
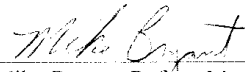


Fire Management Plan

**Alligator River and Pea Island
National Wildlife Refuges**

Prepared by: 
Thomas G. Crews, Jr.
Fire Management Officer, District 1

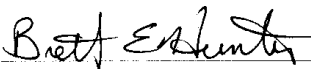
Date: 11/20/08

Reviewed: 
Mike Bryant, Refuge Manager
Alligator River and Pea Island NWRs


Date: 11/20/08

Reviewed: 
As King Roger Boykin, Regional Fire Mgmt. Coordinator
Southeast Region, U.S. Fish & Wildlife Service

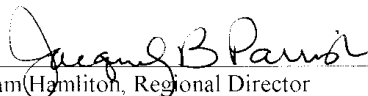
Date: 3/9/07

Reviewed: 
for Brett Eskenta
Refuge Supervisor, Area 3
Southeast Region, U.S. Fish & Wildlife Service

Date: 3/10/09

Reviewed: 
JA Jon Andrew, Regional Chief, Refuges
Southeast Region, U.S. Fish & Wildlife Service

Date: 03/10/09

Approved: 
Sam Hamilton, Regional Director
Southeast Region, U.S. Fish & Wildlife Service

Date: 3/11/09

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1.0. Introduction

1.1. Purpose of the Fire Management Plan (FMP)

This plan is written to meet U.S. Department of Interior (Department) and U.S. Fish & Wildlife Service (Service) requirements that every area with burnable vegetation must have an approved FMP. It enables the Refuges to meet a Service requirement that refuges review and/or revise FMPs at a minimum of five-year intervals or when significant changes are proposed, such as might occur if significant land use changes are made adjacent to Service lands.

The original FMP for Alligator River and Pea Island National Wildlife Refuges was approved in 1998. The current FMP is a step-down plan of the refuges' outdated Master Plans. Pea Island completed a Comprehensive Conservation Plan (CCP) in September 2006 and Alligator River completed its CCP in August 2008. These CCPs serve as the new foundation for management actions on these refuges. The Alligator River and Pea Island FMP needs to be revised to incorporate management changes identified in the CCPs and adapted to an interagency template approved by National Wildfire Coordinating Group (NWCG).

The goal of wildland fire management is to plan and make decisions that help accomplish the mission of the National Wildlife Refuge System. That mission 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.

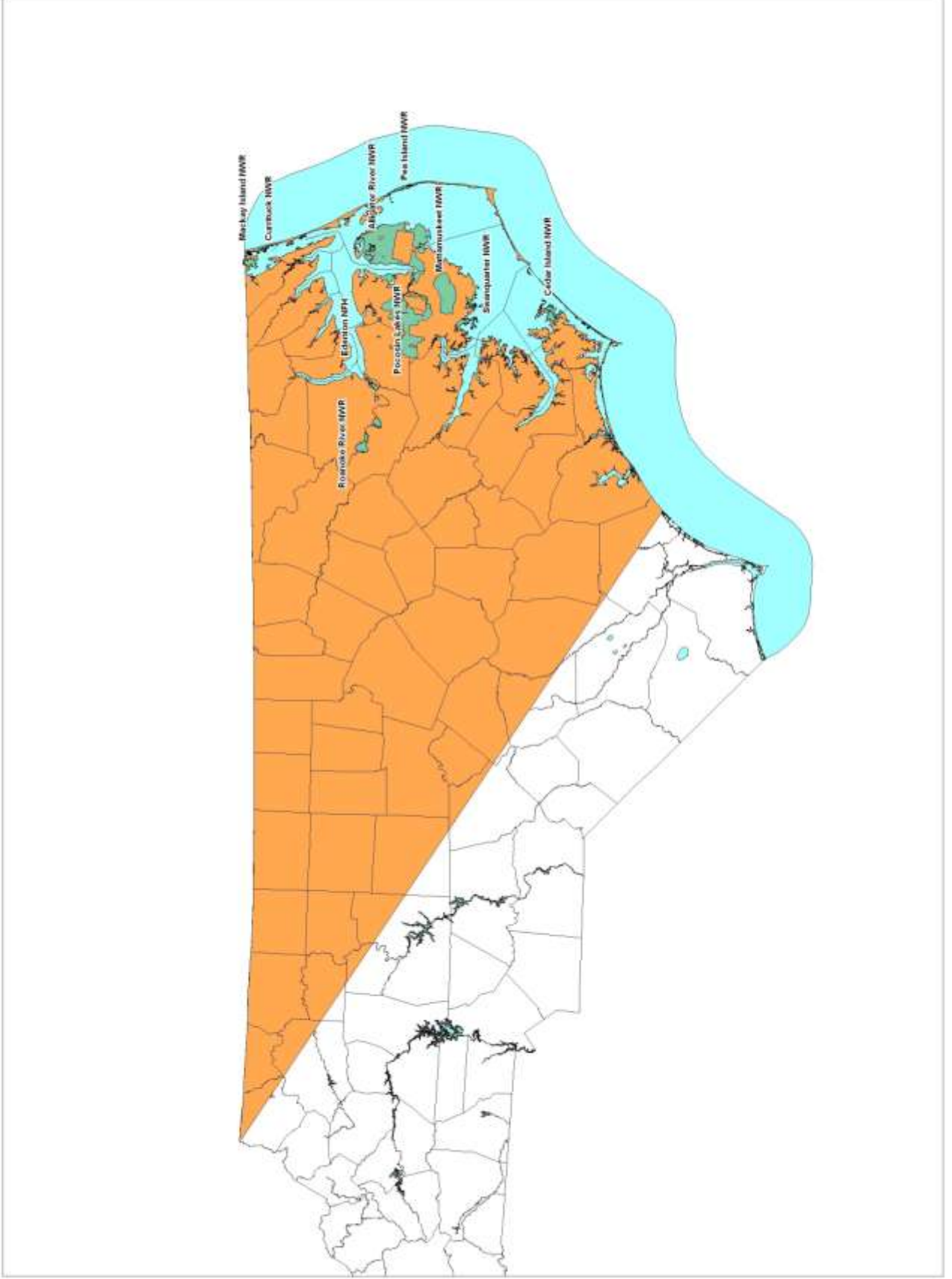
This FMP identifies and integrates all wildland fire management and related activities within the context of the approved CCPs for Alligator River and Pea Island National Wildlife Refuges. It defines a program to manage wildland fires (wildfire and prescribed fire) and all other aspects of fire management including prevention, fuel treatments, education and outreach, and training. Its purpose is to assure that wildland fire management goals and components are coordinated between refuge program areas, fire management resources within the District, and with fire management cooperators.

1.2. General Description of the Area in the Fire Management Plan

Table 1: Management Units included in the Fire Management Plan

FWS Management Units	Total Acres (Burnable Acres)
Alligator River National Wildlife Refuge (ARNWR)	152,260 (144,717)
Pea Island National Wildlife Refuge (PINWR)	4,388 (3,481)
Total	156,648 (148,198)

Figure 1: USFWS Southeast Region Fire Management District 1



In 1984, the Service started administering Pea Island National Wildlife Refuge (NWR) as part of a two-refuge complex with the newly created Alligator River NWR. Today, both refuges are part of a larger complex of national wildlife refuges called the North Carolina Coastal Plain Refuge Complex, which also includes Mackay Island, Currituck, Roanoke River, and Pocosin Lakes NWRs. Both Pea Island and Alligator River NWRs are administered from an office in Manteo, North Carolina. Together with the Edenton National Fish Hatchery and Mattamuskeet, Swanquarter, and Cedar Island NWRs, the North Carolina Coastal Plain Refuge Complex makes up Fire District 1 of the Southeast Region of the Fish and Wildlife Service (FWS) (Figure 1). Although specific to each refuge and a refuge's FMP, much of the fire management operations and planning are done on a District basis.

1.2.1. Alligator River National Wildlife Refuge

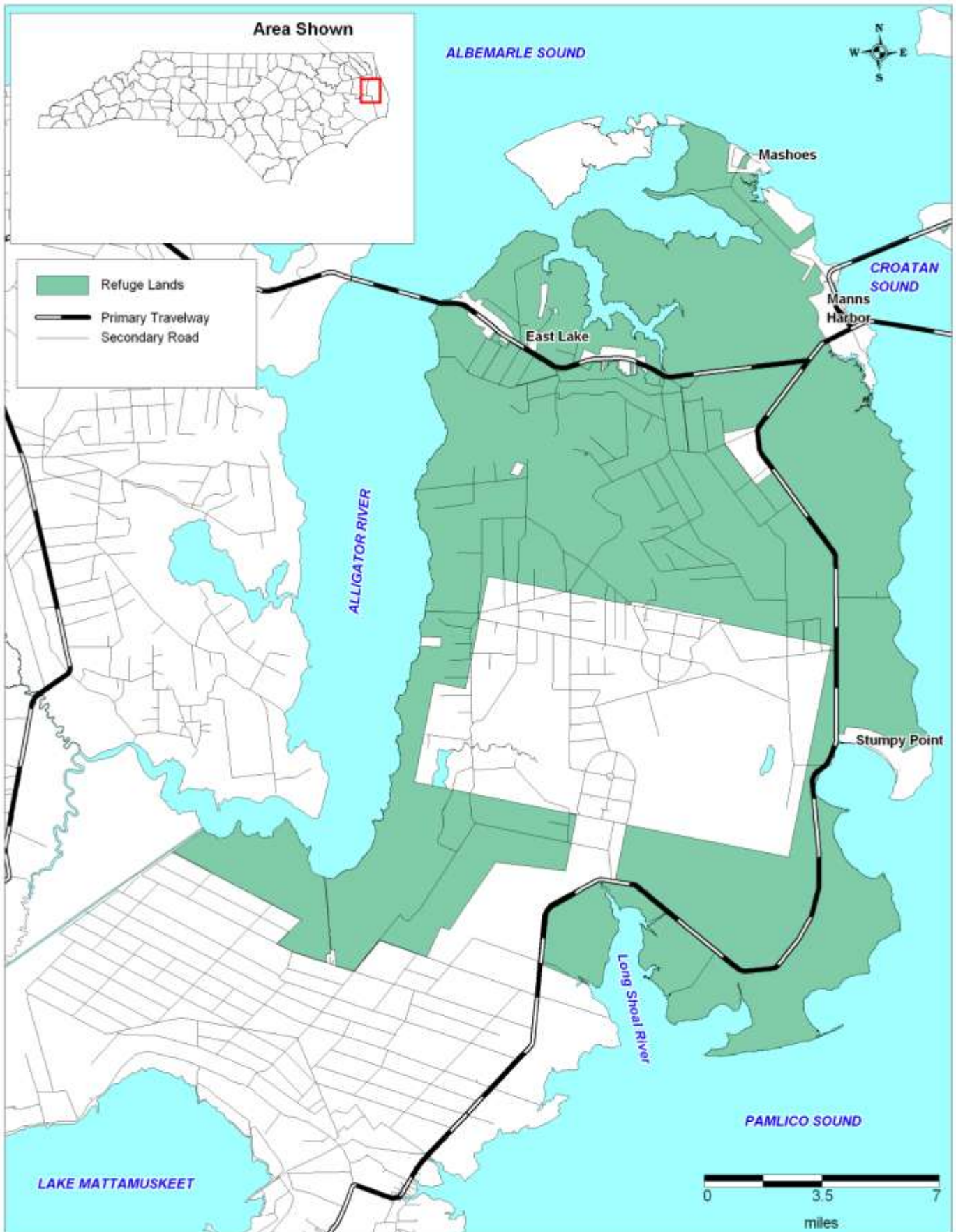
Alligator River National Wildlife Refuge (ARNWR) was established in March 1984 with land donated by the Prudential Life Insurance Company for the purpose of protecting and conserving migratory birds and other wildlife resources through the protection of wetlands. ARNWR is composed of 152,260 acres lying in Dare and Hyde Counties of northeastern North Carolina. The majority of the refuge lies on a peninsula bordered by the Alligator River, Hyde County mainland, and the Albermarle, Croatan, and Pamlico Sounds. The refuge owns a small tract of land on the north end of Roanoke Island opposite Fort Raleigh National Historic Site. The Dare County Bombing Range (DCBR) lies in the interior of the peninsula and covers 46,000 acres. It is owned by the U.S. Air Force (USAF) and administered by Seymour Johnson Air Force Base in Goldsboro, NC. The DCBR contains two target areas or ranges, one run by the USAF and the other run by the U.S. Navy. Within the DCBR, the North Carolina Wildlife Resource Commission (NCWRC) manages 41,200 acres as game land. Figure 2 shows a general map of the refuge and its location on the North Carolina coast.

