquisition by the Refuge. The addition areas include critical wildlife habitat that is resistant to salt water intrusion and/or is currently at risk of alteration.

The proposed subtraction areas are as follows:

- **Subtraction Area One (Figure 2) – 2,784 Acres**
Subtraction area one is comprised of a portion of the Woodbury Wildlife Management Area, which is currently owned and managed by South Carolina Department of Natural Resources (SCDNR). This area was added to the AAB before SCDNR acquired the property. The previous owner, International Paper, indicated they were only interested in selling the southern portion of the tract; however, SCDNR secured an acquisition for the entire tract the following year.
- **Subtraction Area Two (Figure 3) – 265 Acres**
Subtraction area two was added to the AAB during the 2001 minor expansion to provide upland buffers to floodplain wetlands. It was converted into a golf course and residential community before the Service could acquire it.
- **Subtraction Area Three (Figure 4) – 262 Acres**
Subtraction area three was added to the AAB during the 2001 minor expansion. This area has also been converted into a golf course and residential community.
- **Subtraction Area Four (Figure 5) – 3,110 Acres**
Subtraction area four is owned by the Grand Strand Water and Sewer Authority

(GSWSA). In 2010, GSWSA clear-cut the majority of the longleaf pine on this tract and converted the land into a tertiary wastewater treatment facility. They have recently received the permits necessary to construct a marine industrial park and are in the process of building a four-lane highway to facilitate commercial access to the property.

- **Subtraction Area Five (Figure 6) - 428 Acres**

Subtraction area five contains a privately owned golf course with an adjoining residential community. Because of the clubhouse and extensive infrastructure on this property, the acquisition of this tract would be cost prohibitive.

The proposed addition areas are as follows:

- **Addition Area One (Figure 7) – 1,400 Acres**

Addition area one contains 736 acres currently owned by Upper Waccamaw Task Force partners. The partnership would donate said acres to the Refuge pending approval of the proposed action. Ducks Unlimited is currently negotiating an additional 160 acres in this area, which would also be donated to the Refuge. This area contains tracts that would connect the current boundary to the Refuge-owned Resource Management Service (RMS)/Springwood tract. The RMS/Springwood tract was recently converted into the Black Water Recreation Area. The recreation area serves as a public access point to the Waccamaw River National Water Trail, which is managed by the National Park Service. Resource Management Services, LLC is a timber management organization.

- **Addition Area Two (Figure 8) – 752 Acres**

Addition area two contains a portion of Hasty Point Plantation. The owner of the plantation has agreed to sell this portion to the Refuge. Upon acquisition of this property, the Refuge would construct a trail system and convert the main structure into a community education and interpretive center. In addition, the infrastructure on this property would provide storage space and housing accommodations. This property would also serve as an access point to Sandy Island.

- **Addition Area Three (Figure 9) - 4,426 Acres**

Addition area three encompasses Carvers Bay and Vandross Bay. Carvers Bay is owned by The Nature Conservancy (TNC). TNC has expressed their intent to donate this property to the Refuge. The donation would include a \$125,000 management endowment. In addition, there are several RMS-owned tracts in addition area three that are available for acquisition.

- **Addition Area Four (Figure 10) – 60 Acres**

Addition area four is adjacent to the current Refuge acquisition boundary. The owner

of this property has expressed an interest in selling it to the Refuge. The acquisition of this area would enable the Refuge to expand its youth and mobility impaired hunting programs. As of present, these hunts are severely restricted in size due to a lack of suitable land.

Approximately 61% of the addition areas are prioritized in the Blueprint (Figure 11) (SALCC, 2017). Nearly 100% of the streams and rivers within the addition areas are surrounded by natural vegetation and score highly as riparian buffers (Figure 12), which contributes to better water quality (SALCC, 2017). The river systems within the addition areas are also highly complex, with seven connected stream classes (SALCC, 2017). River systems with a variety of connected stream classes can help retain biodiversity in a changing climate by allowing species to migrate to more suitable habitat (SALCC, 2017).

As of 2019, the Refuge does not contain brackish marsh; however, the National Oceanic and Atmospheric Administration's (NOAA) revised Sea Level Affecting Marshes Model (SLAMM) predicts that $\approx 13,000$ acres of freshwater marsh located in the southern portion of the Refuge will transition into brackish marsh (Figure 13) by 2050. Conversely, addition areas one and two are less susceptible to the effects of sea level rise (SLR) because of their upstream location. The large volume of freshwater discharge in the Great Pee Dee and Waccamaw rivers creates a salinity gradient whereby salt concentration is highest at the mouth of the river and lowest upstream (Jones et al., 2017). As a result, tidal freshwater forested wetlands (TFFW) located upstream are expected to persist as wetlands further downstream transition into brackish marsh.

Purpose and Need for the Proposed Action:

The mission of the NWRS, as outlined by the NWRSA, as amended by the National Wildlife Refuge System Improvement Act (16 U.S.C. 668dd et seq.), is to "...administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

The NWRSA (16 U.S.C. 668dd(a)(4)) mandates the Secretary of the Interior in administering the system to:

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the NWRS;
- Ensure that the biological integrity, diversity, and environmental health of the NWRS are maintained for the benefit of present and future generations of Americans;
- Ensure that the mission of the NWRS described at 16 U.S.C. 668dd(a)(2) and the purposes of each refuge are carried out;
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the States in which the units of the NWRS are located;
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the NWRS and the purposes of each refuge;

- Recognize compatible wildlife-dependent recreational uses as the priority general public uses of the NWRS through which the American public can develop an appreciation for fish and wildlife;
- Ensure that opportunities are provided within the NWRS for compatible wildlife-dependent recreational uses;
- Monitor the status and trends of fish, wildlife, and plants on each refuge.

The purposes of the proposed action are in accordance with the mission and goals of the NWRS as set forth in the NWRSAA. Purposes include but are not limited to:

- Protect TFFW and their associated wildlife and vegetative communities;
- Protect riparian corridors and buffer zones;
- Expand the Refuge's outdoor education program;
- Enhance wildlife-dependent recreation by creating a public access point to Sandy Island, expanding the Refuge's hunt program, and opening the first Refuge-owned trail system in Georgetown County;
- Provide public access to a locally significant cultural heritage site;
- Mitigate increasingly destructive flood events by protecting the natural hydrology of the landscape;
- Implement landscape-scale management techniques in response to large-scale threats, such as climate change, habitat fragmentation and human population pressure.

As outlined in the Strategic Habitat Conservation Handbook, the Service is committed to using adaptive management to overcome the unprecedented scale and complexities of present-day conservation challenges (USFWS, 2008a). The proposed action is necessary to enable the Refuge to adjust its acquisition priorities in response to anticipated and observed changes in the coastal landscape.

Alternatives Considered

Alternative A – Modification of Approved Acquisition Boundary – [Proposed Action Alternative]:

The Refuge has prepared a Minor Boundary Modification Land Protection Plan, which is attached to this document to provide more details regarding the Proposed Action Alternative.

Under the Proposed Action, the Refuge would remove 6,849 acres from its current AAB, which would result in those areas no longer being eligible for acquisition by the Service. The Service would also add 6,638 acres to its AAB. This is the preferred alternative. It would enable the Service to protect and adequately buffer vulnerable habitats, such as riparian forests, floodplains, isolated wetlands, and sites with sensitive or listed species, as emphasized in the Central Coastal Plain Landscape Conservation Design (LCD) (Mordecai, 2018). In addition, this alternative would enable the Refuge to accomplish the following objectives listed in the Refuge's Comprehensive Conservation Plan (CCP) (USFWS, 2008b):

1. Acquire and restore historic rice fields to improve habitat for wintering waterfowl;

2. Protect and restore habitat within wetland corridors to improve black bear habitat connectivity;
3. Conserve, manage, and enhance natural diversity, abundance, and the ecological functions of Refuge habitats...with special emphasis on old growth bottomland hardwood forests.

The Central Coastal Plain LCD includes predictive models for SLR, coastal resilience, and flood mitigation, which were used to identify conservation priorities. Horry County, TNC, and American Rivers currently own ≈3,400 acres within the proposed action area. This land would be donated to the Refuge within two years pending approval of the proposed action. To acquire the remaining addition land within the proposed action area, the Refuge plans to use a combination of funding sources, including the Land and Water Conservation Fund, the Migratory Bird Conservation Fund, and the North American Wetland Conservation Act.

Alternative B – Retention of Approved Acquisition Boundary – [No Action Alternative]:

Under Alternative B, the Service would not modify the AAB, accept donations, or acquire any land within the addition areas. Permanent changes in land use on unacquired tracts are probable. Partner-owned tracts would have to be sold or donated to an alternative land management agency, which would result in inconsistent management practices and loss of public access. The 6,849 unacquired acres in the current AAB would remain within the boundary but are unlikely to be acquired. Protection of natural resources within the addition areas would be contingent upon the enforcement of existing federal, state, and local regulatory authorities (the Clean Water Act, state water quality and pollution requirements, etc.), and the discretion of private landowners.

Potential threats to privately owned forested wetlands and uplands include timber harvests, mining, and permanent changes in land use, such as commercial and residential development. Long-term persistence of old growth bottomland hardwood forests on privately owned tracts would be unlikely. Residential development would reduce habitat quality and degrade the area's natural resources as a result of increased nonpoint source pollution, removal of vegetation, construction, and alterations to hydrology. Secondary impacts would include the installation of utility easements and the construction of docks for waterfront access.

Furthermore, the Refuge would be unable to successfully accomplish landscape-scale conservation objectives that require broad, consistent management actions. Continuity of management is especially important for species with large home ranges, such as the American black bear and swallow-tailed kite. To successfully restore and protect quality habitat for these species, substantial acreage must be managed long-term and management actions must be universally applied.

Affected Environment

Waccamaw NWR is comprised of ≈34,545 acres in Georgetown, Horry, and Marion counties, South Carolina. The Refuge is primarily TFFW. The proposed action areas are located along the

northern, western, and southwestern borders of the Refuge. Tables 1-6 provide brief descriptions of each resource affected by the proposed action.

For more information regarding the affected environment, please see section II of the Refuge's Comprehensive Conservation Plan, which can be found here: Waccamaw National Wildlife Refuge CCP (<https://catalog.data.gov/dataset/waccamaw-national-wildlife-refuge-comprehensive-conservation-plan>).

Environmental Consequences of the Action

This section analyzes the environmental consequences of the action on each affected resource, including direct and indirect effects. This EA includes the written analyses of the environmental consequences on a resource only when the impacts on that resource could be more than negligible and therefore considered an "affected resource" or are otherwise considered important as related to the proposed action. Any resources that will not be more than negligibly impacted by the action and have been identified as not otherwise important as related to the proposed action have been dismissed from further analyses.

Tables 1-5 provide:

1. A brief description of the affected resources in the proposed action area;
2. Impacts of the proposed action and any alternatives on those resources, including direct and indirect effects.

Table 6 provides a brief description of the anticipated cumulative impacts of the proposed action and any alternatives.

Impact Types:

- *Direct effects* are those which are caused by the action and occur at the same time and place.
- *Indirect effects* are those which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.
- *Cumulative impacts* result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.

TABLE 1. AFFECTED NATURAL RESOURCES AND ANTICIPATED IMPACTS OF THE PROPOSED ACTION AND ANY ALTERNATIVES

NATURAL RESOURCES	
AFFECTED RESOURCE	ANTICIPATED DIRECT AND INDIRECT IMPACTS

<u>Wetlands</u> The wetlands within the proposed action area meet the assessment threshold criteria for the National Wetlands Priority Conservation Plan (USFWS, 1989). As such, they are included in the Winyah Bay wetland system in the Service’s Regional Wetlands Concept Plan for the Southeast Region (USFWS, 1997). The proposed addition areas contain three distinct types of wetland habitat: Tidal Forested Freshwater Wetland TFFW serve as an interface between coastal marshes and fluvial bottomland forested wetlands (United States Geological Survey [USGS], n.d.a). The TFFW in addition areas one and two would provide suitable habitat for old growth bottomland hardwood forests. Upstream forests will become increasingly more important as downstream forest stands are replaced with marsh vegetation in response to increasing salinity and longer periods of inundation. Blackwater Forested Wetland Blackwater forested wetlands are located along the Waccamaw and Little Pee Dee rivers. This habitat contains slow-moving water that is acidic and tea colored as a result of tannins leaching into the water from decaying vegetation. Because of the acidity of the water, these habitats often support organisms that are not found in nearby, less acidic wetlands. The proposed action area contains 1,400 acres of blackwater forested wetlands. Managed Wetland Managed wetlands are manmade impoundments in which the hydrology is	<u>Alternative A: Modification of Approved Acquisition Boundary</u> The proposed action would add ≈5,884 acres of wetland habitat to the AAB. Protection of this acreage would preserve valuable ecosystem services, such as flood mitigation, sediment trapping, and carbon sequestration (USGS, n.d.a). The Refuge would also continue its wetland management activities in addition area two. <u>Alternative B: Retention of Approved Acquisition Boundary</u> The Refuge would cease management activities for wintering waterfowl in addition area two upon expiration of the wetland lease agreement. In addition, privately owned wetlands could eventually be developed and used for agricultural, commercial, residential, and/or industrial purposes. Development in wetland habitats is currently regulated by the U.S. Army Corps of Engineers’ Section 404 (Clean Water Act) permit program. This program only requires permits for the discharge of dredge and fill material in wetlands. Section 404 also provides exemptions for normal ranching, farming, and silviculture practices. However, if these practices convert wetlands into non-wetlands, Section 404 includes a “recapture” provision, voiding the exemption and requiring a 404 permit. According to the U.S. Department of Interior (1994), Section 404 does not restrict activities that may alter wetlands (e.g. excavation, drainage clearing, flooding, or constriction of water supply), when such activities do not involve the discharge of dredge or fill material. As a result of this jurisdictional restriction, a substantial portion of wetland alterations are not covered by the
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manipulated to encourage the growth of emergent vegetation. This type of vegetation provides food for wintering waterfowl. Properly managed moist-soil wetlands, such as those in addition area two, can yield over 2,500 pounds of seed per acre (Nelms, Barringer, & Boyles, 2007). In addition, managed wetlands augment existing habitat and provide alternative options for waterbirds (Ma, Cai, Li, & Chen, 2009). Currently, the Refuge manages 58 acres of impounded wetlands in addition area two in fulfillment of a lease agreement with the property owner.	Section 404 program. Furthermore, Section 404 primarily addresses the physical loss of wetlands and does not cover degradation or contamination (U.S. Department of Interior, 1994).
<u>Wildlife and Aquatic Species</u> The proposed action area contains suitable habitat for a diversity of wetland-dependent wildlife, including black bears, colonial nesting birds, neotropical migratory birds, and wintering waterfowl. <u>Amphibians and Reptiles</u> Addition area two is an important conservation area for species associated with pine and prairie habitat. The majority of the parcel has been identified as a Priority Amphibian and Reptile Conservation Area within pine and prairie ecosystems (Figure 14). Species used to identify PARCAs include the pine barrens tree frog, striped newt, and southern hognose snake. <u>American Black Bear (<i>Ursus americanus</i>)</u> The coastal black bear has an estimated population of 200-250 bears, the majority of which are located in Georgetown and Horry counties (Butfiloski, Still, & SCDNR, n.d.). Their preferred habitat consists of expansive forests interspersed with early successional	<u>Alternative A: Modification of Approved Acquisition Boundary</u> Addition area three provides an opportunity to create a black bear sanctuary that surpasses the 5,000-acre threshold recommended by SCDNR, as it is adjacent to additional high priority black bear habitat owned by the Refuge (Figure 15). Successful management of this acreage would maintain genetic diversity within the population. It would also help sustain a viable hunting population for private landowners and state-owned wildlife management areas. In addition, the proposed action would add important connectivity hubs to the AAB, which would contribute to the preservation of a migration corridor network that would benefit a variety of wildlife species. <u>Alternative B: Retention of Approved Acquisition Boundary</u> Destruction and fragmentation of migration corridors would subject the black bear population to the threats of isolation, such as inbreeding, increased human-wildlife conflict,