The unincorporated communities of East Lake, Mashoes, Manns Harbor, and Stumpy Point directly border the refuge. Other in-holdings include a 64 acre tract north of Grassy Patch Road, 112 acre tract along the Alligator River, three tracts along Buffalo City Road totaling almost 12 acres, and 698 acres of land including the Dare County Landfill and Gun Range. The North Carolina Division of Forest Resources (NCDFR) leases property from the refuge to maintain a maintenance facility and office just to the south of Stumpy Point. Including the DCBR, approximately 87,540 acres of land within the ARNWR approved acquisition boundary (239,800 acres) are not owned by the Service.

The refuge's Comprehensive Conservation Plan was completed in August 2008 to guide the management of Alligator River for the next 15-years. Chapter II of the CCP (FWS 2008) includes a thorough description of the physical and biological environments on the refuge and the socioeconomic conditions of the surrounding area. Appendix VI of the CCP is a list of refuge biota and includes the common and scientific names for species mentioned in this FMP.

The CCP (FWS 2008) established a vision for the refuge of which the following portions are pertinent to fire management on the refuge:

Figure 2: Alligator River NWR - Current Lands



Alligator River National Wildlife Refuge's unique wetland habitats will become more critical for many wildlife, fish, and plants as eastern North Carolina is developed. Refuge habitats will be managed, enhanced, and restored for optimal diversity of wildlife, fish, and plants. Healthy and viable populations of threatened and endangered species, and other wildlife, fish, and plants will be managed and conserved... Refuge staff and volunteers will assume a greater role in educating the visiting public to ensure that biological integrity is maintained and that people have a safe, pleasant and educational experience... Working with others, the refuge's staff and volunteers will adaptively manage the refuge's natural resources and create in this wild place a legacy of fish, wildlife, and plants for future visitors to experience, enjoy, and cherish.

1.2.2. Pea Island National Wildlife Refuge

Pea Island NWR is composed of approximately 4,388 acres (reduced by erosion from 5,915 acres) lying in Dare County, North Carolina. This narrow refuge is part of Hatteras Island, one of a chain of barrier islands lying along the North Carolina coast of the Atlantic Ocean. The Herbert C. Bonner Bridge over Oregon Inlet connects the north end of the refuge to Bodie Island, part of the Cape Hatteras National Seashore (NS). The refuge itself is an overlay of the NS which extends south to Ocracoke Island. Through a Memorandum of Understanding, the National Park Service (NPS) and the FWS work together to manage the refuge and NS. The FWS is responsible for all wildlife and habitat management activities on the refuge.

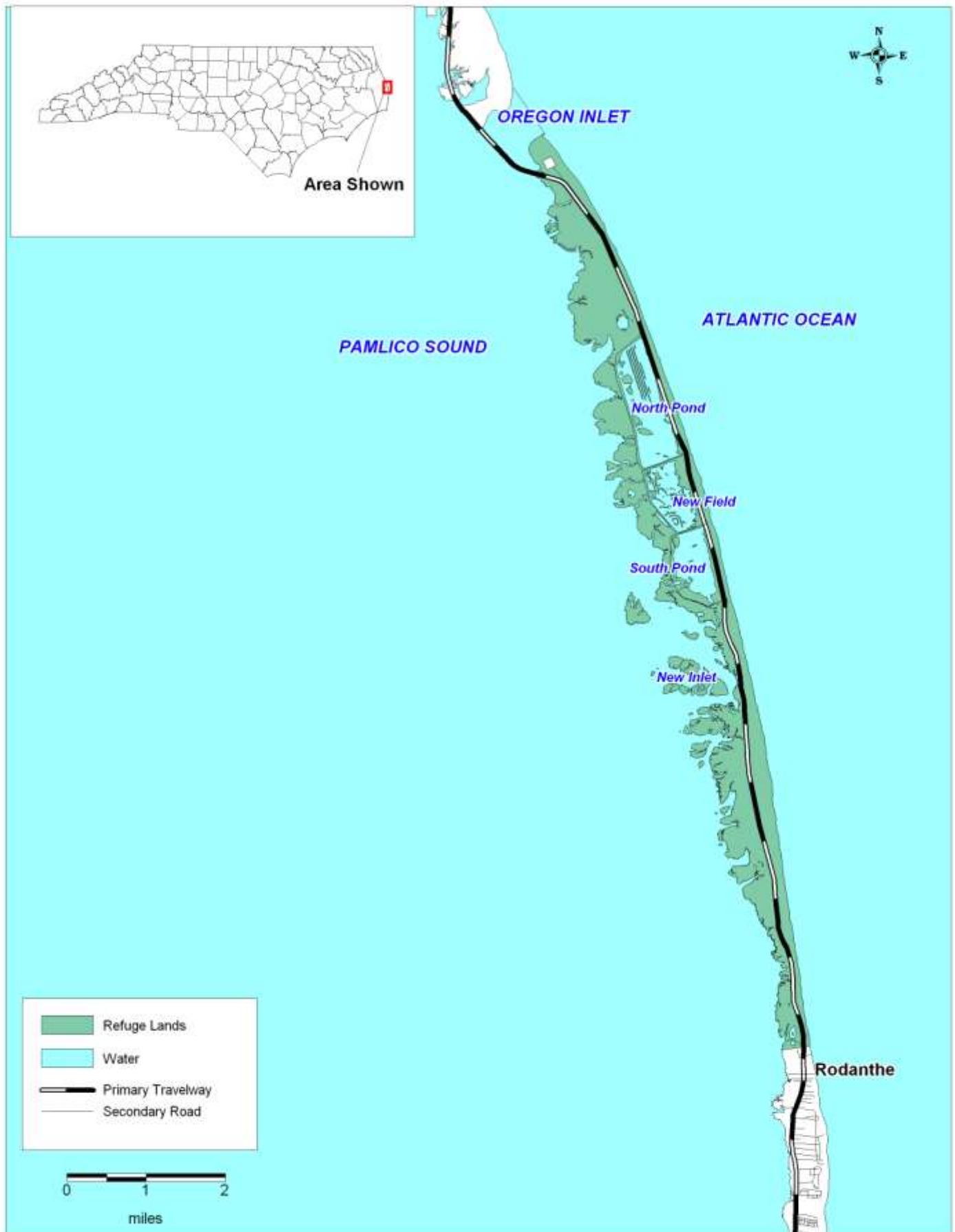
The unincorporated community of Rodanthe lies adjacent to the refuge's southern boundary. Rodanthe is part of the tri-village area composed of Rodanthe, Waves, and Salvo, NC. On the northern tip of the refuge, the State of North Carolina has a 10-acre in-holding (administered by the NC Aquarium) which includes a building that once operated as the Oregon Inlet U.S. Coast Guard Station. This is the only area within the approved acquisition boundary that is not owned by the Department. By Presidential Proclamation, a 25,700 acre area encompassing the refuge and part of the Pamlico Sound is closed to migratory bird hunting. Figure 3 shows a general map of the refuge and its location on the North Carolina coast.

Pea Island NWR was established by Executive Order 7864 on April 8, 1938 as a refuge and breeding ground for migratory birds and other wildlife. The beaches, freshwater impoundments, marshes and maritime shrub plant communities provide important nesting and foraging habitat for colonial nesting birds, waterfowl, marsh and wading birds, shorebirds, and migratory songbirds. The beaches and exposed sand flats are used for nesting by threatened sea turtles and nesting and foraging habitat for the threatened piping plover.

The refuge's CCP was completed in September 2006 to guide the management of Pea Island for the next 15-years. Chapter II of the CCP (FWS 2006) includes a thorough description of the physical and biological environments on the refuge and the socioeconomic conditions of the surrounding area. Appendix VI of the CCP is a list of refuge biota and includes the common and scientific names for species mentioned in this FMP.

The CCP (FWS 2006) established a vision for the refuge of which the following portions are pertinent to fire management on the refuge:

Figure 3: Pea Island National Wildlife Refuge - Current Boundary



Pea Island National Wildlife Refuge in North Carolina is an example of a historic mid-Atlantic coastal barrier island in a relatively undisturbed condition... Refuge staff and partners will be increasingly diligent in the conservation and management of fish, wildlife, and plant species and their habitats in the face of rising human impacts... Working with others, Pea Island National Wildlife Refuge will adaptively manage natural resources and create in this wild place a legacy of barrier island fish, wildlife, and plants for future visitors to experience and enjoy.