vegetation, which provides food and escape cover. A minimum of 5,000 acres of suitable habitat is required before management techniques can be successfully implemented (SCDNR, n.d.). Effective conservation of such a wide-ranging species requires landscape-scale planning. Forested corridors are an important consideration for maintaining connectivity between black bear populations (Hector, 2012). The addition areas have been identified as important inland hubs in the connectivity of lands and waters across the South Atlantic region (SALCC, 2017). Addition area three also contains Carvers Bay, which is the largest Carolina bay in Georgetown County and has been characterized as a top conservation priority for black bear habitat in South Carolina. Carvers Bay has been designated as a “No Hunting” zone for black bears by TNC.	and vehicle collisions (Drewry et al., 2012). Lewis Ocean Bay, located ≈22 miles from Carvers Bay, serves as a predictive model for the adverse effects associated with permanent changes in land use and habitat isolation. Movement barriers (e.g. highways and developments) inhibit the migration of bears in Lewis Ocean Bay (Drewry et al., 2012). As a result, the population is denser in comparison to Carvers Bay, which contributes to increased human-wildlife conflict (Figure 16). In addition, bears in Lewis Ocean Bay experience a higher rate of vehicular mortality, which may become unsustainable (Drewry et al., 2012).
<u>Threatened, Endangered, and Other Special Status Species</u> The Refuge contains habitat for several priority species as identified by Partners in Flight, including the swallow-tailed kite, prothonotary warbler, northern parula, and the black-throated green warbler (SALCC, 2017). Red-Cockaded Woodpecker (<i>Picoides borealis</i>) – Federally Endangered The red-cockaded woodpecker is a federally endangered species with an estimated population of 10,000 to 20,000 birds (USFWS, n.d.a). RCWs nest in longleaf pine trees with a minimum age of 70-120 years (USFWS, 1997). Each cavity takes one to six years to excavate (USFWS, 2016).	<u>Alternative A: Modification of Approved Acquisition Boundary</u> The proposed action would add one active RCW cluster in addition area two and ≈700 acres of longleaf pine forests (located within 20 miles of Sandy Island) to the AAB. Upon acquisition of these areas, the Refuge would implement large-scale management actions, such as intensive management of timber harvest, control of hardwood encroachment, and prescribed burning (James, 1995), as indicated in the CCP (USFWS, 2008b). The proposed action would also add ≈2,366 acres of nesting habitat, ≈4270 acres of forested foraging habitat, and ≈243 acres of open foraging habitat suitable for swallow-tailed kites and Rafinesque’s big-eared bats (Figure 17).

Currently, there are approximately 50 active RCW clusters within the Refuge boundary that likely serve as a donor population for the upper coastal portion of South Carolina. RCWs are present on nearly every property that is 1) located within a 20-mile radius of Sandy Island and 2) managed in accordance with RCW management guidelines. Swallow – tailed Kite (<i>Elanoides forficatus</i>) – State Endangered Historically, the swallow-tailed kite inhabited at least 21 states. Their current range is restricted to six states in the southeastern United States. Waccamaw NWR contains the highest density of nesting swallow-tailed kites in South Carolina (Cely & SCDNR, n.d.). Kites require up to 100,000 acres of contiguous habitat, including riparian forests and open foraging areas, to support a healthy population (USFWS, 1997). They also prefer super canopy trees, such as those found in the old growth forests in the addition areas. Rafinesque’s Big-eared Bat (<i>Corynorhinus rafinesquii</i>) – State Endangered Rafinesque’s big-eared bats are endemic to the southeastern United States and typically roost in caves, hollow trees, wells, and under bridges. Waccamaw NWR is an integral component of the conservation effort, as it contains the increasingly rare bottomland hardwood forests that these bats prefer. There is one documented maternal roost site on the Refuge.	<u>Alternative B: Retention of Approved Acquisition Boundary</u> Changes in management actions could imperil the longleaf pine forests in the proposed action area. This could ultimately reduce or eliminate RCWs on these properties. In addition, privately owned land would be susceptible to encroachment of hardwoods and invasive species, as private landowners are less equipped to implement large-scale management operations. Critical habitat for swallow-tailed kites and Rafinesque’s big-eared bats would also be at risk of commercial logging. As sea level continues to rise, flooding of roost sites will become more common, emphasizing the need to protect habitat less susceptible to SLR.
<u>Geology & Soils</u> Carolina Bays Typically found in Georgia and the Carolinas, Carolina bays are isolated, elliptical basins that are hydrologically	<u>Alternative A: Modification of Approved Acquisition Boundary</u> Currently, the Refuge does not own or lease any Carolina bay habitat. Addition area three has five Carolina bays that contain ≈6.5 miles

driven by rainwater. They are typically oriented in a northwest to southeast direction and range from <1 acre to many square miles. In a study conducted in 1991, researchers utilized aerial photography to analyze rates of disturbance in Carolina bays two acres or greater in size. Their results suggested that of the 2,648 bays surveyed, 97% had been disturbed by human activities, and 81% experienced more than one disturbance type (Bennett & Nelson, 1991). Logging, agriculture, and ditching were the most common types of disturbance (Bennett & Nelson, 1991). Carolina bays provide important breeding habitat for a variety of species that require an aquatic environment for part of their life cycle (Sharitz, 2003). The bays are typically free of fish because of periodic drying (Gibbons, 2003). As a result, amphibian eggs, larvae, and breeding adults have a higher survival rate in isolated wetlands in comparison to wetlands that contain water year-round (Gibbons, 2003).	of bus-accessible trails. Acquisition of these areas would enable the Refuge to offer educational programs that highlight the herpetofaunal diversity and geological characteristics unique to Carolina bays. The trail system would also be open to the public and would become the first Refuge-owned trail system in Georgetown County. <u>Alternative B: Retention of Approved Acquisition Boundary</u> The Refuge would not acquire any land within addition area three and would thus be unable to manage key bay habitat. The Refuge would not be able to offer live demonstrations or on-site educational programs that focus on the ecology of Carolina bays. The trail system would also remain closed to the public and TNC would have to find an alternative management entity to take over ownership and management of the property.
<u>Vegetation</u> The Refuge supports a diversity of vegetation, including emergent wetlands and deciduous forested communities. In a 2006 rare plant survey of Sandy Island, 14 SCDNR-tracked species were found on the Refuge (Table 1.2). In 2018, the Refuge was surveyed for at-risk plants as part of a USFWS Inventory and Monitoring (I&M) Branch contract. Two Federal at-risk species and 11 SCDNR-tracked species were documented (Table 1.3). Two additional SCDNR-tracked species, Plymouth gentian (<i>Sabatia kennedyana</i>) and smooth hedge-nettle (<i>Stachys tenuifolia</i>), have also been found on the Refuge but were not observed during the 2006 or 2018 survey. In the 2018 I&M survey, narrowleaf pond	<u>Alternative A: Modification of Approved Acquisition Boundary</u> Acquisition of the addition areas would protect the bottomland hardwood forests, freshwater tidal marshes, and upland forests where the surveyed plants were documented. The protected areas could become an oasis for freshwater plants as saltwater intrusion alters coastal habitat. The Refuge would implement prescribed burning to restore ecosystems that depend on fire and would also manage threats, such as invasive plants and feral hogs. <u>Alternative B: Retention of Approved Acquisition Boundary</u> The Refuge would be unable to manage the addition areas for rare plant species. Additional

lily was present on 88% of the 189 km of waterways surveyed (Bradley, 2018). In addition, Carolina bishpweed was documented immediately downstream from addition area three.	threats to suitable habitats and their associated plants include residential and commercial development and disruption of riverine and estuarine processes due to dredging activities (Bradley, 2018).
<u>Floodplains</u> An unaltered, functioning river-floodplain system is an important hydrological component of a healthy riparian ecosystem. Periodic flood events deposit nutrient-rich sediment, which creates the fertile soil necessary to support native riparian vegetation. In addition, floodplains recharge groundwater, filter excess nutrients, provide water storage, and reduce flow velocity. As areas within the floodplain are altered, floodwaters are disconnected and diverted, which accelerates erosion and causes repetitive flooding (Christin & Kline, 2017). In Horry County, development has significantly altered the natural hydrology of the Waccamaw/Great Pee Dee floodplain system. Inadequate drainage structures, such as excessively small culverts, have contributed to backwater flooding (Christin & Kline, 2017) in surrounding communities	<u>Alternative A: Modification of Approved Acquisition Boundary</u> The proposed action would add ≈2,227 acres of floodplain wetlands to the AAB. One hundred percent of addition areas two, three, and four received the highest possible score as freshwater pervious surfaces in the Blueprint (SALCC, 2017) (Figure 18). Left undeveloped, these areas would continue to absorb runoff and release it slowly into the ground. This process would also reduce peak rates of discharge by preventing large, fast pulses of precipitation through the stormwater system (USGS, n.d.b). <u>Alternative B: Retention of Approved Acquisition Boundary</u> Residential and commercial development would increase impervious surface area within the floodplain. Because storm water runoff is unable to penetrate impervious surfaces, the Waccamaw and Great Pee Dee rivers would be forced to accommodate larger volumes of runoff. Increased surface runoff would accelerate erosion and degrade aquatic habitat (Environmental Protection Agency [EPA], n.d.). Increased stormwater runoff could also pose a threat to public health, as it could raise the concentration of pollutants in recreational waters (EPA, n.d.) In addition, alterations within the floodplain would stress an already-taxed drainage system.

TABLE 1.2. RARE PLANT SPECIES ON SANDY ISLAND, 2006 SURVEY

SCIENTIFIC NAME	COMMON NAME	USFWS	SCDNR
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<i>Aristida condensata</i>	Big three-awn		S2
<i>Ceratiola ericoides</i>	Florida rosemary		S1
<i>Cladium mariscoides</i>	Twig-rush		S1
<i>Cyperus lecontei</i>	Leconte's flatsedge		S1
<i>Eleocharis robbinsii</i>	Robbins' spikerush		S2
<i>Eleocharis vivipara</i>	Viviparous spikerush		S1
<i>Lachnocaulon beyrichianum</i>	Southern bigbutton		S2
<i>Litsea aestivalis</i>	Pondspice		S3
<i>Pityopsis pinifolia</i>	Sandhill goldenaster		S2
<i>Rynchospora inundata</i>	Narrow-fruit horned beaksedge		S2
<i>Sagittaria isoetiformis</i>	Quillwort arrowhead		S3
<i>Syngonanthus flavidulus</i>	Yellow hatpins		S2
<i>Xyris elliotii</i>	Elliott's yellow-eyed grass		S2
<i>Xyris flabelliformis</i>	Savanna yellow-eyed grass		S1

TABLE 1.3. RARE PLANT SPECIES ON WACCAMAW NATIONAL WILDLIFE REFUGE, 2018 SURVEY

SCIENTIFIC NAME	COMMON NAME	USFWS	SCDNR
<i>Carex amphibola</i>	Eastern narrow-leaved sedge		SNR
<i>Carex crus-corvi</i>	Crowfoot sedge		S2
<i>Carex elliotii</i>	Elliott's sedge		S1
<i>Dichantherium aciculare</i>	Needle-leaved witchgrass		SNR
<i>Epidendrum magnoliae</i>	Green-fly orchid		S3
<i>Hymenocallis pygmaea</i>	Pygmy spiderlily		SNR
<i>Ilex amelanchier</i>	Sarvis holly		S3
<i>Nuphar sagittifolia</i>	Narrowleaf pondlily	At-Risk	S2
<i>Physostegia leptophylla</i>	Tidal marsh obedient-plant		SNR
<i>Pilea fontana</i>	Blackfruit clearweed		SNR
<i>Ptilimnium ahlesii</i>	Carolina bishopweed	At-Risk	S1
<i>Sagittaria weatherbiana</i>	Weatherby's arrowhead		S1
<i>Symphotrichum elliotii</i>	Southern swamp aster		S3

TABLE 2. AFFECTED VISITOR USE AND EXPERIENCE AND ANTICIPATED IMPACTS OF THE PROPOSED ACTION AND ANY ALTERNATIVES

VISITOR USE AND EXPERIENCE	
AFFECTED RESOURCE	ANTICIPATED DIRECT AND INDIRECT IMPACTS

<u>Cox Ferry Lake Recreation Area</u> Cox Ferry Lake Recreation Area is a 552-acre property located in the northeastern corner of the Refuge. It is closed to hunting to facilitate year-round opportunities for fishing, wildlife observation and photography, and environmental education and interpretation. The recreation area features ~8 miles of hiking trails, a mountain bike trail, fishing pier, boardwalk, picnic shelters, overlooks, and kiosks.	<u>Alternative A: Modification of Approved Acquisition Boundary</u> There is limited opportunity for recreation on public lands in Georgetown, Horry, and Marion counties. The majority of the forested land in the three-county area is under private ownership or owned by timber management organizations. Construction of additional trails would accommodate the increase in demand for outdoor recreation activities. The Refuge would expand the trail system at Cox Ferry Lake Recreation Area into addition area one. The Refuge would also construct a new trail system in addition area two and would open the existing trail system in addition area three to the public. The Refuge does not anticipate conflicts at Cox Ferry Lake Recreation Area; however, as public use increases, unexpected conflicts between user groups may arise. The Refuge would manage these conflicts by providing separate access opportunities for competing interest groups. <u>Alternative B: Retention of Approved Acquisition Boundary</u> The demand for non-consumptive recreation, such as hiking, biking, and wildlife photography, is likely to increase in proportion to the area's population growth. Without a proportional increase in publicly accessible recreation areas, pressure on existing public land would increase. Overcrowded recreation areas would increase pollution and wildlife disturbance and decrease the quality of wildlife-dependent recreation on said lands.
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TABLE 3. AFFECTED CULTURAL RESOURCES AND ANTICIPATED IMPACTS OF THE PROPOSED ACTION AND ANY ALTERNATIVES

CULTURAL RESOURCES	
AFFECTED RESOURCE	ANTICIPATED DIRECT AND INDIRECT IMPACTS
<u>Hasty Point Plantation</u> Located in the Pee Dee River Rice Planters Historic District, Hasty Point Plantation is a former rice plantation that was listed on the National Register of Historic Places on October 3rd, 1988. The plantation also contributed to the designation of Plantersville Road as a State Scenic Byway. As such, Hasty Point is an important cultural and historical site for colonial Georgetown and the United States.	In accordance with Section 106 of the National Historic Preservation Act of 1977 and its governing regulations (36 CFR Part 800), the Service reviewed the proposed action for direct and indirect impacts to previously documented and unidentified historic resources and determined that the proposed action will not have significant impacts on historic properties. The Service consulted with the South Carolina State Historic Preservation Office and requested a review and comment letter in regards to the Service's determination of no significant impacts on historic properties. <u>Alternative A: Modification of Approved Acquisition Boundary</u> The proposed action would contribute to the maximization and representation of cultural sites and biotic cultural resources, an objective listed in the LCD. If the proposed action is approved, the Refuge intends to secure funding to convert the plantation's main house into a center for education and cultural interpretation. The facility would serve as a community center where educators, researchers, and engaged citizens could discuss concerns and develop effective conservation strategies specific to Georgetown County. The center would feature exhibits that would highlight important aspects of the Gullah Geechee culture, such as rice cultivation and the turpentine industry. The plantation would also feature a nature trail that would immerse visitors in a living forest laboratory. In addition, the center would serve as an ADA accessible access point to Sandy Island.