1.3. Significant Values to Protect

1.3.1. Alligator River National Wildlife Refuge

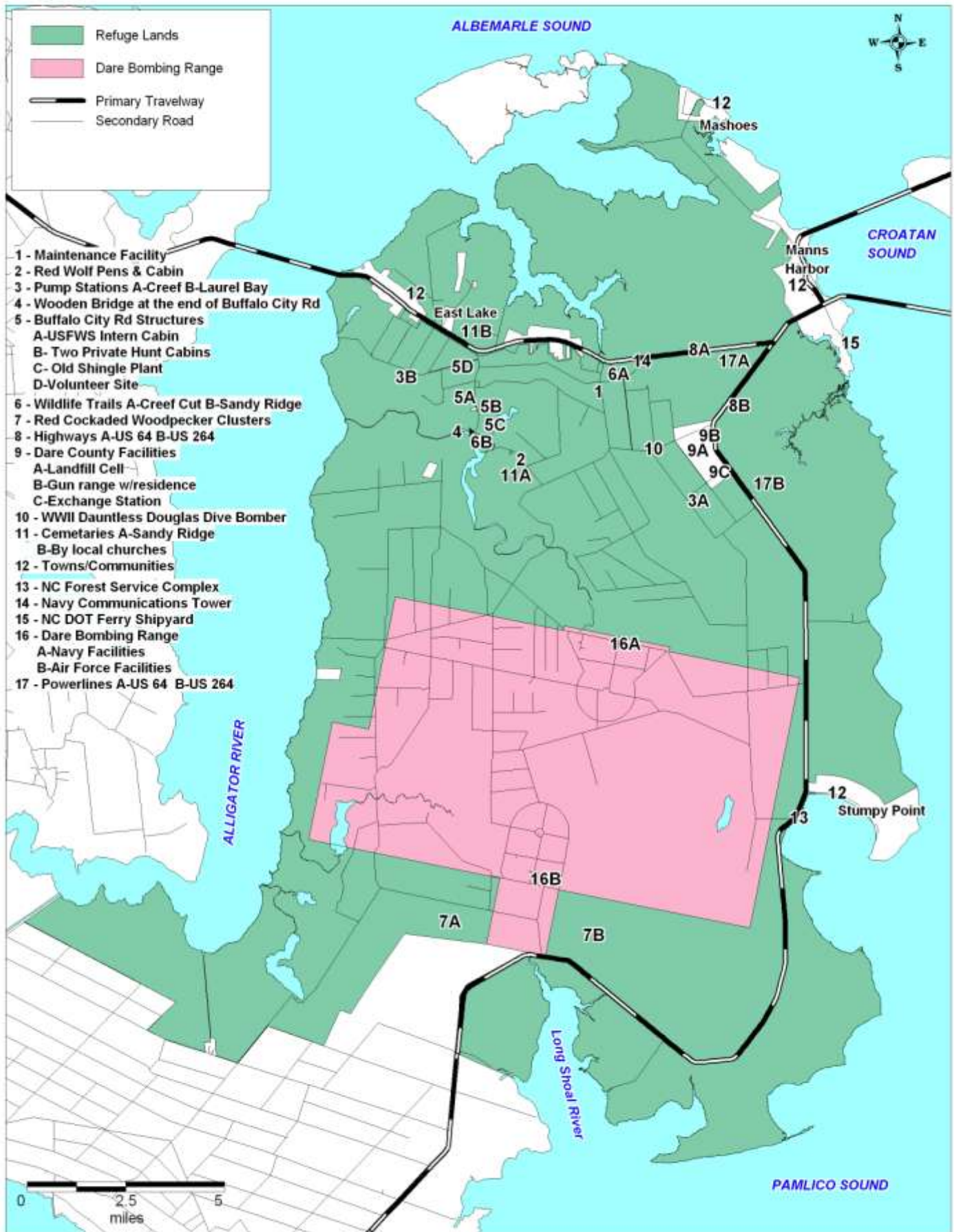
The endangered red wolf (*Canis rufus*) and endangered Red-cockaded Woodpecker (*Picoides borealis*) can be found on Alligator River NWR, as well as the American alligator (*Alligator mississippiensis*), which is threatened by similarity of appearance to other caimans. Red-cockaded Woodpeckers (RCW) are known to inhabit the southern portion of the refuge and the DCBR. Alligators can be found in several creeks, canals, and ditches across the refuge. Critical habitat for the endangered red wolf incorporates a five-county area that includes all of mainland Dare and Hyde Counties. Red wolves can be found all over the refuge. The pens at Sandy Ridge facilitate the captive breeding program, medical treatment, and program management of red wolves in northeastern North Carolina. Standard Operating Procedures (SOP) have been established with red wolf biologists to ensure fire management activities do not conflict with the red wolf recovery program (Appendix E).

The North Carolina Heritage Program has designated most of the refuge, with the exception of its cropland, moist-soil areas, and shop area as a Significant Natural Heritage Area in recognition of the integrity of the vegetative communities. Refuge goals are to maintain the natural plant communities by conducting prescribed burning of fire-dependent communities at natural intervals and severities.

During a Wilderness Review as part of the CCP process (see Appendix IX, FWS 2008), the refuge designated five wilderness study areas. It was determined that these areas would not be proposed as wilderness, but would be actively managed under current management strategies with consideration of their wilderness characteristics. These areas are further described in Section 3 under the Fire Management Unit (FMU) that they are a part of.

The refuge has several signs, informational kiosks, and boardwalks located throughout the refuge in support of the public use program. Administrative values include the East Lake Maintenance Facility, Service residences, pump houses, volunteer site, red wolf pens, and wooden bridge. Historical sites include a cemetery at the red wolf pens, a crashed World War II airplane, and remains of an old shingle plant on Buffalo City Road. Off refuge values to protect include surrounding communities, two private cabins on Buffalo City Road, Dare County Landfill and Gun Range, NC Department of Transportation (NCDOT) Shipyard, NCDFR Stumpy Point facility, DCBR, and several towers. Figure 4 shows the locations of these values to protect and Sections 3.2 – 3.8 list specific descriptions by FMU (values potentially at risk from wildland fires or fire suppression activities).

Figure 4: Alligator River National Wildlife Refuge - Values to Protect



U.S. Highways 64 and 264 are major two-lane travel corridors running through the refuge. Plans are currently being developed to expand US 64 to a four-lane highway. Normal highway traffic as well as potential road construction will affect refuge operations and fire management activities.

1.3.2. Pea Island National Wildlife Refuge

Three threatened species have been documented on Pea Island NWR. The green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtles inhabit the open ocean, but use refuge beaches for nesting. Piping plover (*Charadrius melodus*) use the beach and other unvegetated sand areas. None of these species should be affected by fire management activities. Also, the refuge is within the known range of the threatened seabeach amaranth (*Amaranthus pumilus*) and the dune bluecurls (*Trichostema spp.*), a federal species of concern, but neither has been observed on the refuge.

The North Carolina Heritage Program has designated most of the refuge, with the exception of its impoundments, as a Significant Natural Heritage Area in recognition of the integrity of the vegetative communities. Refuge goals are to maintain the natural plant communities by conducting prescribed burning of fire-dependent communities at natural intervals and severities.

In 1974 the Service submitted a Final Environmental Impact Statement that proposed wilderness designation for all islands on the Pamlico Sound side of Pea Island NWR, encompassing about 180 acres. These areas consist of salt marsh with each island being dominated by black needlerush with marsh elder scattered throughout. The refuge currently manages the islands as if they were wilderness until the Service sends the recommendation to Congress and Congress either approves or denies the recommendation.

The refuge has a Visitor Center on the island along with several signs, informational kiosks, photo blind, observation platforms, restrooms, and boardwalks. Administrative values include the headquarters building, storage sheds, Service residence, pump houses, and pole barn. An old Coast Guard Station is located on the northern tip of the island. Several houses sit adjacent to the southern refuge boundary at Rodanthe. Figure 5 shows the locations of these values to protect and Section 3.9 list specific descriptions for the FMU (values potentially at risk from wildland fires or fire suppression activities).

North Carolina Highway 12 is a major two-lane travel corridor running through the refuge and across the Herbert C. Bonner Bridge. This bridge spans Oregon Inlet to connect Pea Island to Bodie Island. A replacement project is underway for the bridge. Bridge construction and highway maintenance will affect refuge operations and fire management activities.

Figure 5: Pea Island National Wildlife Refuge - Values to Protect



2.0. Policy, Land Management Planning and Partnerships

2.1. Implementation of Fire Policy

Appendix N contains a list of policy references that affect fire management on national wildlife refuges. Appendix III of each of the refuges' CCPs (FWS 2006, FWS 2008) contains another list of relevant legal mandates.

2.1.1. Federal Interagency Wildland Fire Policy

This FMP implements these guiding principles of federal wildland fire policy:

- Firefighter and public safety is the first priority in every fire management activity.
- The role of wildland fire as an essential ecological process and natural change agent has been incorporated into this planning process.
- Fire management plans, programs, and activities support land and resource management plans and their implementation.
- Sound risk management is the foundation of all fire management activities. Risks and uncertainties relating to fire management activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity.
- Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
- Fire management plans and activities are based upon the best available science.
- Fire management plans and activities incorporate public health and environmental quality considerations.
- Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
- Standardization of policies and procedures among federal agencies is an ongoing objective.

2.1.2. National Fire Plan

This FMP emphasizes the following primary goals of *A Collaborative Approach for Reducing Wildfire Risks to Communities and the Environment: 10-Year Comprehensive Strategy (10-Year Strategy)* and *Protecting People and Natural Resources: A Cohesive Fuels Treatment Strategy (Cohesive Fuels Treatment Strategy)*:

- Improving fire prevention and suppression,
- Reducing hazardous fuels,
- Restoring fire-adapted ecosystems, and
- Promoting community assistance.

2.1.3. Department of Interior (DOI) Fire Policy

This FMP meets DOI policy found in *620 DM 1* by making full use of wildland fire as a natural process and as a tool in the planning process.

2.1.4. U.S. Fish and Wildlife Service Fire Policy

This FMP addresses a full range of potential wildland fires and considers a full spectrum of tactical options (from monitoring to intensive management actions) for appropriate management response (AMR) to meet Fire Management Unit (FMU) objectives. It fully applies procedures and guidelines in the *FWS Fire Management Handbook* and the *Interagency Standards for Fire and Fire Aviation Operations (Redbook)*, and affirms these key elements of Service fire policy (*621 FW 1*):

- Firefighter and public safety is the first priority of the wildland fire management program and all associated activities. With the possible exception of instances where the life of another is in jeopardy, we will not purposely expose an employee, contractor, or cooperator to life-threatening conditions or situations.
- Only trained and qualified leaders and agency administrators will be responsible for, and conduct, fire management duties and operations.
- Trained and certified employees will participate in the wildland fire management program as the situation requires, and non-certified employees will provide needed support as necessary.
- Fire management planning, preparedness, wildland and prescribed fire operations, other hazardous fuel operations, monitoring, and research will be conducted on an interagency basis with involvement by all partners to the extent practical.
- The responsible agency administrator has coordinated, reviewed, and approved this FMP to ensure consistency with approved land management plans, values to protect, and natural and cultural resource management plans, and that it addresses public health issues related to smoke and air quality.
- Fire, as an ecological process, has been integrated into resource management plans and activities on a landscape scale, across agency boundaries, based upon the best available science.
- Wildland fire is used to meet identified resource management objectives and benefits when appropriate.
- Prescribed fire and other treatment types will be employed whenever they are the appropriate tool to reduce hazardous fuels and the associated risk of wildfire to human life, property, and cultural and natural resources, and to manage our lands for habitats as mandated by statute, treaty, and other authorities.
- Appropriate management response will consider firefighter and public safety, cost effectiveness, values to protect, and natural and cultural resource objectives.
- Staff members will work with local cooperators and the public to prevent unauthorized ignition of wildfires on our lands.

2.1.5. Southeast Region and Refuge-specific Fire Management Policy

The Southeast Region has a regional aviation requirement that all aviation users take the B-3 Refresher training every 2 years, rather than the national 3 year requirement.

District policy is to have firefighters take the Work Capacity Test (WCT) or “pack test” twice a year using procedures outlined in the *Work Capacity Tests for Wildland Firefighters, Test Administrator’s Guide* (PMS 307, NFES 1109). Casual Hires or ADs will be required to take the WCT only once a year. The District will follow all medical testing standards outlined in the *Redbook*.

2.2. Land/Resource Management Planning

This FMP will support the Service’s initiative for Strategic Habitat Conservation (SHC) by fully supporting adaptive management and the use of science-based information to inform and develop fire management actions. SHC principles can be found at <https://intranet.fws.gov/region4/SHC>.

2.2.1. Land/Resource Planning Documents

The FMP is related to the goals and objectives for refuge management through the overall guidance provided by the *Alligator River National Wildlife Refuge Comprehensive Conservation Plan* (FWS 2008) and the *Pea Island National Wildlife Refuge Comprehensive Conservation Plan* (FWS 2006). Biological planning in the CCPs was in turn influenced by cooperative partnerships reflected in the North American Waterfowl Management Plan including the Atlantic Coast Joint Venture, Partners in Flight Plan, and the South Atlantic Migratory Bird Initiative.

Several CCP step-down management plans will affect the fire management program. As these plans are developed under the new CCPs, changes will be made to the FMP during its annual review if warranted to improve management efficiencies and resolve resource conflicts between plans. The following list includes those step-down plans that will most likely impact fire management operations on the refuges:

- Biological Inventory/Monitoring Plan
- Habitat Management Plan
- Moist Soil/Water Management Plan
- Marsh Management Plan
- Integrated Pest Management Plan
- Environmental Education Plan

The DCBR is currently revising its Fire Management Plan and is striving to expand its fuels management program on the range. Implementation of the DCBR FMP may influence fire operations on Alligator River NWR, potentially in fuel treatment prioritization and project collaboration.