	<u>Alternative B: Retention of Approved Acquisition Boundary</u> Hasty Point Plantation would likely remain under private ownership and would be inaccessible to the public. The Refuge would be unable to create a cultural interpretive program at the plantation and would also be unable to host community events, construct new trails, or improve its outdoor educational programs.
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TABLE 4. AFFECTED REFUGE MANAGEMENT AND OPERATIONS AND ANTICIPATED IMPACTS OF THE PROPOSED ACTION AND ANY ALTERNATIVES

REFUGE MANAGEMENT & OPERATIONS	
AFFECTED RESOURCE	ANTICIPATED DIRECT AND INDIRECT IMPACTS
<u>Land Use</u> The Refuge does not currently have a maintenance compound or an equipment storage area. Acquisition of a facility has been a top priority for the Refuge for several years but has not been feasible due to a lack of funding. Currently, the Refuge leases the Georgetown SCDNR office to store boats, vehicles, trailers, fuel, and miscellaneous equipment. The lease commenced in 2003 and expired in 2018. The Refuge has continued to utilize this space as a storage facility; however, SCDNR is planning to reopen the office and the Refuge will be required to move its equipment.	<u>Alternative A: Modification of Approved Acquisition Boundary</u> Hasty Point Plantation has an adequate equipment storage facility and a maintenance compound. The Refuge would use the property's existing facilities as opposed to building a new compound. The property also has several structures that would be used as office space and housing quarters for students and seasonal technicians. In addition, the property is already equipped with filtered water and septic systems. The Refuge would relocate its volunteer village to Hasty Point Plantation, as the expansion of Highway 701 has encroached upon the current village and has made volunteer recruitment and retention more challenging. Lastly, the property includes a boat ramp, boat shed, and boat basin that would serve as a future launch point for educational tours of Sandy Island.

	<u>Alternative B: Retention of Approved Acquisition Boundary</u> The Refuge will be required to move its equipment before the SCDNR office is reopened. The Service would have to provide funding to build a storage facility. The Refuge does not have the capacity to store additional equipment at its visitor's center. Furthermore, the Refuge would have to acquire additional land and install a septic system and laundry facility to create a new volunteer village or it would be unable to maintain its RV program. The Refuge relies heavily on camper/worker volunteers to supplement its workforce. Without the RV volunteer program, the Refuge would be unable to staff the visitor center or maintain the trail system at Cox Ferry Lake Recreation Area.
<u>Administration</u> Current Refuge staff consists of four full-time employees, including a GS-12 Refuge Manager, GS-11 Refuge Operations Specialist, GS-9 Park Ranger, and GL-9 Wildlife Officer. The annual budget for Waccamaw NWR in 2018 was \$633,396.88. Approximately 95% of the budget is consumed by salaries, visitor center utilities, fuel, and vehicle repairs. The Refuge also covers the majority of the costs associated with its environmental education program, which is administered by its Friends Group. Additional funding will be required to restore and maintain newly added properties. The Refuge, in collaboration with several partners, is currently working to secure a management endowment that would help offset these additional costs and provide a secure funding source for future needs. The Refuge would not need to hire additional full-time employees to accommodate the new additions.	<u>Alternative A: Modification of Approved Acquisition Boundary</u> The cost of this alternative is estimated at \$40,000-\$50,000/ year. These costs will include part-time staff, utilities, and standard management operations. Implementation of the proposed action is expected to consume 20% of staff hours. This is not expected to have a significant impact on the Refuge's priority operations, such as habitat restoration, wildlife management, and education programs. Procurement of a management endowment would cover the costs associated with restoration, management, and expansion of public use programs. This alternative would also allow the Refuge to generate funding through the establishment of a recreation fee program. <u>Alternative B: Retention of Approved Acquisition Boundary</u>

	Refuge staff would continue to administer educational programs and manage existing public use areas; however, minimal growth is expected under this alternative. Refuge accessibility would remain a limiting factor. Approximately 50% of the Refuge Manager's time would be required to coordinate with the Upper Waccamaw and Winyah Bay Focus Area Task Forces to identify alternative options for partners who have acquired land with the intent of donating it to the Refuge.
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TABLE 5. AFFECTED SOCIOECONOMICS AND ANTICIPATED IMPACTS OF THE PROPOSED ACTION AND ANY ALTERNATIVES

SOCIOECONOMICS	
AFFECTED ENVIRONMENT	ANTICIPATED DIRECT AND INDIRECT IMPACTS
<u>Local and Regional Economies</u> The Refuge is a component of the economic region of Georgetown, Horry, and Marion counties. It is assumed that visitor expenditures occur primarily within these counties. Since 2011, the Refuge has added Sandy Island, the Long Tract, and the Blackwater Recreation Area to the Refuge's public use program. After these additions, Refuge visitation increased from 7,691 visits in 2011 (Carver & Caudill, 2013) to 509,300 visits in 2017 (USFWS, 2019). Total recreation expenditures increased from \$164,900 to \$10.3 million (USFWS, 2019). Expenditures on non-consumptive activities accounted for 91% of all expenditures in 2017 (USFWS, 2019). The contribution of recreational spending was associated with 4 jobs in 2011, which increased to 148 jobs in 2017 with a combined total income of \$4	<u>Alternative A: Modification of Approved Acquisition Boundary</u> Based on these historical trends, the proposed action is expected to result in a substantial increase in consumptive and non-consumptive recreation expenditures in Georgetown and Horry counties. In addition, the proposed action is expected to expand employment opportunities in said counties. Horry County and the City of Conway will continue to utilize the FEMA buyout program to acquire residential property in flood-prone areas. The proposed action would allow the city and county to transfer these properties to the Refuge, thus alleviating the costs of restoration and management. The county's CRS score is expected to improve as Waccamaw NWR protects more land within the floodplain. <u>Alternative B: Retention of Approved</u>

million (USFWS, 2019). The Refuge also contributed \$1.2 million in local tax revenue (sales, property, and income taxes) in 2017 (USFWS, 2019), compared to \$27,800 in 2011 (Carver & Caudil, 2013). Total spending attributed to Refuge visitation totaled \$14.4 million (USFWS, 2019). In addition, the protected land within the Refuge contributed to the upgrade of Horry County from a Class 9 to a Class 7 rating in the National Flood Insurance Program (NFIP) Community Rating System (CRS) in 2017. The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. It is administered by the U.S. Department of Homeland Security and the Federal Emergency Management Agency (FEMA). As a former Class 9 community, there was approximately \$314,313 in Flood Insurance Savings in the unincorporated areas of Horry County. As an upgraded Class 7 community, residents who reside within the floodplain of the unincorporated areas of Horry County will receive a 15% discount on their flood insurance premiums, which will total \$875,147.	<u>Acquisition Boundary</u> The recreation area would not be expanded, which would stifle the local economic growth driven by the Refuge. Horry County would be unable to transfer FEMA buyout properties to the Refuge. These tracts would remain idle due to lack of funding for restoration and management activities. According to the Fourth National Climate Assessment, “without substantial and sustained global mitigation and regional adaptation efforts, climate change is expected to cause growing losses to American infrastructure and property and impede the rate of economic growth over this century (USGCRP, 2018).” Low-lying regions in the southeast are expected to experience daily high tide flooding by 2100 (USGCRP, 2018). During Hurricane Florence, 378 homes in the City of Conway were damaged, and damages to public facilities totaled \$3 million. Additional expenses associated with flood events include loss of property value, diminished tourism, mosquito control, infrastructure and building repair, and construction of mitigation structures. As development within the floodplain continues, flood events will become more frequent and local communities will be caught in an escalating cycle of damage and repair (Christin & Kline, 2017).
<u>Agricultural Practices</u> Invasive feral hogs have been reported in every county in South Carolina and cause \$45 million in damages every year (SCWHTF, 2018). Damages and threats include rooting, transfer of disease to humans and livestock, vehicle collisions, and destruction of crops (SCWHTF, 2018). Feral hogs also contribute to declines in native plants and animals.	<u>Alternative A: Modification of Approved Acquisition Boundary</u> The Refuge would implement management strategies, including Refuge hunts, trapping, and annual monitoring to stabilize the feral hog population at Hasty Point Plantation. Population stabilization would benefit native species, such as longleaf pine, eastern wild turkey, and bobwhite quail, and would reduce agricultural and commercial forest damage in

According to a report released by Clemson University, the estimated population of feral hogs in South Carolina is 150,000 individuals. Due to a high reproductive rate, 50-75% of the population must be eradicated annually to stabilize or reduce the population (SCWHTF, 2018). Currently, the Refuge manages a comprehensive feral hog control program that uses Refuge hunts and remotely sensed trapping to control the hog population. The feral hog control program has been successful in reducing the population on Refuge lands, which has helped mitigate damages on the Refuge and adjacent privately owned land.	the surrounding community. <u>Alternative B: Retention of Approved Acquisition Boundary</u> The Refuge would not expand its feral hog control program, and the feral hog population would likely increase. This would have a negative impact on neighboring plantations.
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ENVIRONMENTAL JUSTICE	
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires all Federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities.	<u>Alternative A: Modification of Approved Acquisition Boundary</u> In Georgetown County, 38% of the population identifies as non-white and 22% of the population is living below the poverty line (GCCP, 2016). Eighteen percent of the population in Horry County is living below the poverty line (GCCP, 2016). The Service has not identified any potential high and adverse environmental or human health impacts from the proposed action. <u>Alternative B: Retention of Approved Acquisition Boundary</u> The no action alternative would have a disproportionate negative impact on low-income and minority communities. Failure to prevent development within the floodplain could contribute to an increase in the severity and duration of flood events in said communities. In addition, it would limit access

	to the unspoiled natural resources that contribute to a better quality of life.
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Cumulative Impact Analysis:

Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR 1508.7).

TABLE 6. ANTICIPATED CUMULATIVE IMPACTS OF THE PROPOSED ACTION AND ANY ALTERNATIVES

Other Past, Present, and Reasonably Foreseeable Activity Impacting Affected Environment	Descriptions of Anticipated Cumulative Impacts
<u>Wildlife-dependent Recreation</u> Scenic Vista and Recreation along the Waccamaw River As a self-proclaimed “river town,” the City of Conway has collaborated with Waccamaw NWR, Horry County, The Nature Conservancy, American Rivers, and the Open Space Institute to create a scenic vista along the Waccamaw River. The river is the city’s most celebrated and important asset, and the Refuge and its partners will continue to work together to protect land within the Waccamaw floodplain and expand recreational opportunities.	As existing parks and recreation areas are expanded, the network of conservation and public lands along the Waccamaw River is expected to attract more visitors to the City of Conway, bolster the local economy, and create additional jobs within the tourism sector. Construction of a new trail system in the addition areas would connect ≈10,000 young adults to nature and link Coastal Carolina University to the City of Conway. This would also provide alternative parking options and alleviate traffic congestion in the city. In addition, the expanded riverfront would engage the next generation and increase public awareness of conservation issues through education and volunteer opportunities on public lands. Most importantly, the protection of land and expansion of recreation areas would help preserve the Waccamaw River and its associated lifestyle for future generations. Construction of additional facilities (e.g. parking areas, roads, trails) may cause minimal short-term disturbance to localized soils and waters, wildlife, and vegetation. Refuge maintenance activities would be conducted periodically to accommodate daily refuge management operations. Refuge staff would schedule such activities (seasonal and/or

	daily) to ensure minimal disturbance to wildlife. Siltation barriers would be used to minimize soil erosion, and all disturbed sites would be restored to as natural a condition as possible.
<u>Development and Population Increase</u> The population of Horry County is projected to increase from 309,199 (2015) to 584,500 by 2040 (Imagine 2050, n.d.). The county will require an additional 116,160 housing units to accommodate this growth (Imagine 2040, n.d.). In Georgetown County, the population is projected to increase from 65,240 (2015) to 80,501 by 2035 (GCCP, 2016). The Waccamaw Neck area, which constitutes 11% of the land area in Georgetown County, experienced a 601% growth in population between 1970 and 2010 (GCCP, 2016). In addition, the number of housing units in the county increased from 28,096 in 2000 to 33,672 in 2010, a 19.8% increase (GCCP, 2016). Trends suggest development could begin to spread into rural areas to accommodate the population growth, which could jeopardize the county's scenic and historical areas (GCCP, 2016).	Rapid population growth and urban sprawl would threaten 419 square miles of wetlands and 214 square miles of upland forest (Imagine 2040, n.d.) in Horry County. Future development within the addition areas could also detract from the area's marketability as a nature-based tourist destination. Protection of land within the floodplain would mitigate the adverse impacts associated with development and population growth, such as altered hydrological function and habitat fragmentation. In addition, it would secure the land along the Waccamaw River that contributes to the area's marketability as a destination "river town."
<u>Agricultural Uses</u> From 1982 to 1992, ~40,000 acres in South Carolina were converted from forests and farmland into urban developments. According to the same report, the National Resources Inventory, this rate increased to ~100,000 acres from 1992-1997. As a result, the state was ranked ninth in the Nation in terms of total land area developed per year (USDA, 1997). This development trend and the conversion of rural lands to urbanized uses – with their attendant impacts on wildlife habitat – continue unabated today. Agricultural land provides important	The proposed action would allow the Refuge to expand its upland wildlife management operations. The Refuge would also continue to manage the historic rice fields at Hasty Point Plantation. The hydrology of the impoundments is manipulated to encourage the growth of emergent vegetation, such as smartweed (<i>Polygonum</i> spp.), panic grass (<i>Panicum</i> spp.), red root (<i>Lachnanthes caroliana</i>), water shield (<i>Brasenia schreberi</i>), spikerush (<i>Eleocharis baldwinii</i>), arrow-arum (<i>Peltandra virginica</i>), white water lily (<i>Nymphaea odorata</i>), southern naiad (<i>Najas guadalupensis</i>), Asiatic dayflower (<i>Commelina communis</i>), and soft-stem bulrush (<i>Schoenoplectus tabernaemontani</i>). This type of vegetation provides food for a variety of waterfowl species. The Refuge could also plant

foraging habitat for upland game birds, especially dove, quail, and wild turkey. Agricultural lands adjacent to wetland floodplains also provide refuge for many game and nongame species during annual flood events. Currently, agriculture lands on the Refuge are scarce. As a consequence, acquisition of key agricultural tracts adjacent to the floodplain is a priority. In addition to providing quality habitat for avian species, these tracts also contribute to the Refuge's public use program, as they are ideal for youth turkey and deer hunts. The National Wild Turkey Federation has supported the Refuge's wildlife farming program by providing annual funding through their Superfund Program. These funds enable the Refuge to actively manage its agricultural areas to support the youth hunt program.	rice to enhance its proposed interpretive exhibits that would highlight the Gullah Geechee culture and its contributions to the rice cultivation industry in colonial Georgetown.
<u>Climate Change</u> Increasing ocean temperatures coupled with rising sea levels are expected to have significant impacts on human health, infrastructure, natural resources, and the economy. In comparison to the preindustrial era, the average global temperature is expected to increase by 9°F (5°C) by the end of the century if current rates of emission are not reduced (USGCRP, 2018). Since 1900, global sea level has risen by 7-8 inches, half of which has occurred in the last 16 years (USGCRP, 2018). Scientists predict that sea level could rise by as much as 8 feet by 2100 (USGCRP, 2018); however, the severity of SLR will be dependent upon natural processes, anthropogenic change, and mitigation and adaptation.	Tidal marshes are among the most susceptible ecosystems to climate change, especially accelerated SLR. Rising sea level may result in tidal marsh submergence (Moorhead & Brinson, 1995) and habitat migration as salt marshes transgress landward and replace tidal freshwater and brackish marsh (Park et al., 1991). NOAA's revised SLAMM model predicts ≈13,000 acres within the current Refuge boundary will transition from freshwater marsh to saltwater marsh by 2050. As a result, wildlife that requires freshwater wetlands, such as black bears, red-cockaded woodpeckers, swallow-tailed kites, and Rafinesque's big eared-bats, will be restricted to increasingly smaller ranges. Addition areas one and two are expected to persist as freshwater marsh because of their upstream location. In addition, highly flexible invasive species are expected to outcompete native species as warming temperatures transform ecosystems (USGCRP, 2018). The proposed action would mitigate the effects of climate change by preserving the carbon storage

	capacity of the tidal wetlands positioned along the estuary of the Waccamaw River. Surpassed only by tropical mangroves, these wetlands were identified as the second-most efficient coastal ecosystem in terms of carbon storage capacity (Krauss, 2017).
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Summary of Analysis:

The purpose of this EA is to briefly provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI).

Alternative A – Proposed Action Alternative – Modification of Approved Acquisition Boundary

As described above, the proposed action would protect critical habitat, such as old growth bottomland hardwood forests and freshwater tidal marsh, which is situated upstream and is thus less susceptible to SLR. These resistant areas will become increasingly more important for vulnerable plants and wildlife, such as narrowleaf pondlily, Carolina bishopweed, black bears, red-cockaded woodpeckers, swallow-tailed kites, and Rafinesque's big-eared bats, as saltwater intrusion decreases the availability of suitable freshwater habitat. The proposed action's potential impacts to the local community are mostly positive and include 1) expansion and protection of the scenic vista on the Waccamaw River, 2) increased tourism revenue for local businesses, 3) increased access to natural areas and outdoor recreation, 4) a reduced cost of flood insurance for residents of Horry County, and 5) the creation of a community education center at Hasty Point Plantation.

Potential adverse effects are minimal and include additional staff demands and increased disturbance to wildlife and vegetation due to visitor traffic. Disturbance of wildlife and vegetation would be restricted to trail corridors and public use facilities (e.g. picnic areas). The Refuge would restrict operating hours to minimize disturbance to wildlife. In addition, the Refuge would install RV pads at Hasty Point Plantation to accommodate the additional volunteers that would be required to manage and maintain the new trails and facilities.

This alternative helps meet the purpose and needs of the Service as described above because it would 1) protect threatened habitat for vulnerable plants and animals, 2) provide additional wildlife-dependent recreational opportunities, 3) protect the natural hydrology of the landscape, and 4) enhance the Refuge's educational programs. The Service has determined that the proposed action is compatible with the purposes of Waccamaw NWR and the mission of the NWRS.

Alternative B – No Action Alternative – Retention of Approved Acquisition Boundary

Under this alternative, the Refuge would be unable to implement large-scale management activities in the proposed action area. In addition, 6,638 acres of critical habitat would be at risk of permanent changes in land use, such as development, dredging, and mining. Potential adverse impacts to plants and wildlife include 1) loss of TFFW, upland forests, and old growth bottomland hardwood forests, 2) increase in habitat fragmentation, and 3) proliferation of invasive species. Potential adverse impacts to the local community include 1) increase in severity and duration of flood events due to alterations in hydrology, 2) decrease in nature-based marketability in the City of Conway, 3) increased human-wildlife conflict due to fragmentation, and 4) loss of access to natural areas and recreational opportunities. This alternative would limit the Service' ability to continue to meet the mission of the NWRS and the purposes of Waccamaw NWR as described above.

List of Sources, Agencies and Persons Consulted:

The following agencies and organizations were consulted in the development of this EA:

- American Rivers
- City of Conway
- Ducks Unlimited
- Open Space Institute
- South Atlantic Landscape Conservation Cooperative
- South Carolina Department of Natural Resources
- The Nature Conservancy
- Upper Waccamaw Task Force
- United States Geological Survey

List of Preparers:

State Coordination:

The Refuge has met with Winyah Bay and Upper Waccamaw Task Force members, including SCDNR. The Refuge has also presented the LCD and refuge expansion proposal at the annual 2017 SCDNR/USFWS biologist meeting. In addition, the Refuge has coordinated with the SCDNR Chief of Game on this environmental assessment and a letter of support is included.

Tribal Consultation:

The Service will send a notification and request input from the chiefs of the Catawba Indian Nation and the Eastern Shawnee Tribe of Oklahoma and their respective Tribal Historic Preservation Officers. The Service will coordinate with said tribes to identify and protect sites with cultural and religious significance.

Public Outreach:

The Refuge has targeted local community civic groups and hosted several public speaking engagements in collaboration with refuge partners. Some of these communications have been recorded as public service announcements and are available on social media platforms, such as YouTube.

Determination:

This section will be filled out upon completion of any public comment period and at the time of finalization of the Environmental Assessment.

- ☐ The Service's action will not result in a significant impact on the quality of the human environment. See the attached "**Finding of No Significant Impact**".
- ☐ The Service's action **may significantly affect** the quality of the human environment and the Service will prepare an Environmental Impact Statement.

Preparer Signature: _____ Date: _____

Name/Title/Organization: _____

Reviewer Signature: _____ Date: _____

Name/Title: _____

Figure 1. Overview of Refuge lands and proposed action area.

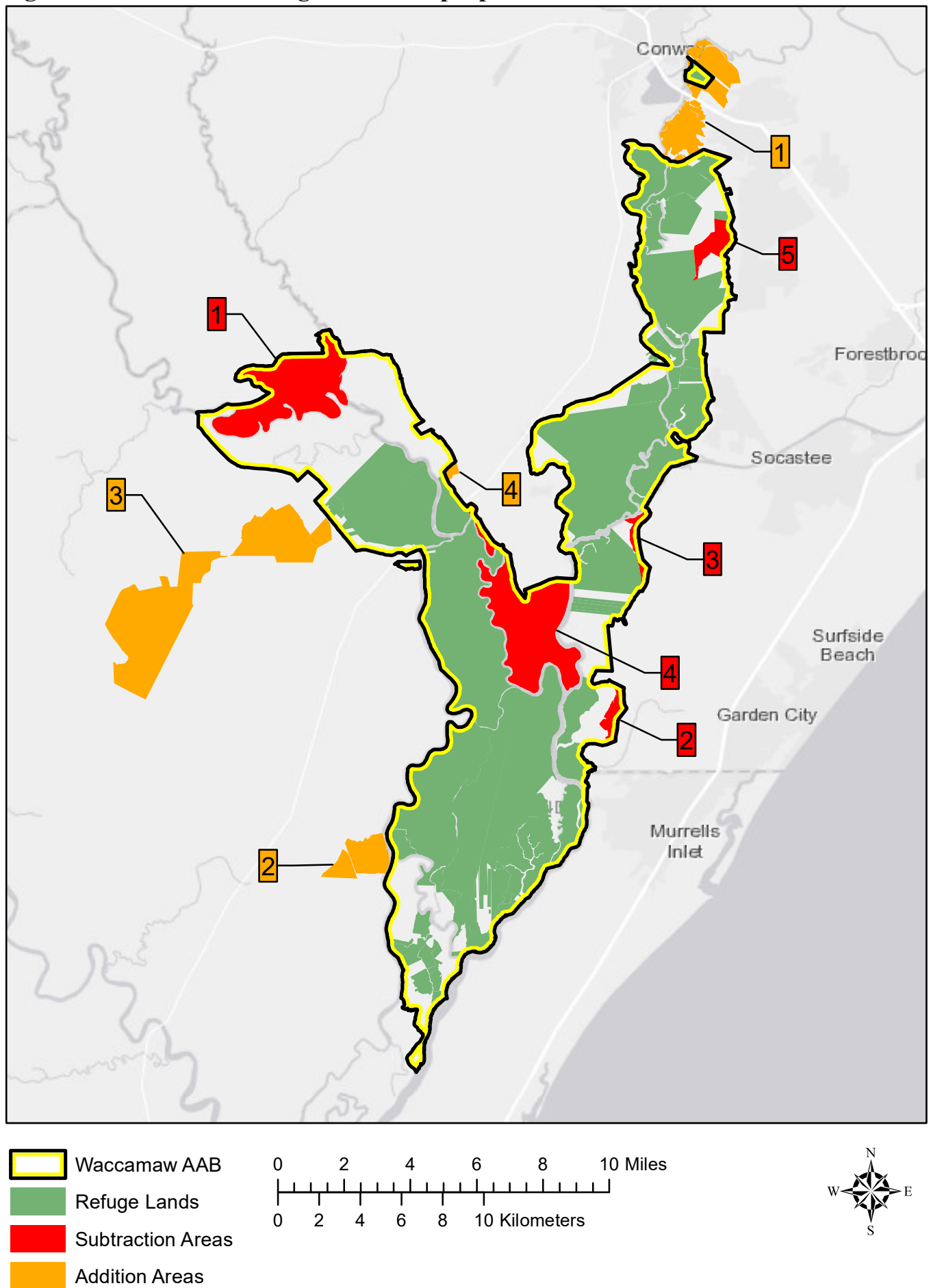


Figure 2. Subtraction area one.

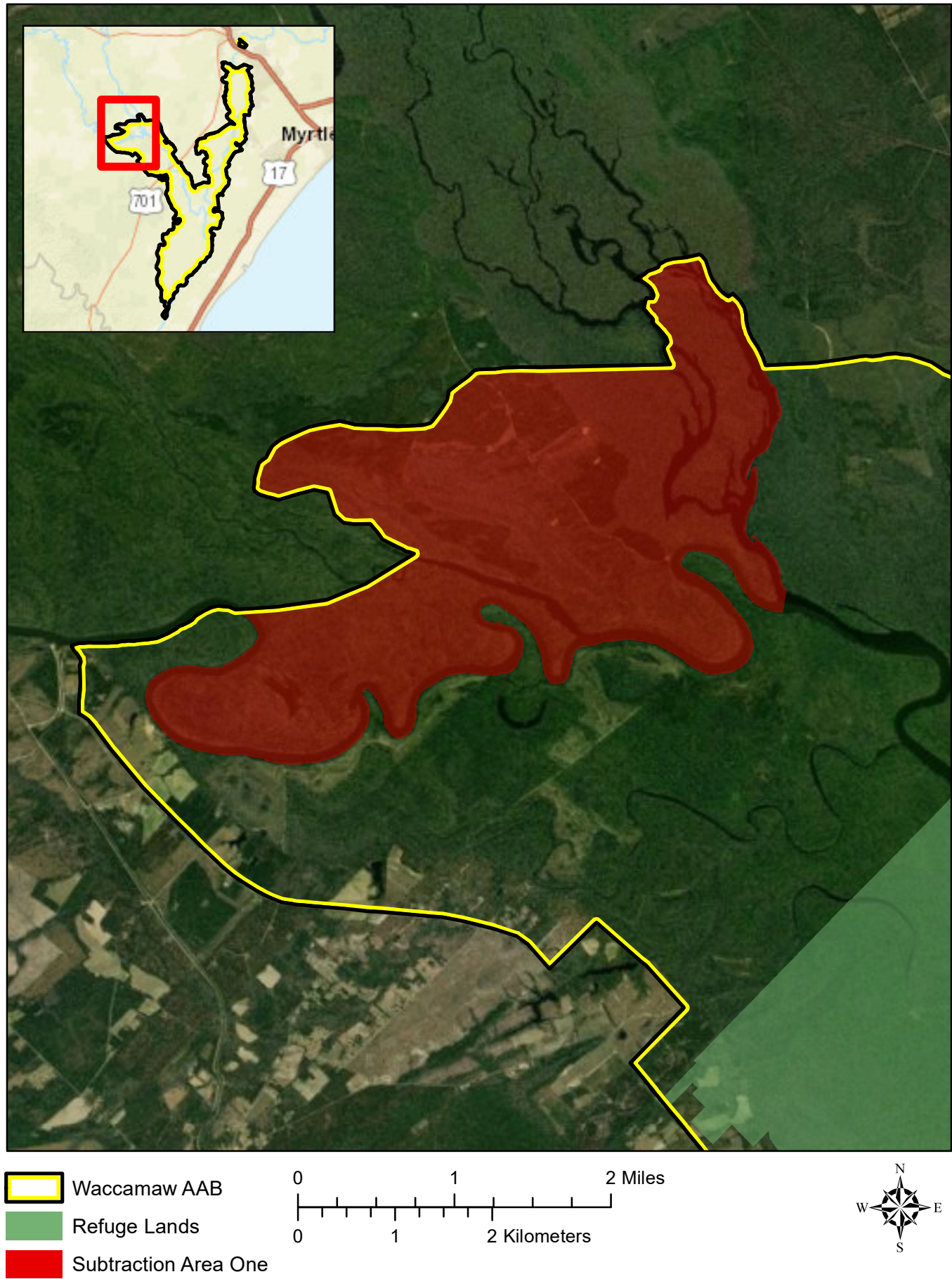


Figure 3. Subtraction area two.

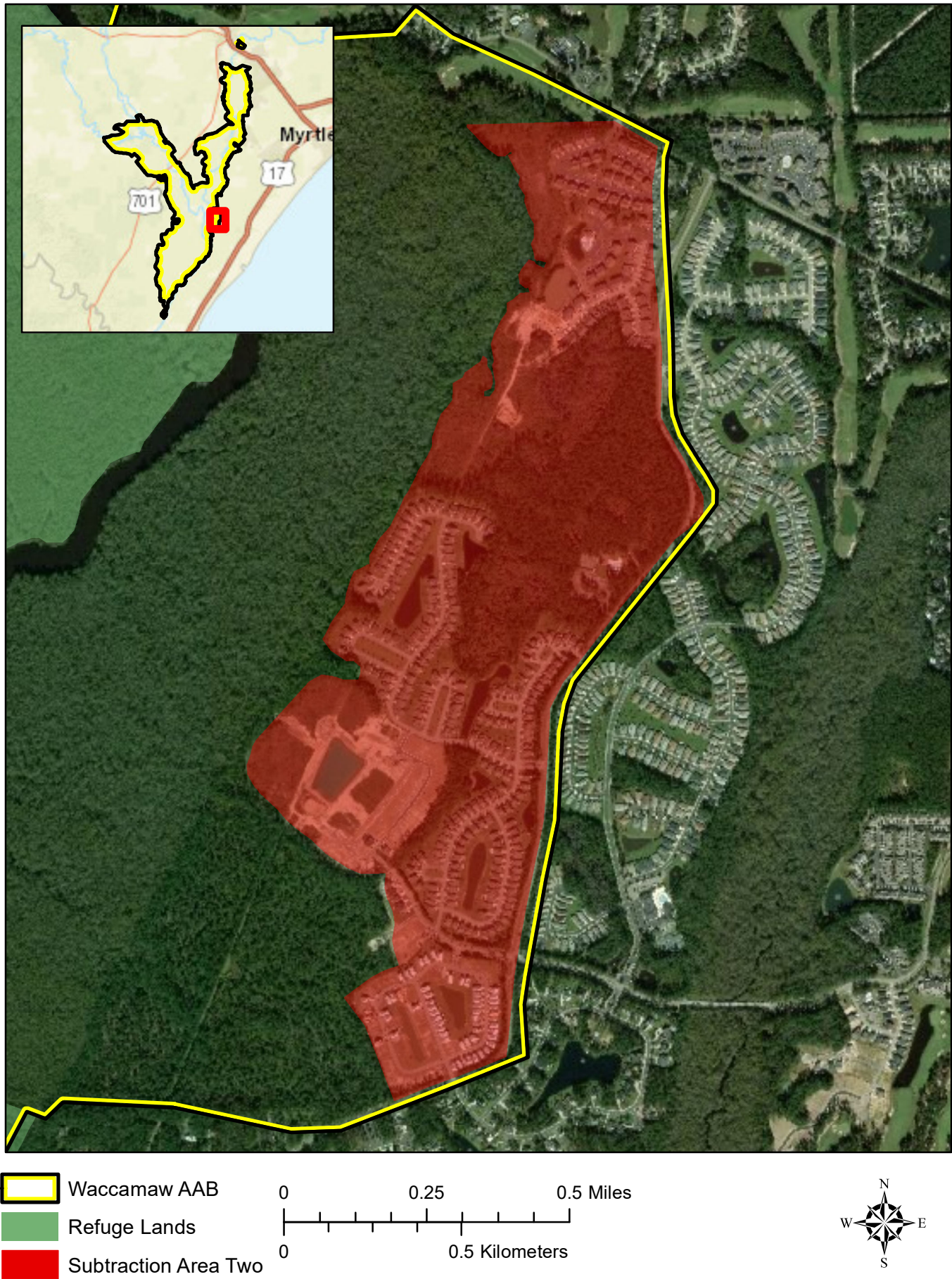


Figure 4. Subtraction area three.