The Southern Wildfire Risk Assessment (SWRA) is an interagency effort to characterize wildland fire risk to communities in the South. This GIS based tool will be utilized to generate planning maps, characterize communities at risk, guide development of Community Wildfire Protection Plans (CWPP), and prioritize fuel treatment projects.

A CWPP is an interagency, community developed plan to address wildland fire risk and actions on a community level. In the CWPP planning process, wildland-urban interface (WUI) areas can be designated for a community based on fire history and surrounding fuels. The CWPP also lays out actions for agency and community partners to carry out in order to address the community's wildland fire risk. Plans are designed to be reviewed and updated on a regular basis. CWPPs should be closely linked to the FMP in regards to Service involvement and accomplishment of FMP objectives. As CWPPs are developed for communities surrounding Alligator River and Pea Island NWRs they will be added as an appendix to the FMP.

Fire Program Analysis (FPA) is an interagency budgetary planning tool for fire management. The newest computer software for this planning tool will be utilized in Fiscal Year 2008 and 2009 to develop a national interagency fire budget for FY 2011 and each year thereafter. Fire District 1 is part of the interagency North Carolina Coastal Fire Planning Unit (FPU). As part of the planning process, the FPU will develop a series of preparedness, prevention, and fuels options which will shape the budget. As a strategic tool, the FPA budgetary planning process has the potential to influence selection of projects and positioning of fire resources across Service Fire District 1.

2.2.2. Compliance with Regulatory Acts

National Environmental Policy Act (NEPA) compliance was accomplished by completion of an Environmental Assessment (EA) for the Fire Management Plan during the fall of 2008. The EA and Draft FMP were made available for public review for 30 days. The Service received 8 responses during this period. Upon review, the Service issued a Finding of No Significant Impact (FONSI). A record of the decision will be maintained in the refuge files.

In conjunction with the 2008 EA, the refuge requested an Intra-Agency Endangered Species Act Section 7 Consultation from Raleigh Ecological Services Office. A copy of the consultation is included in the Appendix of the EA.

The FMP must comply with Section 118 of the Clean Air Act. A geographic area that meets or does better than the primary standards for air pollutants is called an attainment area; areas that do not meet the primary standards for each pollutant are called non-attainment areas. Alligator River and Pea Island NWRs are located in Dare and Hyde Counties which are currently in attainment for all criteria pollutants. Since these counties have been designated by the EPA as attainment areas, a Clean Air Act Conformity determination is not necessary. Consideration of air quality is further discussed in Section 4.2.1.5 under smoke management for prescribed burning.

For compliance with the Federal Coastal Zone Management Act of 1972, a federal Consistency Determination has been prepared and will be submitted to the North Carolina Division of Coastal Management for concurrence. The Consistency Determination will be maintained in refuge files.

All FMP actions/decisions comply with Section 106 of the 1966 National Historic Preservation Act and Archeological Resources Protection Act of 1979. The wetland environment (habitat type, presence of saturated organic soils, and the hydrological regime) makes it unlikely that there are cultural or archeological resources on Alligator River. Likewise, the dynamic nature of geologic forces on barrier islands makes it unlikely that any cultural or archaeological resources are preserved on Pea Island. The few known cultural sites on the refuges are:

- Old bridge pilings across New Inlet at Pea Island
- Old shingle plant along Buffalo City Road at Alligator River
- WWII dive-bomber airplane at Alligator River
- Sandy Ridge cemetery at Alligator River

Should any other potential historical or cultural resources be discovered during fire operations, personnel will notify refuge management and take appropriate steps to safeguard the site and prevent further disturbance. If needed, local NPS historians with the Cape Hatteras National Seashore could be contacted to help with immediate stabilization of resources. Regional Archaeologist Richard Kanaski at Savannah Coastal Refuges is our cultural resources expert should issues on cultural resources arise.

Individual projects may need separate, individual clearance to comply with all regulatory acts and will be reviewed on a project basis.

2.3. Fire Management Partnerships

The U.S. Fish and Wildlife Service in the Southeast Region, Fire Management District 1 places development of cooperative relations as an extremely high priority. Sharing resources during wildfires is the primary advantage of cooperative relationships. Due to the hazardous fuels, poor soil traffic ability, remoteness, and poor visibility on Refuge and adjoining state and private lands, no one agency has the capability to be self-sufficient for initial or extended attack. The FWS in eastern North Carolina will always depend on cooperators, primarily the NCDFR, for assistance. It is common for as many as eight or ten tractors with crews, a handful of engines, a scout plane, single-engine air tankers (SEATS), heavy air tankers and helicopters to be committed to an initial attack on a pocosin fire. It is also likely that due to frequent ground fire occurrence, extended attack organizations with specialized water-handling equipment and expertise will be needed.

Cooperative ties between agencies are also becoming more important for prescribed burning, other non-fire fuel treatments, and fire prevention and outreach projects. As prescribed burning activities increase within the agencies in eastern North Carolina, cooperative assistance will play a greater role in helping these agencies carry out their programs. District fire management and Refuge staff will continue to cooperate and seek partnerships with nearby agencies and

communities to increase the efficiency, productivity, and safety of all fire management activities throughout the District.

2.3.1. Internal Partnerships

The refuges in the North Carolina Coastal Plain Refuge Complex and the Mattamuskeet Refuge Complex are involved in a fire management partnership and together these refuges form the Southeast Region Fire District 1. District fire personnel that work on fire management issues across the District include a Fire Management Officer (FMO), Prescribed Fire Specialist, Wildland-Urban Interface Specialist, and a Fire Program Technician. These positions are all based at Alligator River NWR. An Assistant District FMO is based at Pocosin Lakes NWR. Operational fire resources from across the District work together on all the district refuges to implement fire management activities.

An interdisciplinary team of refuge and District fire staff was used to develop this FMP (Table 2). The FMP planning team utilized information developed from several sources, relying heavily on information gathered during the development of the refuges' Comprehensive Conservation Plans and Environmental Assessments, including the Roanoke-Tar-Neuse-Cape Fear (RTNCF) Biological Review which provided habitat assessments and land management recommendations for the CCPs. The CCP planning teams also incorporated the input of State agencies, non-governmental organizations, local citizens, and the general public through a series of stakeholder and public scoping meetings which are described in each CCP (FWS 2006, FWS 2008).

Table 2: Fire Management Planning Core Team Members

Member	Affiliation
Mike Bryant, Project Leader Scott Lanier, Deputy Project Leader Thomas Crews, Fire Management Officer Kelley Van Druten, Wildland-Urban Interface Specialist Dennis Stewart, Wildlife Biologist Donnie Harris, Fire Control Officer Greg Suszek, Prescribed Fire Specialist	Alligator River National Wildlife Refuge Fish and Wildlife Service Manteo, North Carolina
Vince Carver, Fire Management Officer	Pocosin Lakes National Wildlife Refuge Fish and Wildlife Service Columbia, North Carolina

2.3.2. External Partnerships

The U.S. Fish and Wildlife Service has an interagency agreement for wildland fire management in North Carolina. The *Master Cooperative Wildland Fire Management and Stafford Act Response Agreement* (Master Agreement) is between the Service's Southeast and Northeast Regions, NPS, Bureau of Indian Affairs, U.S. Forest Service (USFS), and the NCDFR for wildland fire management in North Carolina. An Annual Operations Plan (AOP) sets forth the operational guidelines of this agreement within District 1 and includes the NPS, NCDFR, and Great Dismal Swamp National Wildlife Refuge in the Northeast Region. In the future other state

and local AOPs may be developed as step down plans of the wider interagency agreement. The AOP is included in Appendix A.

The Service has also developed cooperative relations with several Volunteer Fire Departments (VFD) through grant agreements with the Rural Fire Assistance Program. Over the next five years, the District plans to strengthen these ties through cooperative agreements with AOPs and development of Community Wildfire Protection Plans (CWPP). Alligator River NWR has agreements with Stumpy Point VFD and Manns Harbor VFD.

The Alligator River and Pea Island NWRs are also involved in a partnership for federal fire budget planning called Fire Program Analysis (FPA). The country was divided into Fire Planning Units (FPU), and the agencies within an FPU are working together to develop an interagency fire budget. The Refuges are part of the North Carolina Coast FPU which includes all the national wildlife refuges in District 1, the Croatan National Forest, Cape Hatteras National Seashore, and Cape Lookout National Seashore.

To facilitate prescribed burning, the refuges or District have entered into several Memoranda of Understanding with private landowners or agencies. These are covered in Section 3 under the affected Fire Management Units.

A Draft FMP and EA were made available for public comment and review. Relevant comments and concerns received during the review period were incorporated into the Final FMP. Regional Service fire staff and local fire management cooperators will be consulted for input during the public review period. Solicited cooperators included a fire researcher, Volunteer Fire Departments, the NCDFR, The Nature Conservancy, the USFS, and the NPS. A complete list of contacts is listed in the EA.

3.0. Fire Management Unit Characteristics

Alligator River National Wildlife Refuge (ARNWR) and Pea Island National Wildlife Refuge (PINWR) have been broken down into Fire Management Units (FMU). A FMU is a land management area definable by objectives, management constraints, topographic features, access, values to protect, political boundaries, fuel types, major fire regime groups, etc. that set it apart from the characteristics of an adjacent FMU. A FMU may have dominant management objectives and pre-selected strategies assigned to accomplish these objectives and can further be divided into Fire Compartments and/or Burn Units. Table 3 and Figure 6 show the FMUs delineated by refuge.

Table 3: Fire Management Units within the Fire Management Plan

FMU Name	Total Acres	Burnable Acres
1	24,810	24,790
2	38,410	38,205
3	6,314	5,112*
4	19,360	19,009
5	28,720	28,038
6	11,240	11,171
7	19,400	18,882
8	4,388	3,487

* Once water is removed from impoundments, the entire FMU could be considered burnable.

FMUs were consolidated under the Fire Program Analysis (FPA) budget planning process to facilitate data entry and analysis while FPA is completely developed. Table 4 and Figure 7 show the FMUs as delineated in FPA.

Table 4: Fire Management Units in FPA

Fire Management Units	Total Acres	Burnable Acres
AR East	87,519 (85,468)	85,468
AR Threat East	56,754 (56,210)	56,210
AR West	60,492 (59,249)	59,249
AR Threat West	15,358 (15,321)	15,321
Pea Island	4,649 (3,481)	3,481

Under the interagency Master Agreement, a mutual threat zone was defined as lands within 1/2 mile of refuge property where there is potential for fires to impact Service lands. Mutual threat zones were formally delineated as FMUs in FPA (1-mile, see Table 4), but they are not under this FMP. The Service will respond to fires in the mutual threat zone per the Master Agreement. A threat FMU was not designated in FPA for Pea Island because of proximity to land with NPS ownership.

Figure 6: Alligator River National Wildlife Refuge - Fire Management Units

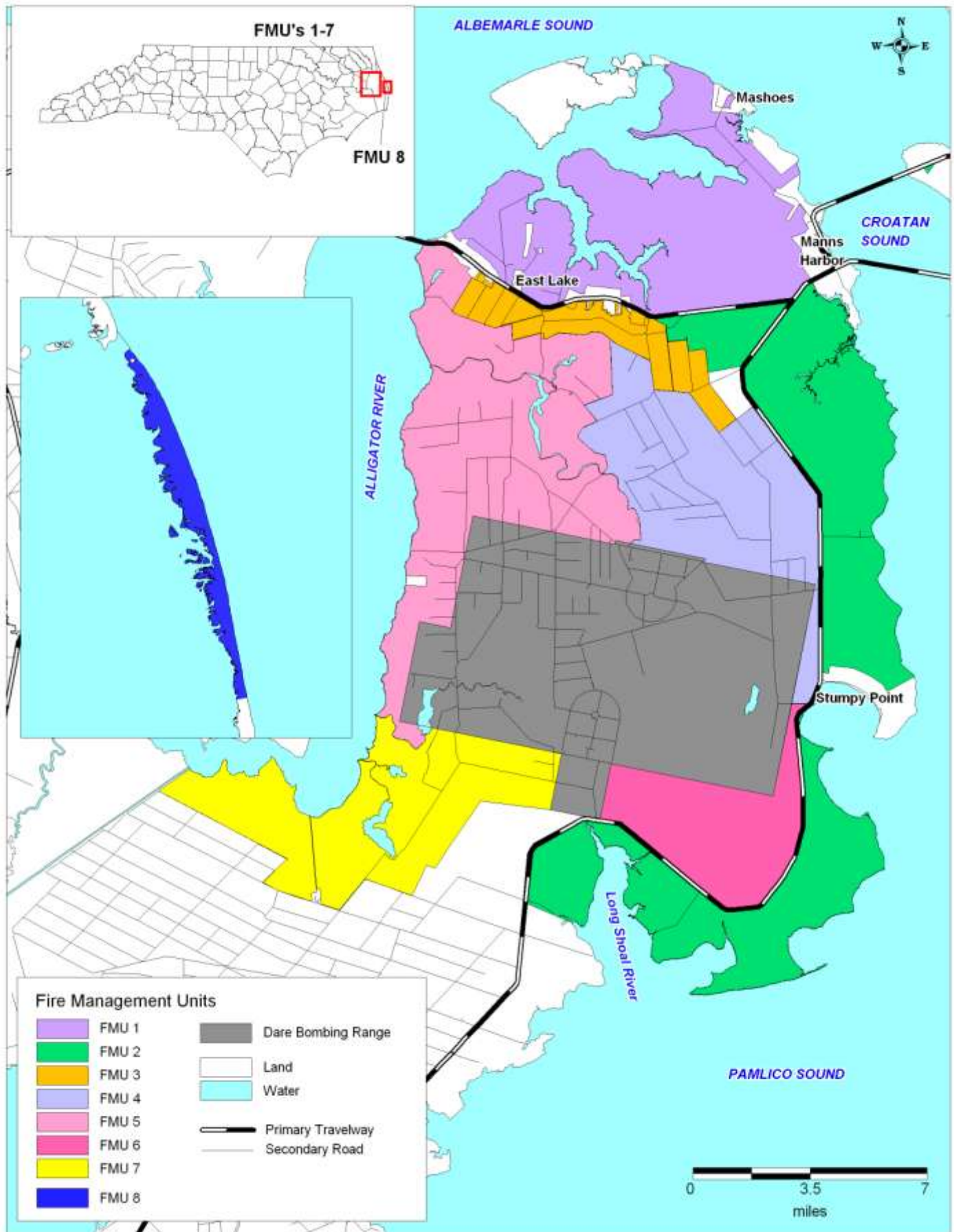
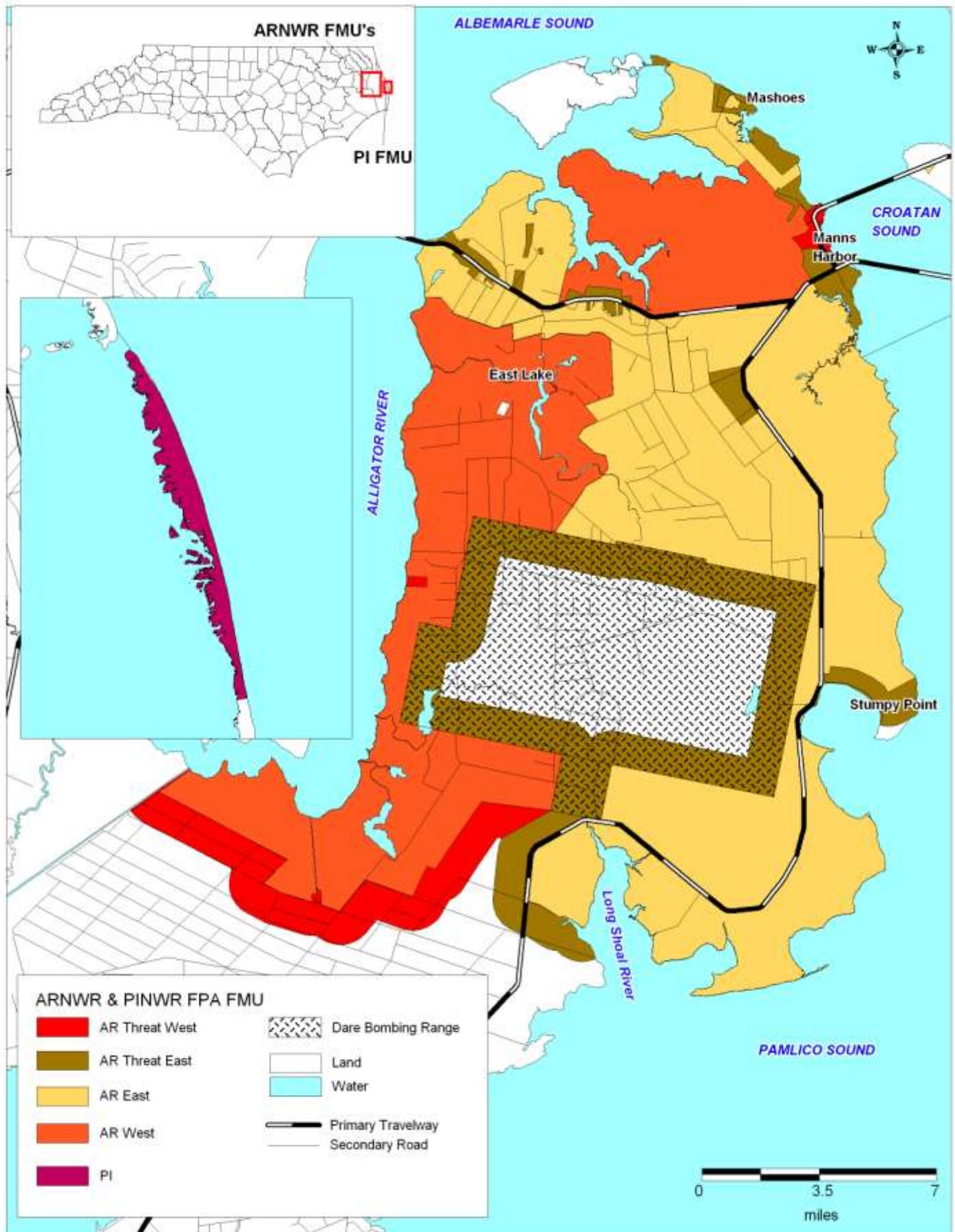


Figure 7: Fire Program Analysis Fire Management Units



3.1 Area Wide Management Considerations

3.1.1. Management Goals, Objectives, and Constraints in CCPs

The refuges' CCPs (FWS 2006, FWS 2008) have broad refuge management goals related to fish and wildlife populations, habitat, public use, resource protection, and administration with more specific objectives and strategies identified under each broad goal. The following fire management goals for Alligator River and Pea Island NWRs reflect the goals and objectives as identified in the CCPs. More specific fire management objectives are listed by Fire Management Unit in Sections 3.2 to 3.9.

Fire Management Goals

1. Manage wildland fires on refuge lands to minimize risks to firefighter and public safety.
2. Develop and implement a process to ensure the collection, analysis and application of high quality fire management information needed for sound management decisions. Adaptively manage fuel treatments and wildfire response by developing and implementing a fire effects monitoring plan and effective use of After Action Reviews.
3. Consider impacts to the integrity of wetlands in the mainland and barrier island ecosystems during planning and implementation of all fire management activities. The effects of climate change and sea-level rise on these ecosystems will also be considered in fire management.
4. Use prescribed fire to mimic pre-settlement fire intervals and intensities where appropriate to restore ecosystem integrity and endangered species habitat, and accomplish resource management objectives.
5. Maintain and support a District fire organization capable of providing leadership in fire management planning, prevention, and preparedness with administrative and operational capacity to support all nine refuges and a hatchery in District 1.
6. Continuously develop and manage a Refuge fire organization consisting of fire management specialists, firefighters, and equipment operators capable of safely and effectively addressing fire management needs for Alligator River and Pea Island NWRs as well as integrating with staff from other refuges and the hatchery to meet fire management needs on the District.
7. Develop cooperative relations with neighboring fire management districts, refuges, cooperators and interagency partners to facilitate overall fire management missions within multiple jurisdictions in northeastern North Carolina and the State as a whole.
8. Develop a High Reliability Organization in which the safety and well-being of firefighters and the public are always paramount above all other objectives within the refuges and district fire management programs.
9. Conduct fuel treatments with the highest professional and technical standards to achieve resource management objectives, hazardous fuel reduction, and community protection.
10. Support the development and implementation of other CCP step-down plans that would affect fire management on the refuges, such as plans for habitat management, hydrology, invasive species, and endangered species.
11. Purchase, develop and maintain a fleet of fire equipment that best meets the fire needs of the refuges within funding constraints.

Fire Management Constraints

- ARNWR has large blocks of contiguous fuels with few natural or man-made containment lines. Throughout these areas are constructed v-ditches that range from 8-12 feet wide and 6-8 feet deep, creating special hazards for tractor plow operations.
- Extremely large expanses of wet, spongy soils with very poor access are common, requiring the use of specialized tracked equipment, fire management tactics, and safety requirements for wildland fire operations. See Standard Operating Procedures (SOPs) in Appendix F.
- Organic soils, covering over 90% of ARNWR, can ignite and create additional risks for fire escape, special hazards for suppression, and produce extremely dense smoke for long periods of time. Loss of organic soils as a result of consumption by fire is considered environmentally undesirable.
- Refuge equipment will be washed prior to leaving the District and before returning to help prevent the spread of invasive species.

3.1.2. Management Goals, Objectives, and Constraints from other sources

The following goals, objectives and constraints are taken from various policy or guidance documents that affect fire management on national wildlife refuges (see Appendix N).

1. Respond to every wildfire on or threatening our lands with an Appropriate Management Response, taking into consideration public and firefighter safety, impacts to natural resources, and cost effectiveness.
2. The range of appropriate management responses to wildfires may include direct or indirect attack strategies, or surveillance and monitoring to ensure fire spread will be limited to a designated area.
3. Confine wildland fire to refuge lands where possible. Where feasible and needed to meet refuge goals and objectives, develop agreements to authorize fire activity on private or other agency lands.
4. Wildfires in candidate wilderness or wilderness study areas will receive an appropriate management response that includes consideration of wilderness values and Minimum Impact Suppression Tactics (MIST).
5. Consider smoke management to the extent possible when developing tactics to meet an AMR.
6. Take necessary measures to protect visibility and safety for motorists along highways and major roads during wildfires or prescribed fire treatments.
7. Take prompt action to determine the need for, design, and implement emergency treatments to minimize threats to life or property or to stabilize and prevent unacceptable degradation to natural and cultural resources from the effects of a wildfire on refuge lands.

Fire Management Constraints

- Aerial or ground application of fire retardants, foams, and water enhancers should be avoided within 300 feet of waterways unless life or property is threatened and their use can reasonably be expected to alleviate the threat. Other exceptions can be found in Chapter 12 of the *Redbook*.
- Agency firefighters will not take direct suppression actions on structure, vehicle, or landfill fires, but limit firefighting efforts to areas where the fire has spread onto agency protected lands.
- Extreme fire weather conditions occur more frequently in the coastal areas of the State due to especially strong winds. Also, local geographic features create localized winds that can defy general and spot weather forecasts.
- Smoke management laws, smoke dispersion patterns, and considerations for military operations at the DCBR narrow available burn windows and can constrain prescribed burning activities on the refuges.
- The Refuge Manager is the decision authority for equipment use in candidate wilderness areas on Pea Island NWR.