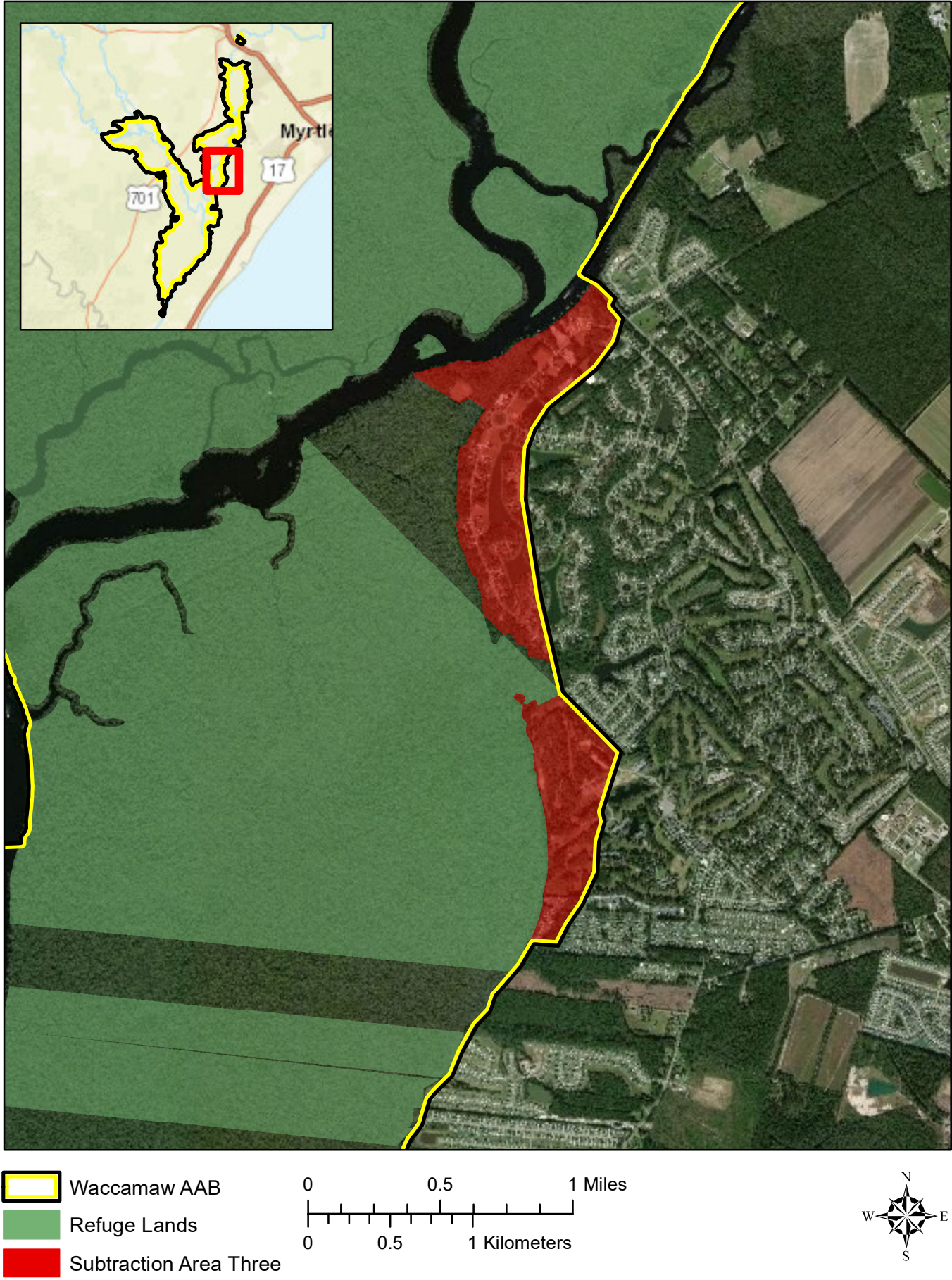


Figure 5. Subtraction area four.

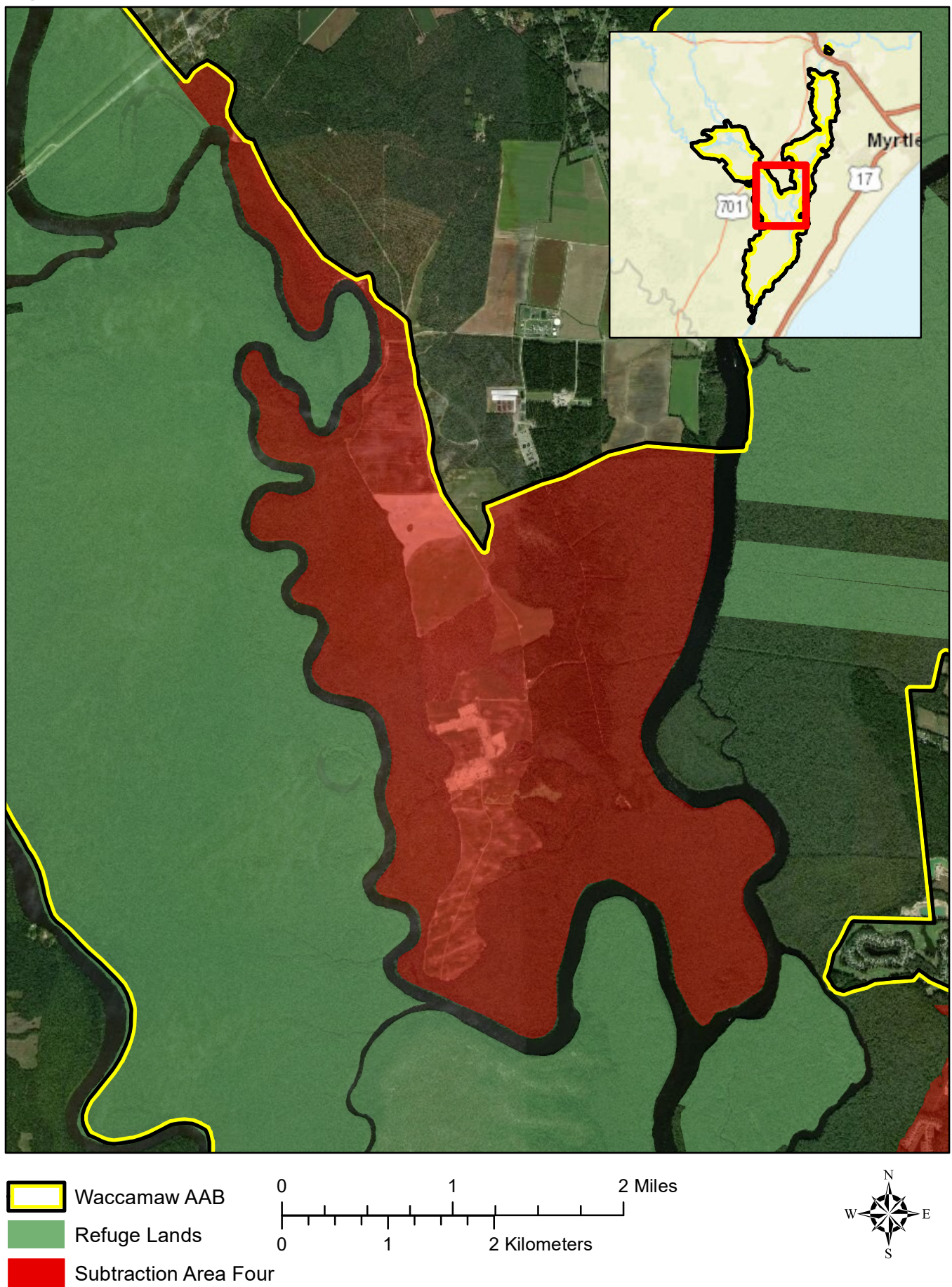


Figure 6. Subtraction area five.

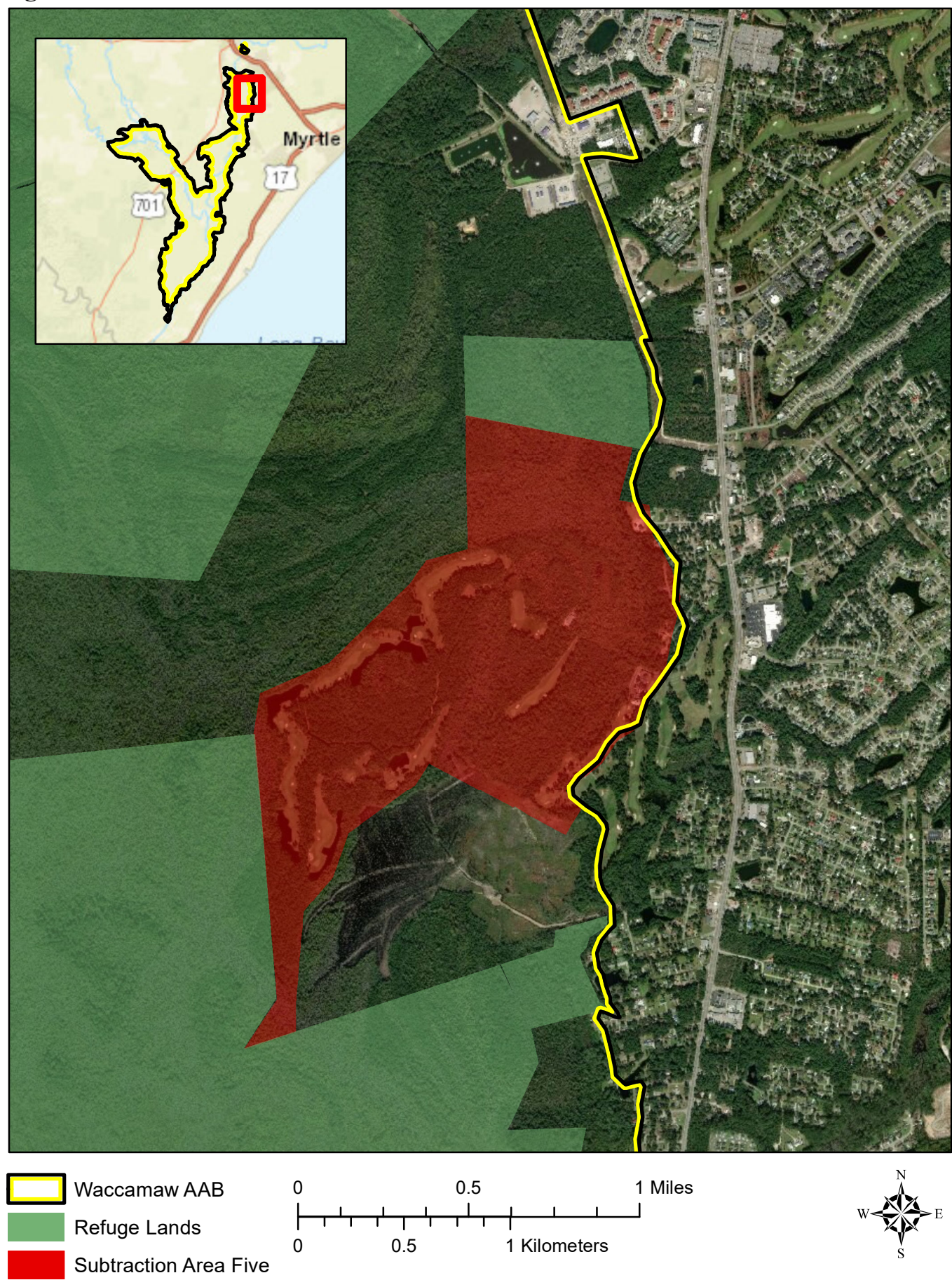


Figure 7. Addition area one.

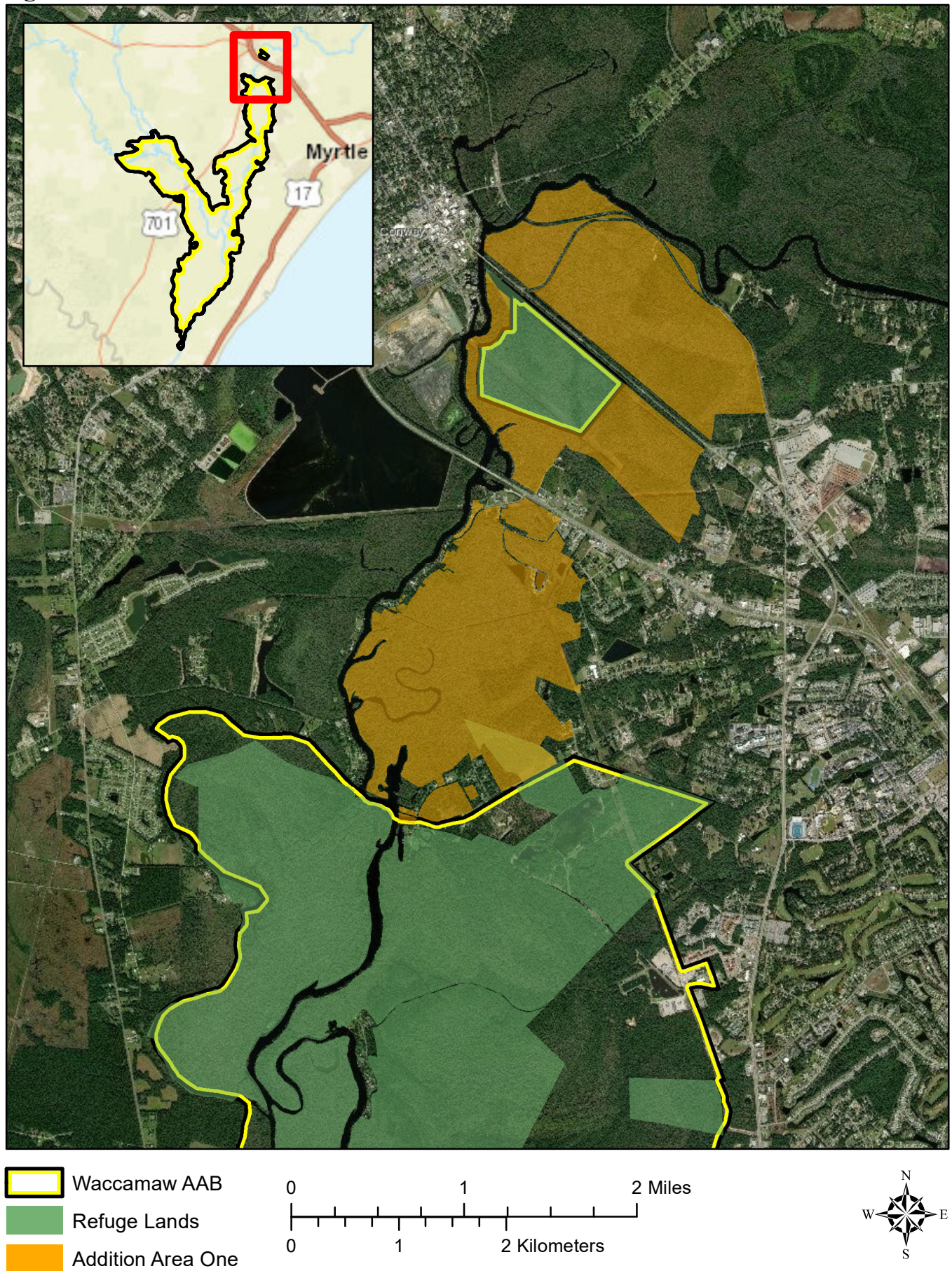


Figure 8. Addition area two.