Cost Effectiveness

Maximizing the cost effectiveness of any fire operation is the responsibility of all involved, including those that authorize, direct, or implement these operations. Cost effectiveness is the most economical use of the suppression resources necessary to accomplish mission objectives. Accomplishing fire operations objectives safely and efficiently will not be sacrificed for the sole purpose of “cost savings.” Care will be taken to ensure that suppression expenditures are commensurate with values to be protected, while understanding that other factors may influence spending decisions, including the social, political, economic, and biophysical environments. Hazardous fuels projects will be planned for the most economical, effective, and safe treatment that is commensurate with the values to protect. Cost containment goals for Alligator River and Pea Island NWRs are:

1. Use a Wildland Fire Situation Analysis (WFSA) and other decision support tools along with relevant, accurate intelligence data for analysis and cost management of Type-3 or above incidents. Examples include extended weather forecasts, projected long-term weather outlooks, fire history analysis, climatological predictions (such as probability of event ending rainfall event), fuels mapping, short and long-term fire behavior analysis, FSPro/RAVAR analysis (or equivalent), aerial infrared photography and satellite imagery, and intelligence gathered on the incident.
2. Consider the full range of Appropriate Management Response strategies for each wildfire and apply one or more strategies that best meet objectives which will include cost containment.
3. Continue working with fire management and research partners to develop and implement tools for predicting ground fire development and fire behavior in pocosin fuels in order to make appropriate decisions on strategies for AMR.
4. Develop Strategic Long Term Fire Plans to guide Incident Management Teams (IMT) for large wildland fires that are expected to take more than 4 weeks to suppress.

3.1.3. Common Characteristics of the Fire Management Units

FMUs 1-7 are located on Alligator River NWR and FMU 8 is Pea Island NWR. Common characteristics between the refuges include climate and topography. Excluding the dunes, the land on both refuges is very flat and lies from a few inches to about 6.5 feet above sea level. Marshes experience periodic flooding during wind-driven tidal occurrences. Prevalent winds are from the southwest. Sea breezes from the ocean, sounds, or river can cause localized effects and dramatic shifts in wind direction. Average annual rainfall is approximately 51 inches. The mainland has an annual average maximum temperature of 87 degrees and an average annual minimum temperature of 38 degrees. Temperatures at Pea Island are similar, but ocean temperatures will moderate both high and low temperatures on the refuge.

The refuges share several safety considerations. Poison ivy, venomous snakes, ticks, mosquitoes, and biting flies can pose a hazard to firefighters at almost any time of the year. Getting wet during fire management operations is a definite possibility and has the potential to lead to hypothermia. Soft sand and wet, soft organic soils can contribute to vehicles and equipment getting stuck and then entrapped by advancing fire. During the summer, high temperatures and humidity can lead to dangerous heat indices that can cause heat exhaustion or lead to dehydration.

Appropriate Management Response is thoroughly covered in Section 4.1 and can include a range of strategic options such as monitoring, indirect attack, direct attack, and point protection. At times, more than one or perhaps all these strategic responses may be required in combination to meet the needs for an AMR. Sections 3.2 – 3.9 contain a description of AMRs by FMU for each refuge. The listed AMRs are not to be viewed as the only appropriate actions in an FMU, but the most likely responses that would be taken. Each wildland fire is unique with its own set of weather, fire behavior, resource, and event variables that must be taken into consideration by the Incident Commander (IC) when choosing an AMR.

The following common characteristics apply to FMUs 1-7 at ARNWR. Conditions for FMU 8 will be covered in section 3.9. A document can be found at the District FMO office with a description and map of past wildfire occurrences for the District. More information on each fire is available online in the Service's Fire Management Information System (FMIS).

Fire regime history for the Alligator River peninsula was investigated by Robert Mickler and Cecil Frost (2006). They found that the refuge had a distinct east-west gradient from more frequent fire in the east to little or no fire in the west. Splitting the peninsula roughly in half, the east side experienced fire on a two-nine year return interval while the west side ranged from 2-100 years to none. Frequent fire helped maintain large expanses of canebrake, a dome of low pocosin, and pond pine pocosin on the east side. Pre-settlement fires were caused by Native Americans and lightning. Decrease in fire frequency and sea level rise have impacted the vegetation currently present and potentially removed some chances of recovery.

More recent fires of significance have been caused by training bombs (equipment use) on the DCBR. The 1971 Air Force Bomb Range Fire burned much of the refuge between Manns Harbor and Stumpy Point as did the 1980 One Mile Miss Fire. Both fires originally burned off

the DCBR with a southwest wind which then reversed to a north wind in response to a frontal passage. The 2003 First Fire burned with a southwest wind towards Stumpy Point when it hit Lake Worth and turned to the east.

FMUs are delineated in Figure 6, page 19 and significant Values to Protect are shown on Figures 4 and 5 located on pages 8 and 10. Locally developed, 1-meter pixel vegetation and fuel model maps used for the FMU specific descriptions can be found on pages 26 (Figure 8 ARNWR) and 53 (Figure 9 PINWR).

3.2. Fire Management Unit 1

3.2.1. FMU 1 Description

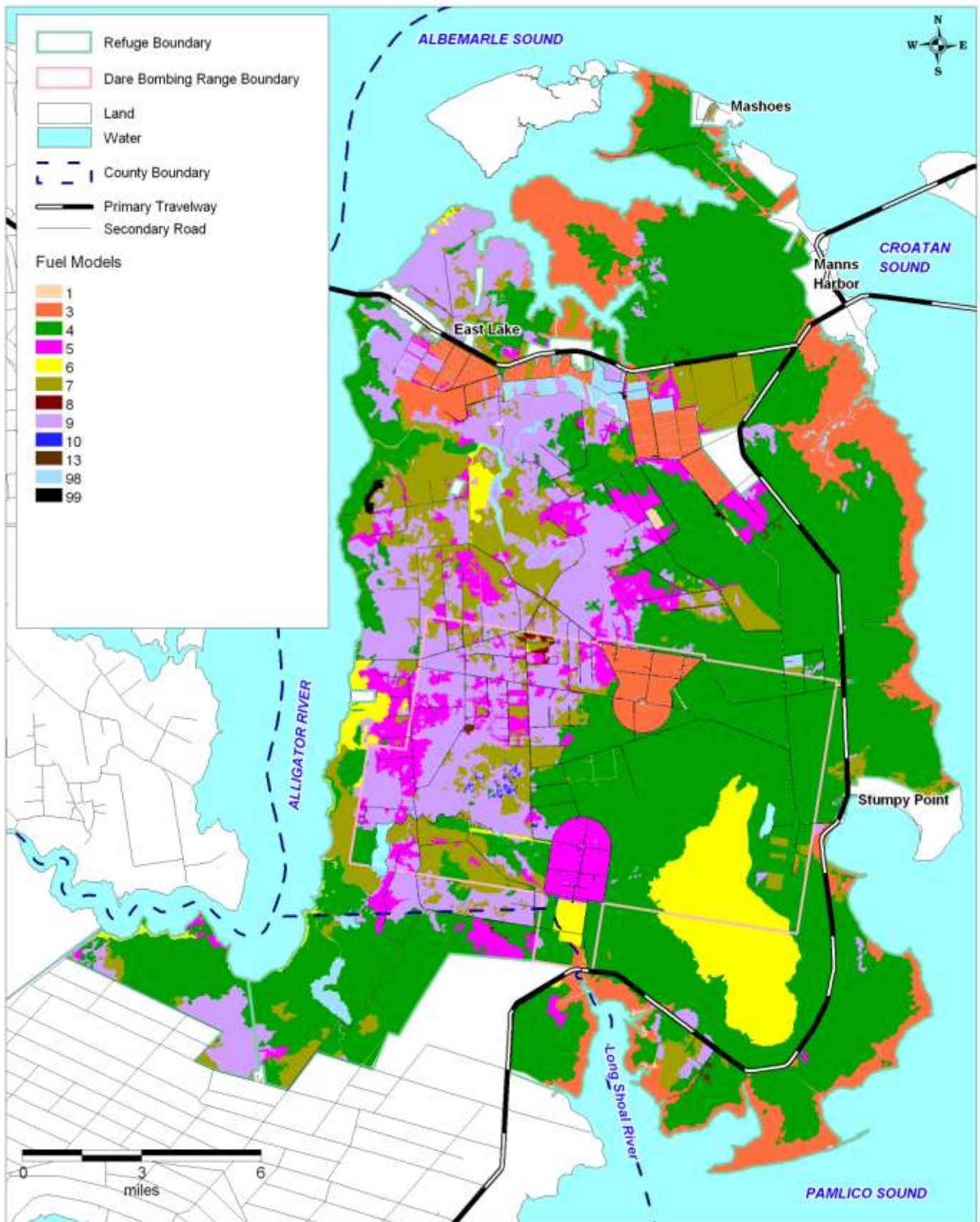
FMU 1 (24,814 acres) is the top portion of the Albemarle peninsula north of US Highway 64. The communities of Mashoes, East Lake and Manns Harbor are located adjacent to FMU 1. This FMU contains a very large block of undisturbed land where no roads, canals or ditches occur and forms the East Lake Wilderness Study Area (WSA). The refuge has Memoranda of Understanding (MOU) with several landowners to allow prescribed burning in conjunction with refuge lands around Mashoes (736 acres).

Ownership	Acres
Alligator River NWR	24,814
Non-refuge	736
Total in FMU	25,550

Vegetation generally transitions from brackish marsh and freshwater marsh along the exterior of the FMU to low tree pocosin in the interior. On the western edge and central area around South Lake lie large expanses of cypress-tupelo swamp and some bottomland hardwoods which generally do not burn except during an extreme drought cycle when a major wind event occurs. There are some loblolly pine plantations and upland hardwood stands around the East Lake and Manns Harbor communities. A hardwood swamp on the west side of Manns Harbor helps insulate this community from most low intensity wildfires coming from the west and southwest. Intermixed with these hardwood swamps, however, lay marshes and pond pine pocosins which will burn any time during a drought year, but particularly during the dry summer months or spring fire season. Under dry conditions or high wind events where long range spotting occurs, firebrands can fall throughout the community and ignite any available fuels. Manns Harbor is particularly vulnerable to fast moving fires that come from the south across the marsh and woodlands.

Fuels across the FMU have accumulated to very high levels during the past 50 years. Fuel Models (FM) 4 and 3 are the dominant fuels in the WSA. FM 9 describes the woodland near the Alligator River. The remainder of the FMU is a mix of FM 3 in the marshes, FMs 4 and 7 in the pocosins, and scattered areas of FMs 5 and 6. Periodically there may also be some FM 10 and 11 when pine beetle outbreaks or blowdown cause heavier concentrations of downed, dead woody fuels.

Figure 8: Alligator River National Wildlife Refuge - Fuel Models



3.2.2. FMU 1 Objectives and Constraints

Hazardous fuel reduction projects may include prescribed burning, mechanical and herbicide treatments, primarily around the communities of Mashoes and East Lake. Specific fuel treatment objectives for FMU 1 include:

1. Conduct prescribed burning in designated burn units, striving for a 3-5 year fire return interval.
2. Refuge resources or contractors will annually maintain about 4 miles of firebreaks in this FMU for wildfire control and in preparation for prescribed burn treatments as needed.
3. Refuge resources will annually maintain approximately 4 miles of roads in preparation for wildfire control and road maintenance as needed.
4. Look for opportunities to establish new burn units where feasible in the FMU to reduce fuels and manage ecosystems.

The table below gives examples of potential AMRs for FMU 1. Specific AMR objectives for this FMU include:

1. Protect communities and private structures through cooperation with the NCDFR and Manns Harbor VFD.
2. Confine fires north of US 64.
3. Consider wilderness values and Minimum Impact Suppression Tactics (MIST) in selection of AMR for fires occurring in the East Lake WSA.

FMU 1 Appropriate Management Response

Potential situations	Potential strategies	Potential tactics
<p>Fire occurs in inaccessible pocosin, swamp and marsh. Fire behavior characterized by low intensity with low potential for rapid spread. High probability of being rained out before it affects communities.</p>	<p>Monitor fire behavior, establishing a maximum management area (MMA) and management action points (MAPs) to achieve management objectives. Establish trigger points for each MAP. Use point protection and or partial perimeter control to confine fire within MMA boundary. Keep fire confined within natural or existing man-made barriers. Use direct attack from the air to slow down the fire from reaching key areas. Use indirect attack by burning out from the ground and air to keep the fire contained and protect values.</p>	<p>Monitor from the ground and air.</p> <p>Use retardant or water drops from aircraft as needed, to guide the fire or buy time.</p> <p>Burn out fuels ahead of the fire using aerial ignitions (or ground ignitions from accessible areas) along potential barriers to control or slow the spread of fire.</p>
<p>Fire occurs on margins of communities or accessible edges of the FMU.</p>	<p>Direct or indirect attack with ground and/or aviation resources. Establish MMAs for each fire situation that escapes initial attack. Trigger points with MAPs may be established to achieve perimeter control or point protection as needed to meet objectives.</p>	<p>Use engines with hose lays to reach accessible locations for point protection and to assist in burnout operations and perimeter defense.</p> <p>Use tractors to plow directly on the fire where needed to achieve objectives set in MAPs.</p> <p>Use aircraft for direct attack with aerially applied water or retardant as needed.</p> <p>Apply indirect attack suppression strategy using engines, tractors, aircraft, etc. where appropriate to protect values by removal of or burning out fuels ahead of the fire's advance.</p>
<p>Fire occurs anywhere in FMU where threat to communities and other values are imminent.</p>	<p>Point protection strategy where needed, combined with direct or indirect attack suppression strategy as appropriate to meet objectives.</p>	<p>Use engines and VFD resources to protect values and hold the fire within desired containment boundaries. Use tractor plows to improve natural and man-made barriers where accessible. Use ground and/or aerial ignition to burn out control lines and protect values. Use aerially applied fire retardant or water to slow down or redirect the fire where feasible.</p> <p>If needed, develop a large-scale water handling plan to flood areas adjacent to the perimeter to mitigate risk of escape using water handling equipment.</p>

3.2.3. FMU 1 Values to Protect

Values to Protect	Description	Risk
Threatened & Endangered Species		
red wolf	critical habitat	endangered species
Air Quality		
Dare County communities and transportation corridors	potential smoke impacts to air quality and visibility	life, human health, socio-economic impacts
WUI		
Manns Harbor	state recognized Community At Risk (CAR)	life, property, human health, socio-economic impacts
East Lake	state recognized CAR	life, property, human health, socio-economic impacts
Cultural Resources		
cemeteries	2 cemeteries around East Lake churches	cultural
Natural Resources		
wetlands	sensitive organic soils	natural
Special Designations		
SNHA	significant natural heritage area	natural, wildlife
East Lake WSA	refuge wilderness study area (WSA)	wilderness attributes
Recreation		
hunting	public hunting available in FMU	life, human health, recreation
fishing	public fishing available in navigable waterways	life, human health, recreation
public boat ramps	NCWRC boat ramp on Mashoes Rd. and 3 unimproved boat ramps	life, property, human health
Right-of-ways		
utility right-of-way	utility poles and telephone boxes along Mashoes Rd. and SR 1102	utilities
Infrastructure		
County of Dare East Lake Landfill	old county landfill and exchange center	hazardous materials
Towers	3 communications towers along US 64	community infrastructure
US Highway 64	major transportation corridor	highway safety

3.2.4. FMU 1 Safety Considerations

Trafficability in this FMU is very poor in most places. More of the FMU is accessible by boat than by vehicle due to limited roads and trafficability for equipment. Escape routes and safety zones are scarce with roads, canals, and large water sources providing good breaks. Because of the potential for re-burn in these fuels, only well burned, blackened areas should be considered safe. Power poles along Mashoes Road (State Road 1113) and Lake Neighborhood Road (SR 1102) can also be potentially hazardous during fire operations. The end of Lake Neighborhood Road is often used as an illegal trash dump site that, along with the East Lake Landfill, could pose a potential hazardous material danger to firefighters and the public if the area burned.

The FMU is open to the public mostly by foot access from a few roads or from a boat. There is a public boat ramp to East Lake maintained by the NCWRC and an unimproved boat ramp off Mashoes Road that accesses the Croatan Sound. There are also unimproved boat ramps off of Brier Hall Road and Deep Bay Road. Except for a few acres by the Alligator River and the Community of Mashoes, the entire FMU is open to public hunting with dogs.

Mashoes Road is a paved two-lane road leading from Manns Harbor to the community of Mashoes. It receives relatively light traffic. US Highway 64 is the major road of concern for traffic hazards caused by smoke. This is currently a two-lane highway that receives heavy traffic, especially from beach tourists on the weekends and during the summer vacation season. NCDOT is working on expanding this highway to four-lanes. Road construction will magnify any smoke hazards on the road and could constrain fire operations.

3.3. Fire Management Unit 2

3.3.1. FMU 2 Description

FMU 2 (38,410 acres) is located on the eastern edge of the refuge. It is divided into two major sections: one to the north and the other to the south of Stumpy Point Bay. The northern section is bounded by US 64, Croatan Sound and US 264 and also includes 34.5 acres on Roanoke Island. The triangle-shaped block of land between US 64, US 264, and the farm fields (FMU 3) is also included in FMU 2. The Callahan Creek WSA is located just south of Manns Harbor in a canal free area adjacent to Croatan Sound. The southern section of FMU 2 lies south of Stumpy Point Bay between US 264, Pamlico Sound and the south boundary of the refuge.

The refuge has a Memorandum of Understanding (MOU) to allow prescribed burning in conjunction with refuge lands around the Dare County Landfill (140 acres). Refuge land on Roanoke Island lies south of US Business 64 across from the Fort Raleigh National Historic Site. This area is the site for a proposed Visitor Center for Alligator River NWR. A subdivision is currently being developed adjacent to refuge lands.

Ownership	Acres
Alligator River NWR	38,410
Non-refuge	140
Total in FMU	38,550

The vegetation in FMU 2 transitions from brackish marsh along the sounds to low and high pocosin along the highways. Soils are very wet, and attempts to drain and develop this area in the past resulted in a maze of canals and v-ditches. These ditches make access difficult for fire tractors, and water levels in the canals respond rapidly to the rising and falling of sound water levels. The ditches allow salt water intrusion during storm events which has caused some vegetation shifts.

About half of the FMU has been burned over the last ten years. Smoke management and weather conditions have hindered burning efforts in units directly to the north and south of Stumpy Point Bay, resulting in high fuel loads. Fuel types range from FM 3 in the marsh to FM 4 in the pocosins and in the marsh/ shrub transition zones. Prescribed burns have created a large area of FM 7 in the Quadrangle Fire Compartment with smaller areas near Stumpy Point and in the Long Shoal River area. Patches of FM 9 occur in the FMU with widely scattered areas of FMs 1, 5, and 6. Periodically, there may also be some FM 10 and 11 when pine beetle outbreaks or blowdowns cause heavier concentrations of downed, dead woody fuels.

3.3.2. FMU 2 Objectives and Constraints

The primary hazardous fuel consideration in this FMU is the creation of two WUI conflagration barriers to protect the communities neighboring the refuge from fires spreading off the refuge. Hazardous fuel reduction projects may include prescribed burning, mechanical and herbicide treatments. Specific fuel treatment objectives for this FMU include:

1. Conduct prescribed burning in priority burn units which compose the WUI conflagration barriers striving for a 3-5 year fire return interval. The Stumpy Point WUI conflagration barrier includes units in the North Stumpy Point Compartment. The Manns Harbor WUI conflagration barrier includes units in the Quadrangle Compartment and Units 2.2.1 and 2.2.2 in the Roanoke Marshes Compartment.
2. Conduct prescribed burning in designated burn units in the remainder of the FMU on a 3-8 year rotation with priority given to burning in previously unburned units as appropriate.
3. Refuge resources or contractors will annually maintain approximately 33 miles of firebreaks in this FMU for wildfire control and in preparation for prescribed burn treatments as needed.
4. Refuge resources will annually maintain approximately 24 miles of roads in this FMU in preparation for wildfire control, prescribed burn treatments, and road maintenance as needed.

The table below gives examples of potential AMRs for FMU 2. Specific AMR objectives for this FMU include:

1. Protect communities and private structures through cooperation with the NCDNR, Stumpy Point VFD, and Manns Harbor VFD.
2. Confine the fire to the smallest logical containment area possible.
3. Prevent smoldering ground fires to the extent possible.
4. Confine fires east of US 264 or the farm fields and south of US 64 if a fire occurs near the northern end.
5. Consider wilderness values and MIST in selection of AMR for fires occurring in the Callahan Creek WSA.

FMU 2 Appropriate Management Response

Potential situations	Potential strategies	Potential tactics
<p>Fire occurs in accessible pocosin, swamp and marsh. Potential for significant ground fire is minimal. KBDI is below 400.</p> <p>Fire behavior characterized by low intensity with low to moderate potential for rapid spread. High probability of fire being contained before it affects communities.</p>	<p>Keep fire confined within the nearest prescribed burn unit or compartment by using indirect attack suppression strategy within natural or existing man-made barriers.</p> <p>Use direct attack from the air to slow down the fire from reaching key areas.</p> <p>Use direct attack from the ground where a quick decisive success can be had without high risks to personnel.</p>	<p>Monitor from the ground and air.</p> <p>Locate established containment lines which can be utilized to make effective control lines and improve as needed.</p> <p>Use retardant or water drops from aircraft to guide the fire or buy time.</p> <p>Burn out from containment lines using ground and/or aerial ignition around the edges of communities and other values as well as containment boundaries if it appears that fire may threaten.</p>
<p>Fire occurs on margins of communities or accessible edges of the FMU.</p>	<p>Direct or indirect attack using engines, tractors, boats, hand crews and portable pumps and hoses.</p> <p>Trigger points with MAPs may be established to achieve perimeter control or point protection as needed to meet objectives.</p>	<p>Use engines with hose lays to reach accessible locations for point protection and to assist in burnout operations and perimeter defense.</p> <p>Use tractors to plow directly on the fire where needed to achieve objectives set in MAPs.</p> <p>Use aircraft for direct attack with aurally applied water or retardant.</p> <p>Apply indirect attack strategy using engines, tractors, aircraft, etc. where appropriate to protect values by removal of or burning out fuels ahead of the fire's advance.</p>
<p>Fire occurs anywhere in FMU when strong winds are pushing it across the woodlands and marsh. The threat to communities or other high values are imminent.</p>	<p>Use a point protection strategy where needed, combined with a direct or indirect attack suppression strategy as appropriate to meet objectives.</p>	<p>Use engines and VFD resources to protect values and hold the fire within desired containment boundaries. Use tractor plows to improve natural and man-made barriers where accessible.</p> <p>Use ground and/or aerial ignition to burn out control lines and around values. Use aurally applied fire retardant or water to slow down or redirect the fire where feasible.</p>
<p>Fire occurs in unit when conditions are extremely dry with potential for ground fire being high</p>	<p>Use a direct attack suppression strategy to try and keep the fire as small as possible.</p> <p>If this fails, must drop back to the nearest logical firebreak or barrier and go indirect.</p>	<p>Utilize tractor plows supported by engines and aircraft.</p> <p>Utilize nearest firebreak or natural barrier and burn out with ground and/or aerial ignition. Use tractors and engines for holding resources. Reinforce lines with retardant drops if needed.</p> <p>As needed, develop a large-scale water handling plan to flood areas adjacent to the perimeter and mitigate risk of escape.</p>