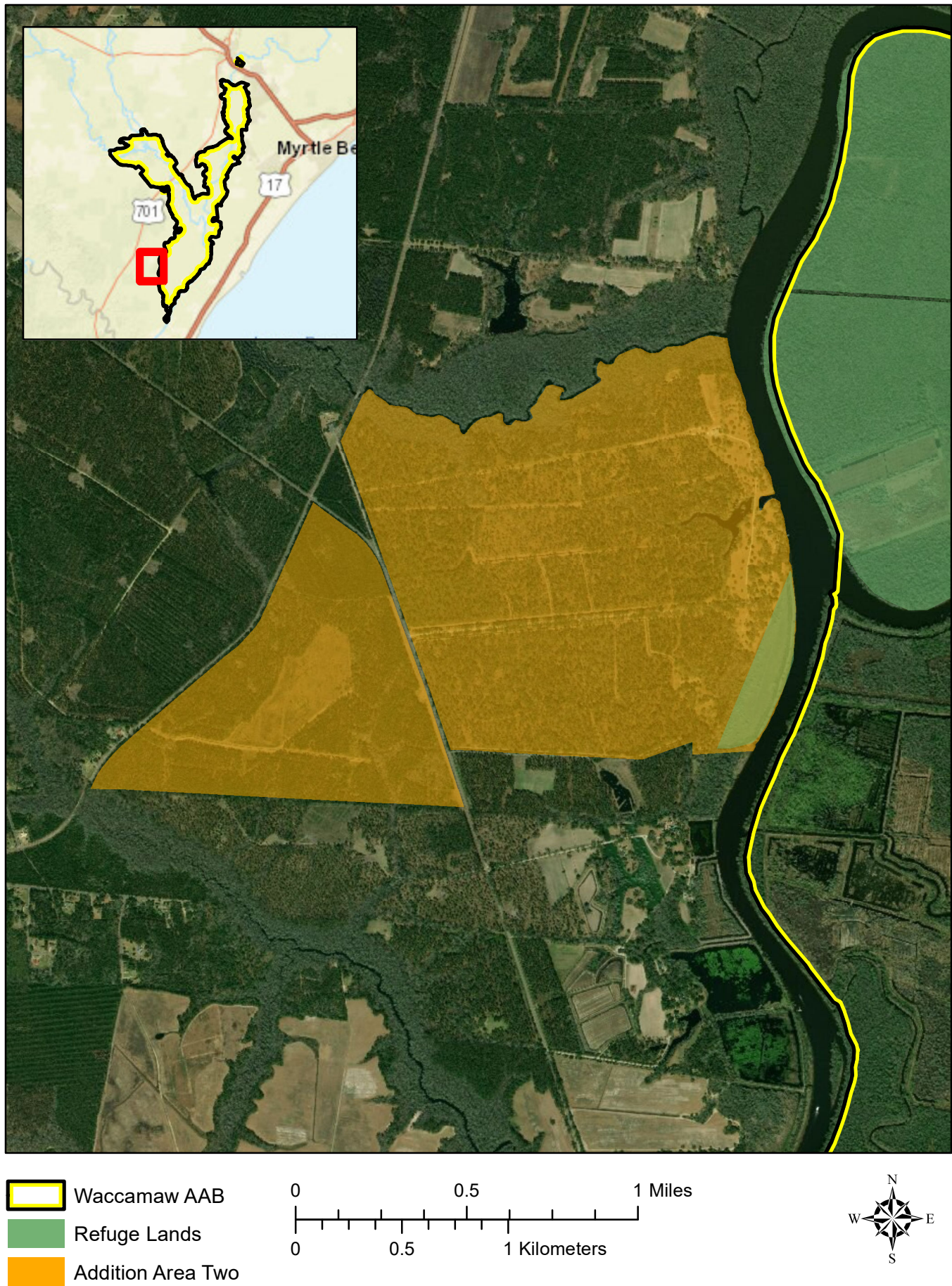


Figure 9. Addition area three.

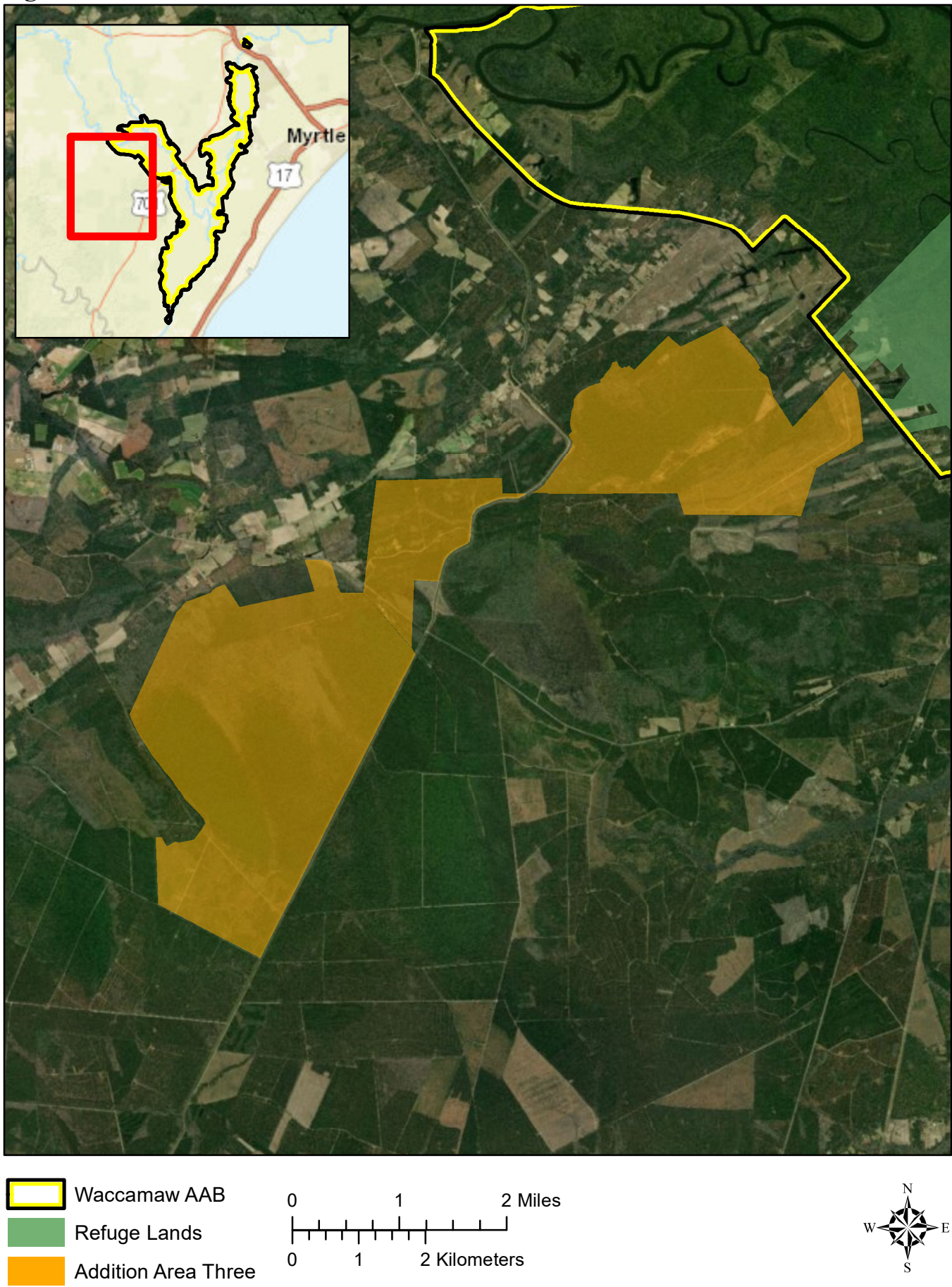
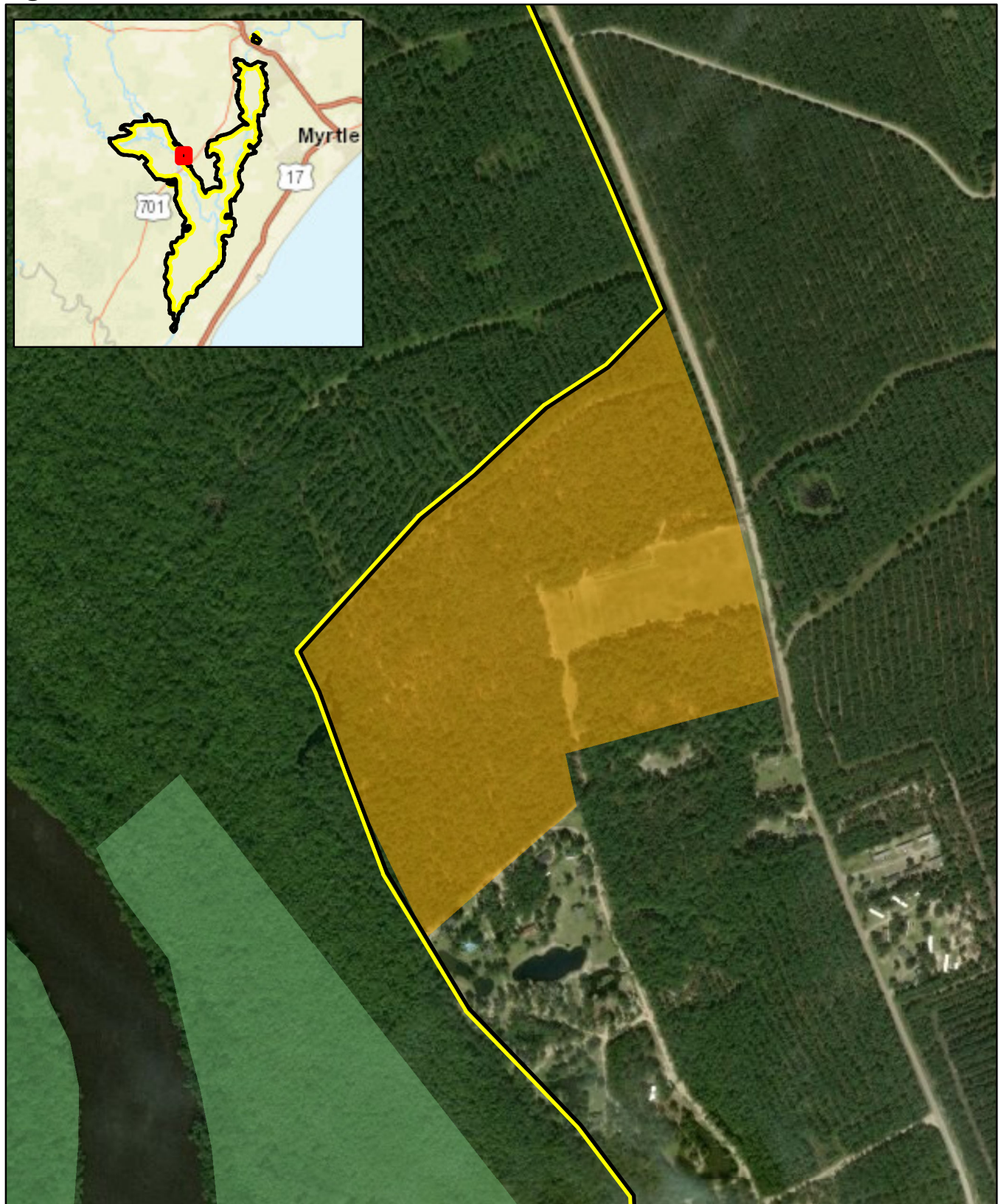


Figure 10. Addition area four.



-  Waccamaw AAB
-  Refuge Lands
-  Addition Area Four

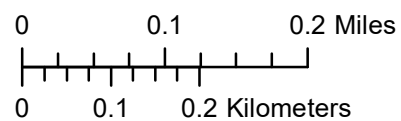


Figure 11. Habitat identified as a conservation priority based on natural and cultural resources. Source: Blueprint 2.2. Note: Carolina bay habitat is underprioritized in the Blueprint (SALCC, 2017).

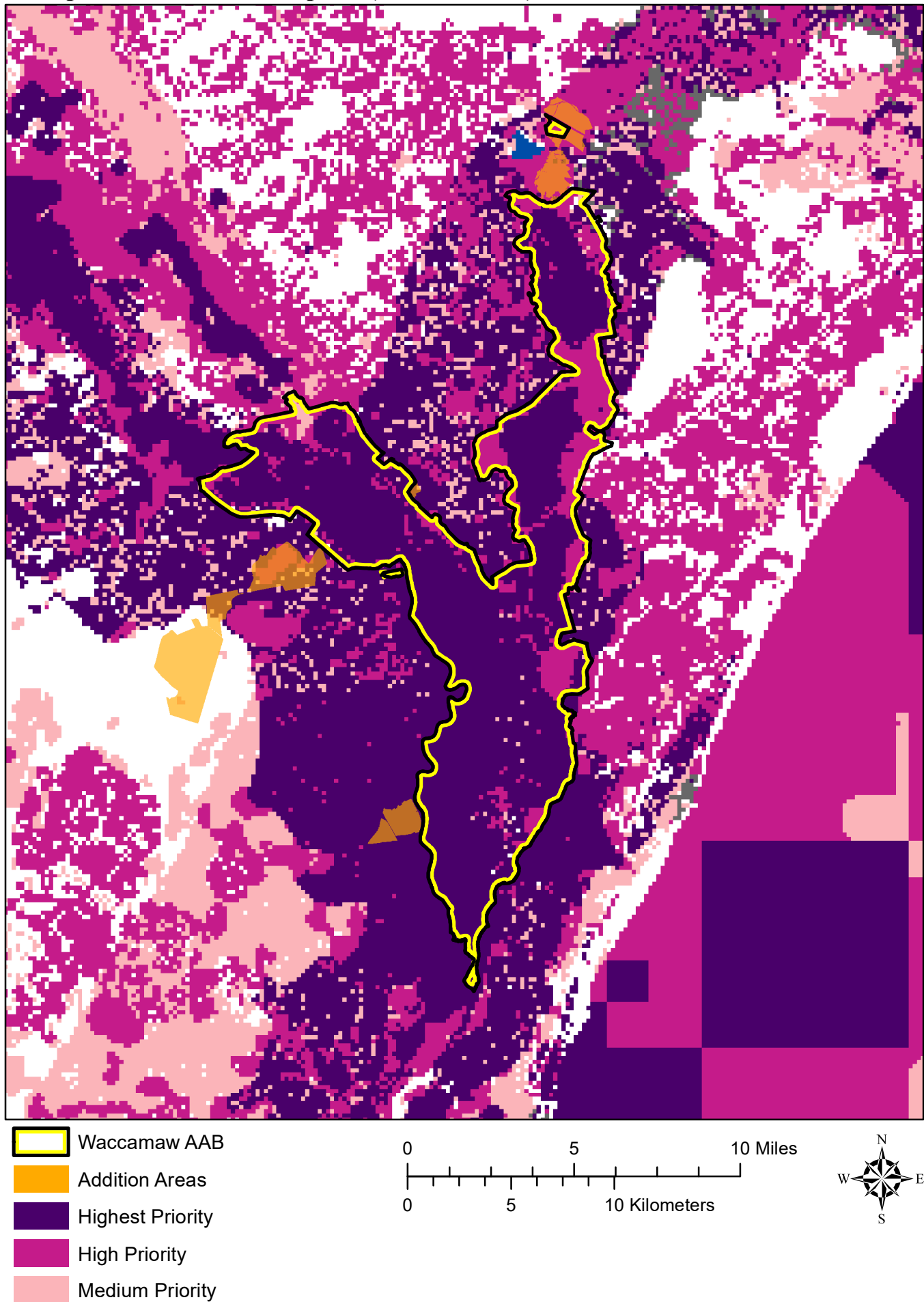


Figure 12. Riparian buffer habitat quality as a measure of the amount of natural vegetation surrounding streams and rivers. Source: Blueprint 2.2.

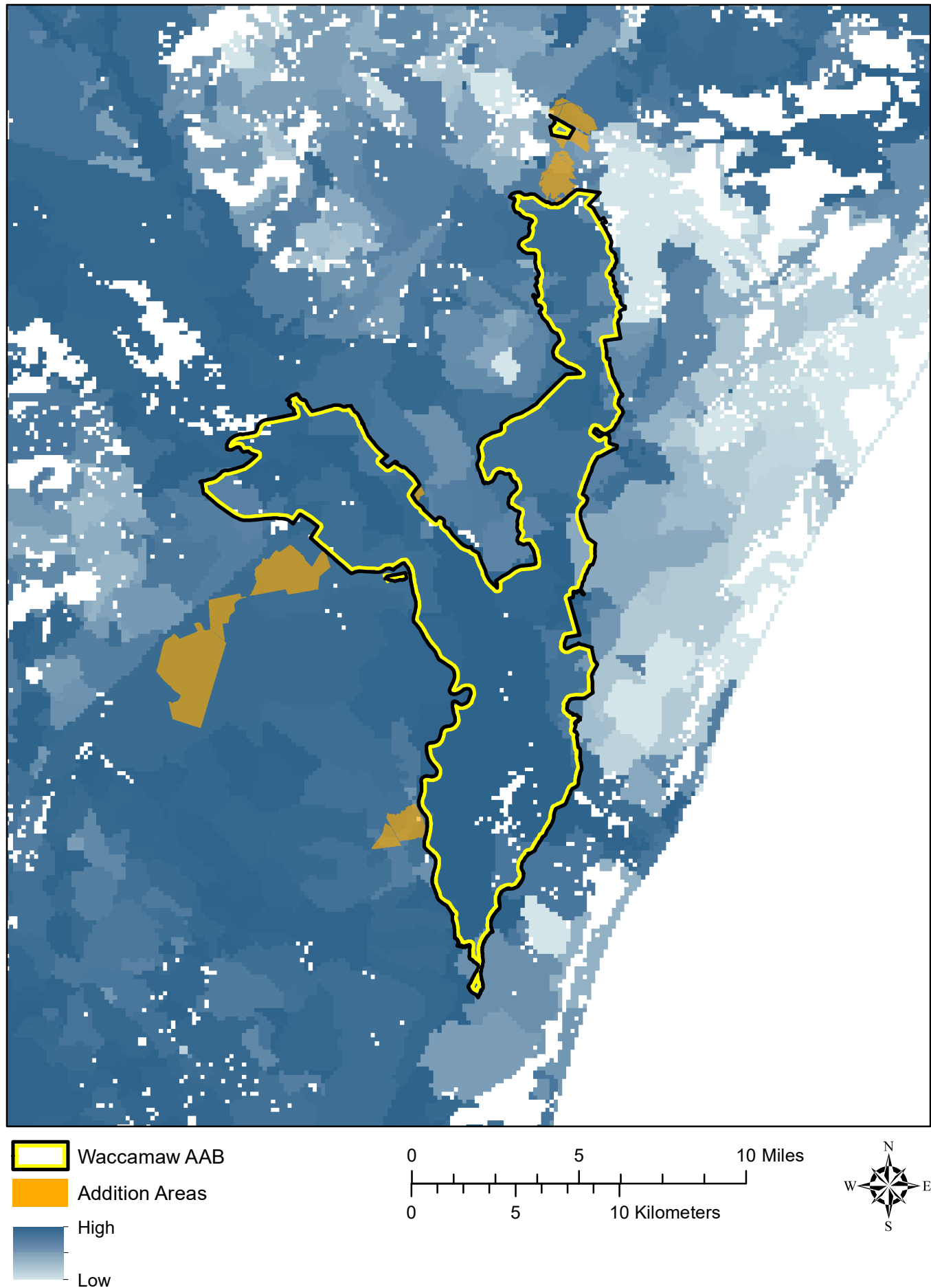


Figure 13. Estimated brackish marsh extent in 2050. Source: NOAA Coastal Services Center.

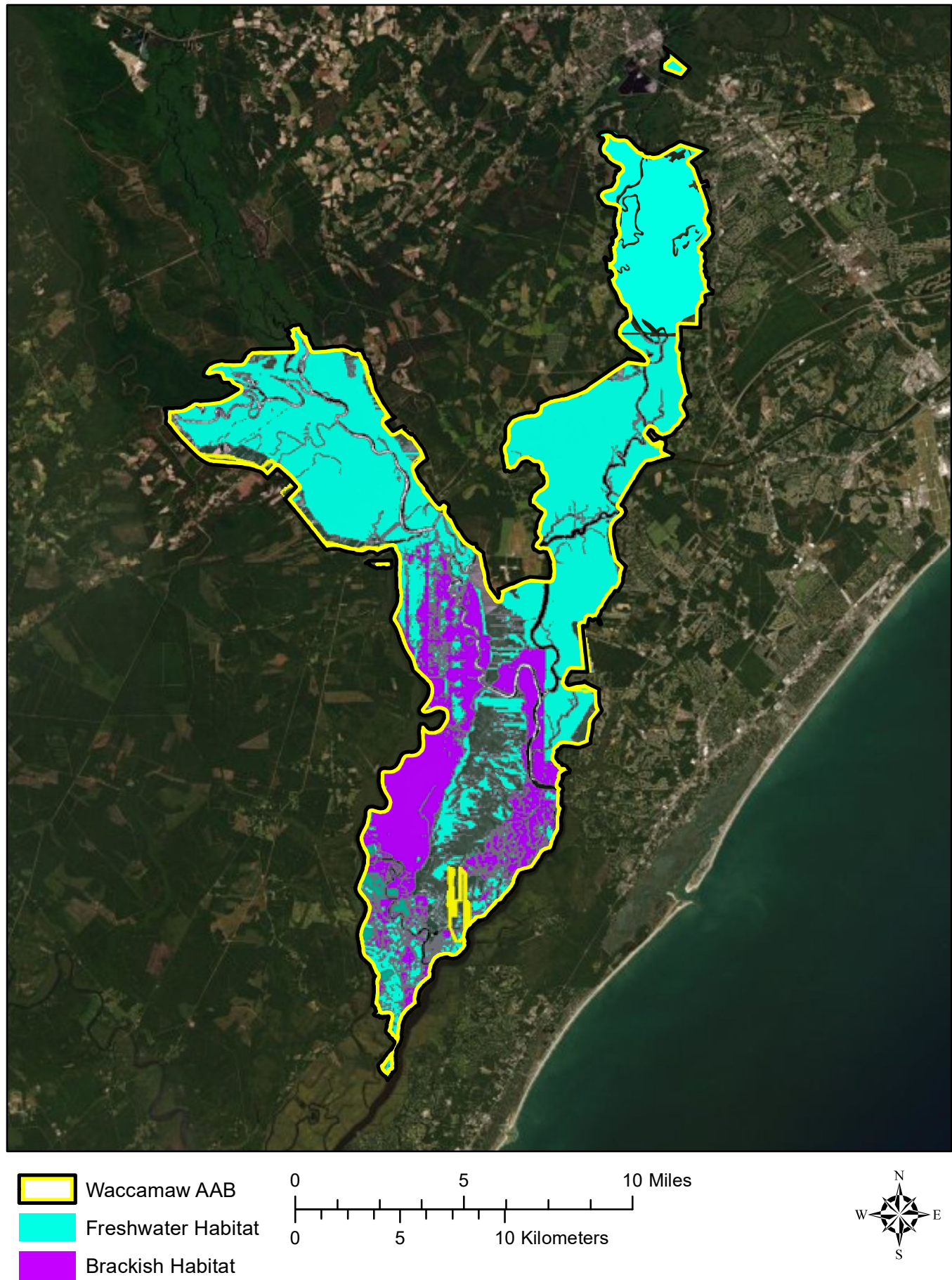


Figure 14. Priority amphibian and reptile conservation habitat in addition area two. Source: Blueprint 2.2.

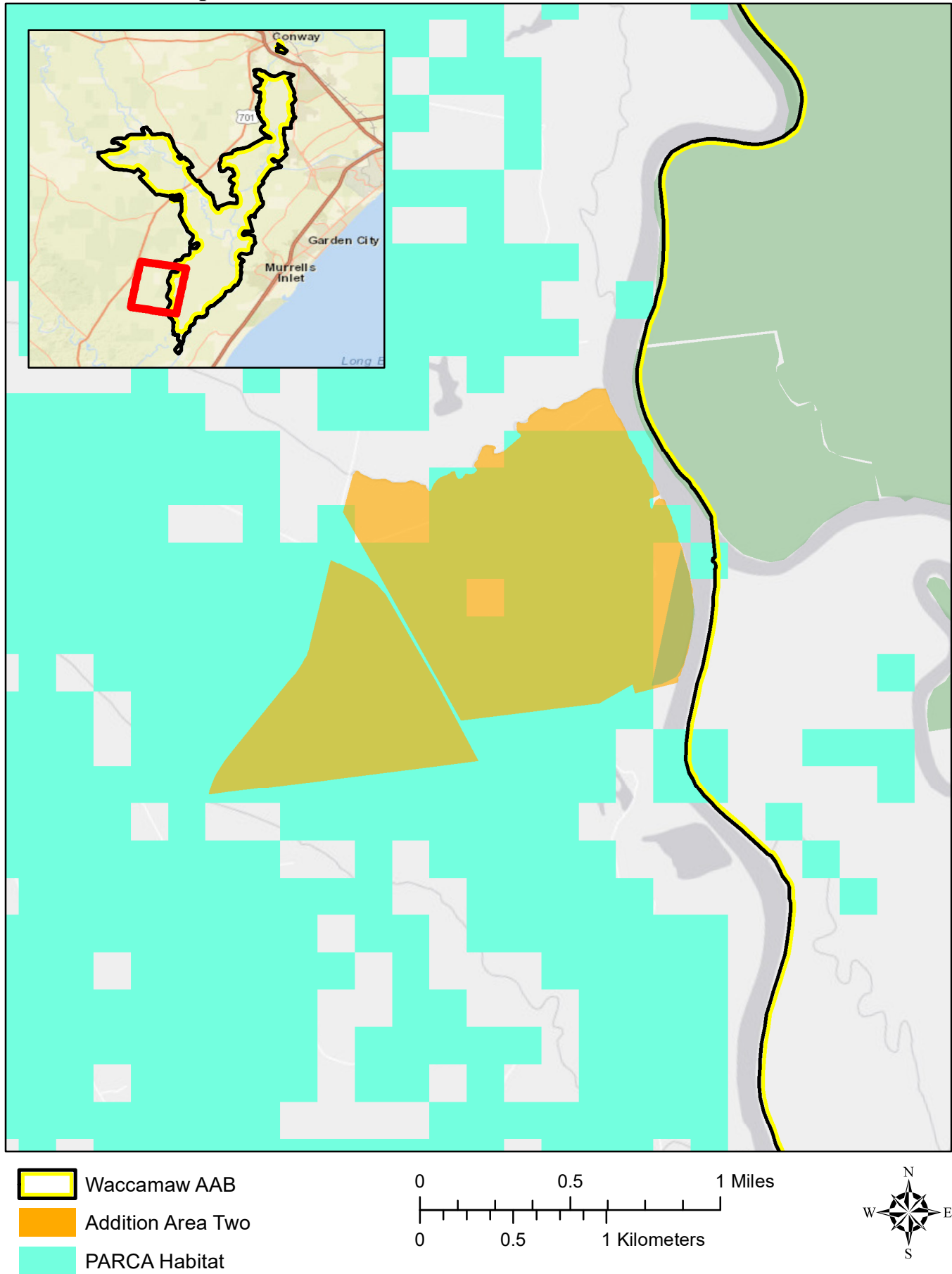


Figure 15. Black bear habitat favorability. Source: The Nature Conservancy.

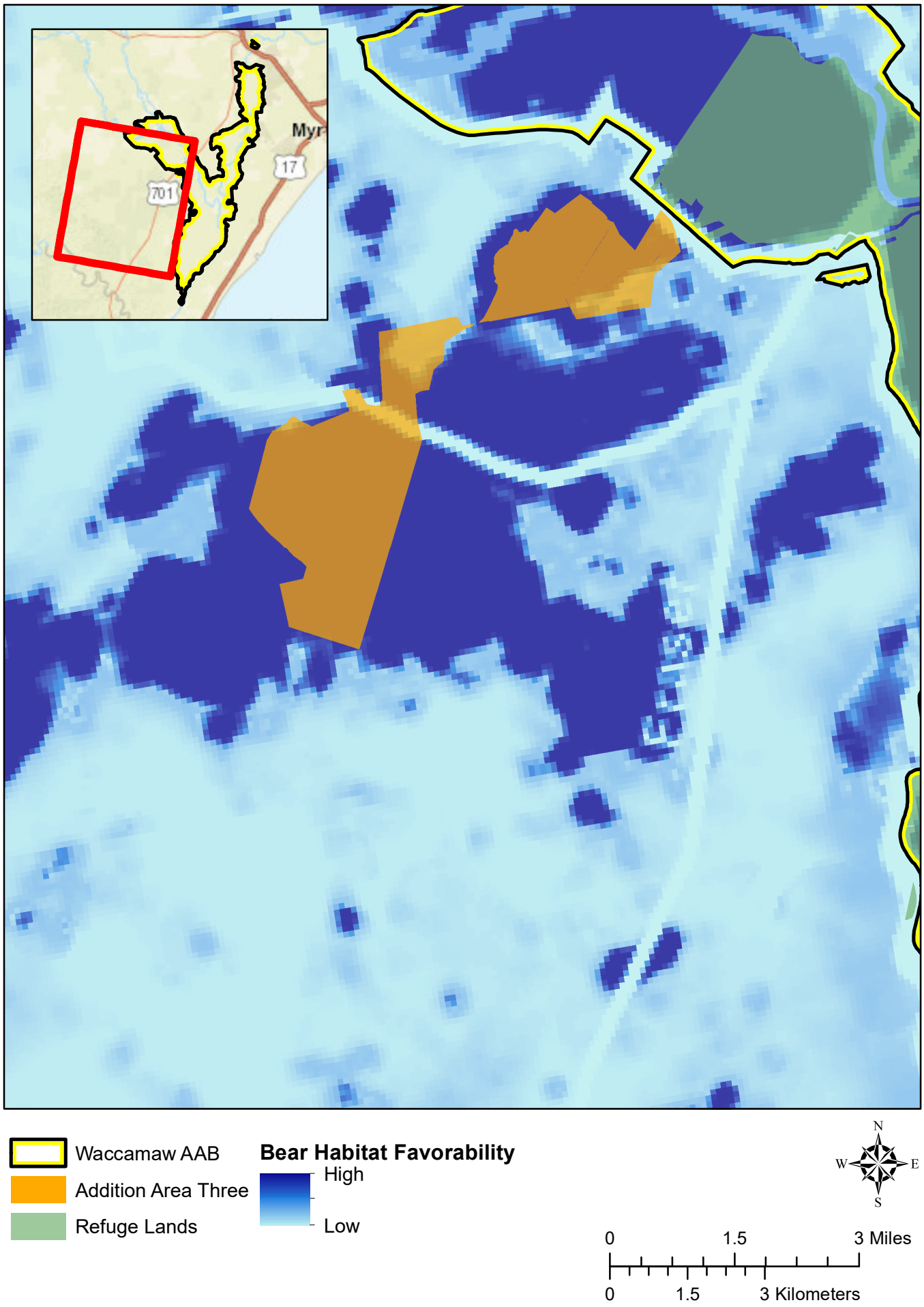


Figure 16. Black bear incidents reported near Carvers Bay and Lewis Ocean Bay in 2018. Source: South Carolina Department of Natural Resources.

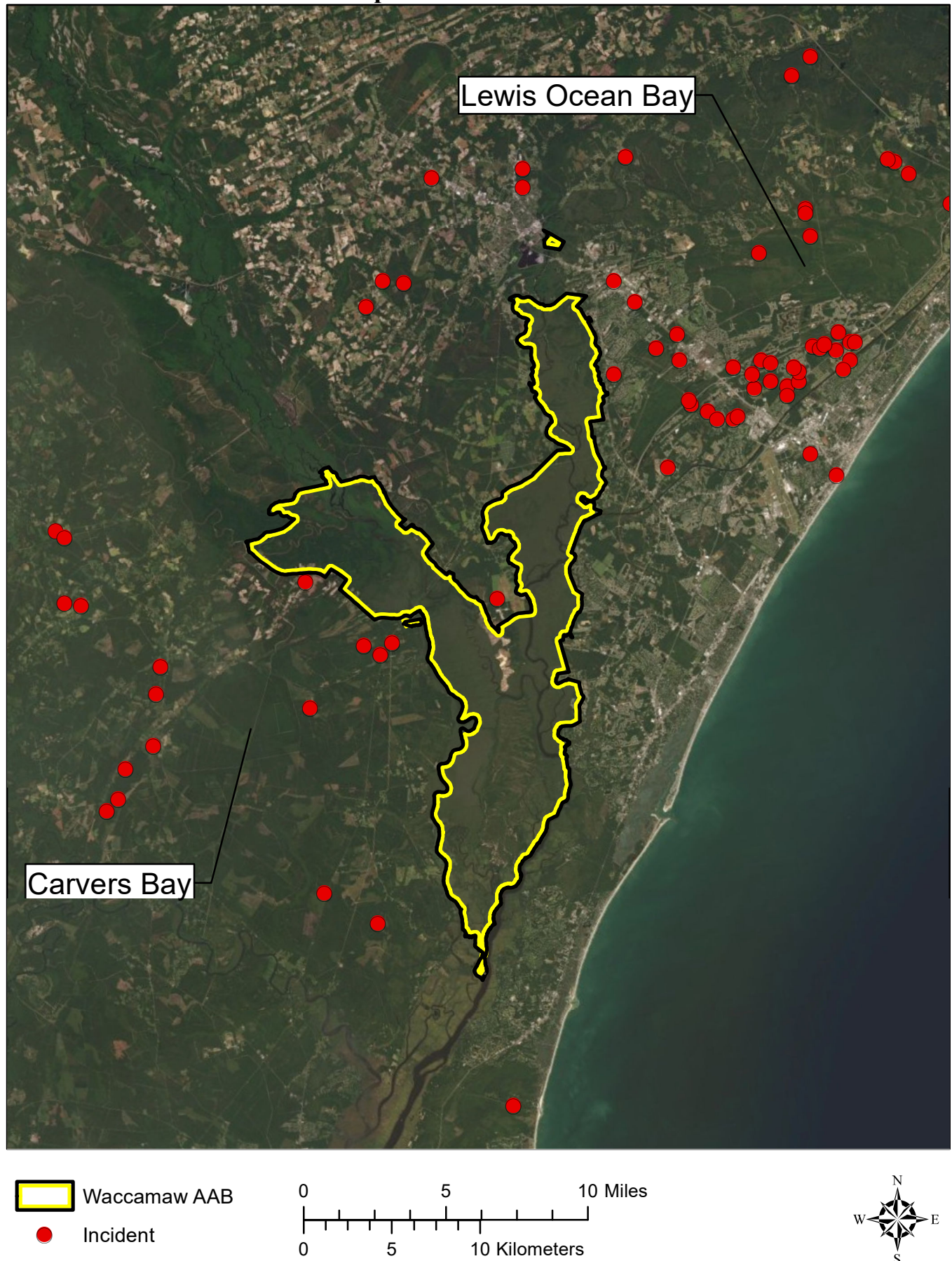


Figure 17. Habitat suitable for swallow-tailed kites and Rafinesque's big-eared bats.
Source: Upper Waccamaw Task Force.

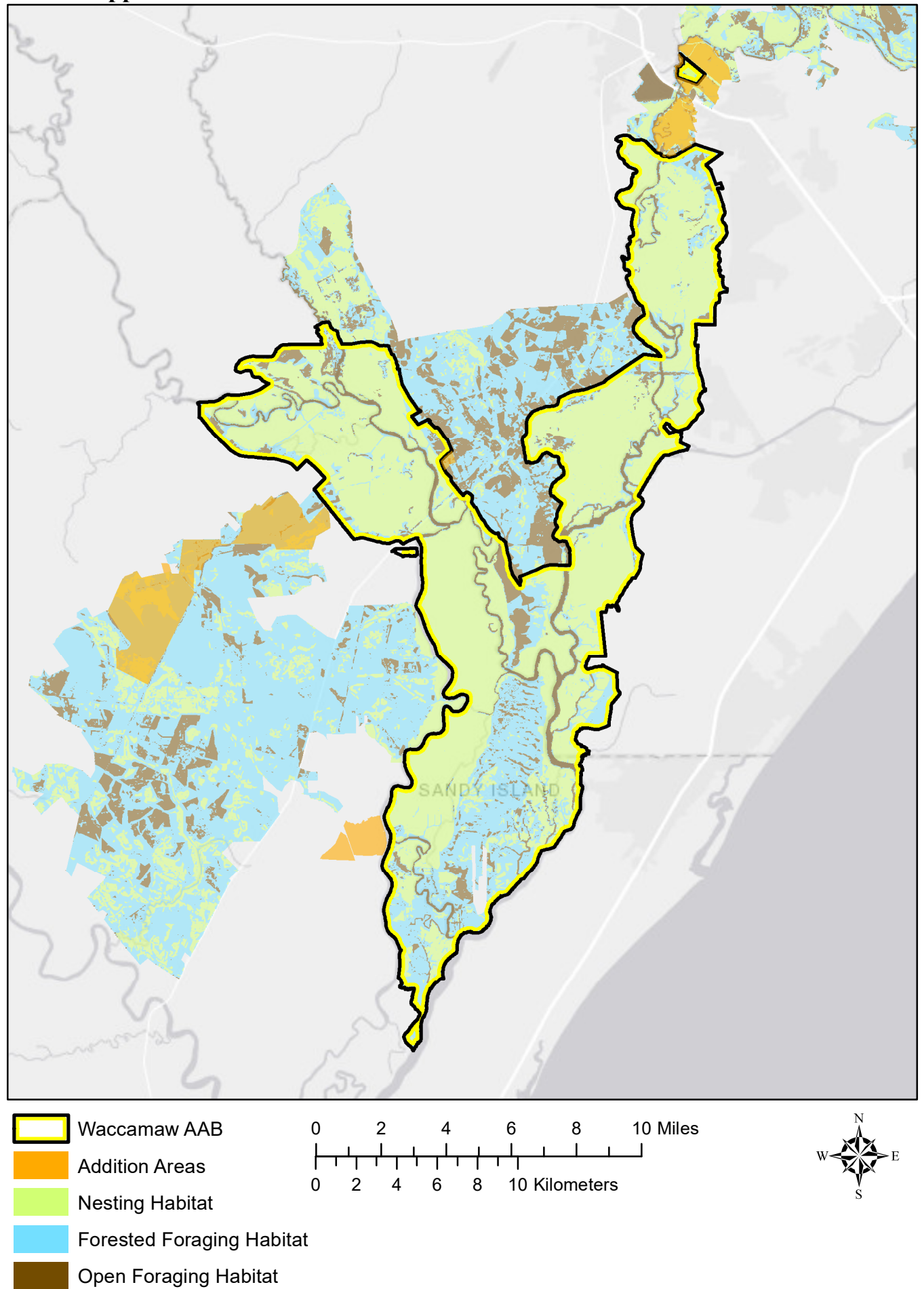
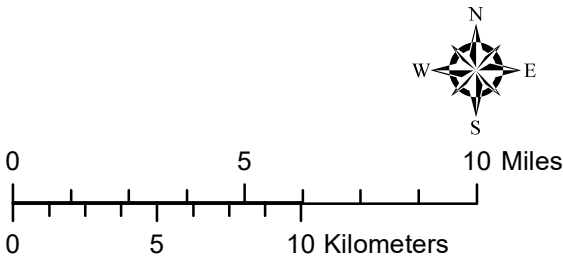
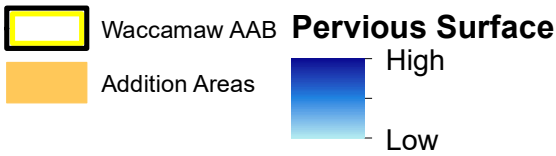
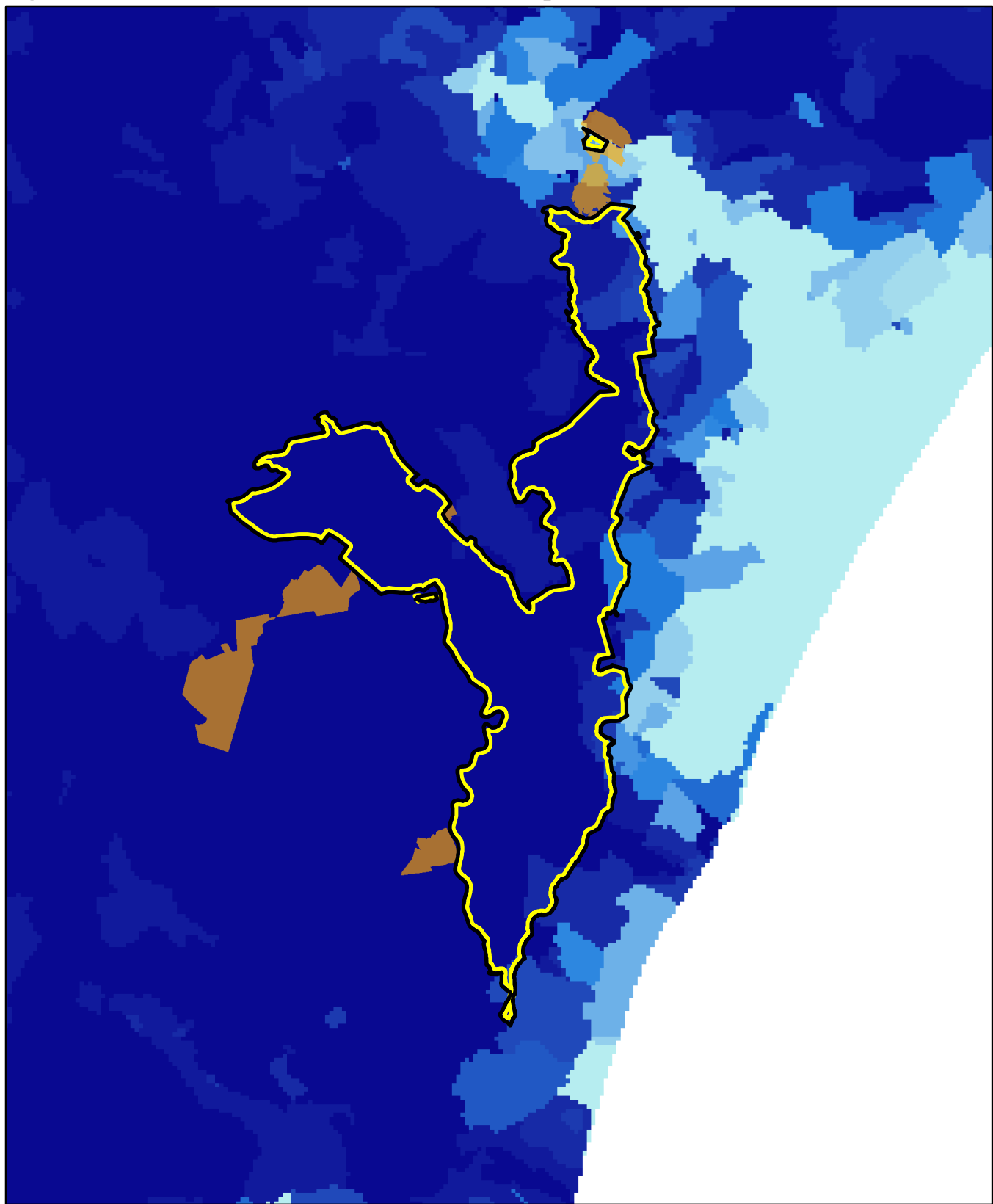


Figure 18. Pervious surface area. Source: Blueprint 2.2.



Appendix I: References

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Appendix II: Other Applicable Statues, Executive Orders, & Regulations

Cultural Resources

- American Indian Religious Freedom Act, as amended, 42 U.S.C. 1996 – 1996a; 43 CFR Part 7
- Antiquities Act of 1906, 16 U.S.C. 431-433; 43 CFR Part 3
- Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa – 470mm; 18 CFR Part 1312; 32 CFR Part 229; 36 CFR Part 296; 43 CFR Part 7
- National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470-470x-6; 36 CFR Parts 60, 63, 78, 79, 800, 801, and 810
- Paleontological Resources Protection Act, 16 U.S.C. 470aaa – 470aaa-11
- Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001-3013; 43 CFR Part 10

- Executive Order 11593 – Protection and Enhancement of the Cultural Environment, 36 Fed. Reg. 8921 (1971)
- Executive Order 13007 – Indian Sacred Sites, 61 Fed. Reg. 26771 (1996)

Fish & Wildlife

- Bald and Golden Eagle Protection Act, as amended, 16 U.S.C. 668-668c, 50 CFR 22
- Endangered Species Act of 1973, as amended, 16 U.S.C. 1531-1544; 36 CFR Part 13; 50 CFR Parts 10, 17, 23, 81, 217, 222, 225, 402, and 450
- Fish and Wildlife Act of 1956, 16 U.S.C. 742 a-m
- Lacey Act, as amended, 16 U.S.C. 3371 et seq.; 15 CFR Parts 10, 11, 12, 14, 300, and 904
- Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712; 50 CFR Parts 10, 12, 20, and 21
- Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001)

Natural Resources

- Clean Air Act, as amended, 42 U.S.C. 7401-7671q; 40 CFR Parts 23, 50, 51, 52, 58, 60, 61, 82, and 93; 48 CFR Part 23
- Wilderness Act, 16 U.S.C. 1131 et seq.
- Wild and Scenic Rivers Act, 16 U.S.C. 1271 et seq.
- Executive Order 13112 – Invasive Species, 64 Fed. Reg. 6183 (1999)

Water Resources

- Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et seq.; 15 CFR Parts 923, 930, 933
- Federal Water Pollution Control Act of 1972 (commonly referred to as Clean Water Act), 33 U.S.C. 1251 et seq.; 33 CFR Parts 320-330; 40 CFR Parts 110, 112, 116, 117, 230-232, 323, and 328
- Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.; 33 CFR Parts 114, 115, 116, 321, 322, and 333 Safe Drinking Water Act of 1974, 42 U.S.C. 300f et seq.; 40 CFR Parts 141-148
- Executive Order 11988 – Floodplain Management, 42 Fed. Reg. 26951 (1977)
- Executive Order 11990 – Protection of Wetlands, 42 Fed. Reg. 26961 (1977)