3.3.3. FMU 2 Values to Protect

Values to Protect	Description	Risk
Threatened & Endangered Species		
red wolf	critical habitat	endangered species
Air Quality		
Dare County communities and transportation corridors	potential smoke impacts to air quality and visibility	life, human health, socio-economic impacts
WUI		
Stumpy Point	federal CAR	life, property, human health, socio-economic impacts
Manns Harbor	state recognized CAR	life, property, human health, socio-economic impacts
Manteo	Community of Interest (COI)	life, property, human health, socio-economic impacts
Cultural Resources		
Fort Raleigh National Historic Site	NPS managed site	cultural, historic, recreation
Natural Resources		
nesting sites	bald eagle nests along Alligator River	wildlife
wetlands	sensitive organic soils	natural
Special Designations		
Callahan Creek WSA	refuge wilderness study area	wilderness attributes
SNHA	significant natural heritage area	natural, wildlife
Recreation		
hunting	public hunting available in FMU	life, human health, recreation
fishing	public fishing available in navigable waterways	life, human health, recreation
Creef Cut Wildlife Trail	kiosk, boardwalk, signs, bathrooms	public use, refuge infrastructure
boat ramps	unimproved boat ramp at Long Shoal River and Point Peter Rd.	life, human health, recreation
Dare County gun range	county operated public gun range with residence	life, property, human health
fishing cabins	cabins on Durants Island and eastern marshes near Mashoes	property
Right-of-ways		
utility right-of-way	utility poles and telephone boxes along US 64 and 264	community infrastructure
gas line	underground gas line leading to home	utilities
Infrastructure		
NCDFR DCBR Shop	State offices and equipment	property, government facility
US Highway 264	major transportation corridor	highway safety
Towers	microwave tower on US 64 near Milltail	community infrastructure
US Highway 64	major transportation corridor	highway safety
utility transfer station	along US 264 south of Stumpy Point	community infrastructure
Dare County Landfill	county landfill and exchange station	hazardous material
water treatment plant	under construction at Stumpy Point	community infrastructure
NCDOT Ferry Shipyard	State offices and ferry repair site	government facility

3.2.4. FMU 2 Safety Considerations

While tractors can and have been used to control fires in this FMU, they generally have a great amount of difficulty due to the soils and v-ditches. Use of tractor plows in this FMU requires special mitigation due to safety concerns for personnel from thick fuels and very poor trafficability soils in some locations (such as Callahan Creek). Close coordination with air support is required. Strike Team Leaders or the most experienced equipment operators should be used to lead initial attack operations in this FMU. South of Stumpy Point Bay, access into the FMU is limited because of the wide canal running alongside US 264 and cross canals that make some burn units into islands. Roads, canals, sounds and bays are good safety zones. Only well burned, blackened areas should be considered completely safe in the event of a major wind shift because of the potential for re-burn in these fuels.

Power poles along the highways and Mashoes Road can be potentially hazardous during fire operations. The Dare County Landfill adjoining the FMU is a large, potential hazmat danger. Although the berm along Link Road has been heightened, the Dare County Gun Range poses another potential safety hazard for firefighters if this berm is not properly maintained.

The refuge owned portions of this FMU are open to the public mostly by foot access from a few roads or from a boat. There are unimproved boat ramps at Long Shoal River and Point Peter Road. Except for a few acres by the Creef Cut Wildlife Trail and the Community of Mashoes, the entire FMU is open to public hunting with retrieving dogs.

U.S. Highways 64 and 264 are the major roads of concern for traffic hazards caused by smoke. US 64 is currently a two-lane highway that receives heavy traffic, especially from beach tourists on the weekends and during the summer vacation season. NC DOT is working on expanding this highway to four-lanes. Road construction will magnify any smoke hazards on the road and could constrain fire operations. US 264 does not receive as much traffic, but it has narrow road shoulders that make unloading heavy equipment a traffic and firefighter safety hazard.

3.4. Fire Management Unit 3

3.4.1. FMU 3 Description

FMU 3 (6,314 acres) consists of the refuge's agricultural and moist soils management fields and associated wooded blocks just south of US 64. This area has water control capabilities that allow the entire FMU to be flooded or pumped dry. Vegetation is controlled by a combination of farming activity and/or prescribed burning with migratory waterfowl and habitat for the endangered red wolf being the primary management considerations. In any given year some fields will lay fallow, especially in the moist soil management areas, allowing the accumulation of fine, flashy fuels. There are wooded blocks within the perimeter of the water control dikes adjacent to the farm fields. Soils are primarily mineral with high organic content in the fields, but have a heavy root mat and organic matter concentrations in the wooded blocks.

While the representative fuel models stay relatively constant in the FMU, the exact fields where they can be found change with moist soil management and crops planted. Generally, the crop or fallow fields are considered to be FM 3. The wooded areas are FM 9 with some FM 7 or 5.

3.4.2. FMU 3 Objectives and Constraints

The primary fuel treatment consideration in this FMU is to enhance the Manns HarborWUI conflagration barrier and protect the community of East Lake. Hazardous fuel reduction projects may include prescribed burning, mechanical and herbicide treatments. Specific fuel treatment objectives for this FMU include:

1. Refuge resources will annually maintain approximately 14 miles of roads in this FMU in preparation for wildfire control, prescribed burn treatments, and road maintenance as needed.
2. Conduct prescribed burns in the farm fields and filter strips at intervals prescribed by refuge management to allow for a rotation of wildlife cover areas. This will usually be on a 3 year cycle in most cases.
3. Investigate and develop burn plans for desired wood blocks to conduct prescribed burns, striving for a 5-8 year fire return interval.
4. Treat dikes, ditch banks, and managed waterfowl impoundments with prescribed burns as prescribed by refuge management.

The table below gives examples of potential AMRs for FMU 3. Specific AMR objectives for this FMU include:

1. Contain the fire within existing fields and impoundments.
2. Protect farm equipment, pumping stations, dikes, and other refuge improvements from wildfires.
3. Contain the fire south of US 64 and off adjacent private property.

FMU 3 Appropriate Management Response

Potential situations	Potential strategies	Potential tactics
Fires occur in farm fields where it is spreading.	Burn out and hold within nearest identified logical field or burn unit.	Use ground ignition to burn out to the nearest logical firebreak identified Use tractor with disk to create a good firebreak and burn out from there.
Fire escapes from fields into nearby woodlands and is spreading.	Use direct attack suppression strategy to arrest the spread of fire and bring it under control. Use indirect attack suppression strategy to contain the fire within a logical block of land.	Direct attack will utilize engines, tractor plows or hand crew as needed. Indirect attack will utilize ground ignition methods and deploying holding forces to keep the fire contained within key locations.
Fire is escaping into the fields from nearby woodlands responding to strong winds pushing the fire across the refuge. The fields are a last resort to stop the spread of the fire.	Use direct or indirect attack suppression strategy or combination, as needed to stop the fire before it crosses the fields to the woodland on the other side.	Direct attack with type 6 engines and tractor plows or even farm tractors with disc/harrows can be effective at stopping fires in crop stubble. Using indirect attack strategy by setting burnout fires to stop the forward spread of fire across the fields. Use aviation resources as needed to support operations.

3.4.3. FMU 3 Values to Protect

Values to Protect	Description	Risk
Threatened & Endangered Species		
red wolf	critical habitat	endangered species
Air Quality		
Dare County communities and transportation corridors	potential smoke impacts to air quality and visibility	life, human health, socio-economic impacts
WUI		
East Lake	state recognized CAR	life, property, human health, socio-economic impacts
Cultural Resources		
airplane wreck	wrecked WWII bomber in wooded block	historical
Natural Resources		
nesting sites	bald eagle nests along Alligator River	wildlife
wetlands	sensitive organic soils	natural
Recreation		
hunting	public hunting available in FMU	life, human health, recreation
fishing	public fishing available in navigable waterways	life, human health, recreation
Right-of-ways		
utility right-of-way	utility poles and telephone boxes along US 64	community infrastructure
Infrastructure		
Dare County Landfill	county landfill and exchange center	hazardous material
farm equipment	cooperative farming equipment stored in farm fields	property,, socio-economic impacts
U.S. Highway 64	major transportation corridor	highway safety
Refuge property		
East Lake Maintenance Facility	office, garage, equipment housing, fire cache, and storage space	government facility
Pump stations	stations in Creef and Laurel Bay fields	government property
weather station	Remote Access Weather Station	government property
Volunteer Site	building with washing, meeting, and computer access for volunteers in RVs	life, government facility, private property

3.4.4. FMU 3 Safety Considerations

The narrow v-ditches in the farm fields are often overgrown and difficult to spot when lighting from equipment. Operators must be careful not to hang equipment up in these ditches. The flashy fuels in the farm fields can exhibit surprisingly fast rates of spread and surprise firefighters working in the light fuels.

This FMU is open to public access by foot year round with the roads open to vehicles in September, October, and February. Except for a few areas near refuge facilities the FMU is open to public hunting for deer and small game in accordance with State seasons.

U.S. Highway 64 is the major road of concern for traffic hazards caused by smoke. US 64 is currently a two-lane highway that receives heavy traffic, especially from beach tourists on the weekends and during the summer vacation season. NC DOT is working on expanding this highway to four-lanes. Road construction will magnify any smoke hazards on the road and could constrain fire operations.

3.5. Fire Management Unit 4

3.5.1. FMU 4 Description

FMU 4 (19,360 acres) is generally bounded by FMU 3 to the north, US Highway 264 to the east, the Dare County Bombing Range (DCBR) to the south, and Milltail Creek and Milltail Road to the west. This unit is the most heavily roaded on the refuge with numerous loop roads and dead-end roads dissecting it. The roads, canals and water structures allow for good access and some water control capabilities for about one third of this FMU. Some houses and businesses of Stumpy Point adjoin this unit, though the village is mostly across US 264 (in FMU 2). The NCDNR maintenance facility at the DCBR Stumpy Point Shop is also adjacent to this unit.

The DCBR Fire Management Plan influences refuge fire operations in this FMU. Project collaboration, and in particular prioritization of fuel treatments, will be conducted in a cooperative fashion with the DCBR. Alligator River NWR has an agreement with the US Air Force to conduct joint-jurisdictional fuel treatments in burn units that cross ownership boundaries.

Ownership	Acres
Alligator River NWR	19,360
DCBR (joint-jursidictional units)	1,386
Total in FMU	20,746

The land is very flat and lies from a few inches to 10 feet above sea level. Vegetation generally transitions from low shrub pocosin to high tree pocosin and pond pine woodlands. There are Atlantic white cedar stands along the edges of Milltail Creek along with other scattered locations, including a few plantations. Relict stands of canebreak occur as understory vegetation beneath some pond pine overstories.

Only about one quarter of FMU 4 has been prescribed burned in the last 10 years, leaving a high fuel loading in most of the FMU. FM 4 dominates in the pocosin areas. Between Milltail and Koehring Roads there are large areas of FM 5, 7, and 9. South of the County Landfill there is also a large area of FM 5. Periodically, there may also be some FM 10 and 11 when pine beetle outbreaks or blowdown cause heavier concentrations of downed, dead woody fuels.

3.5.2. FMU 4 Objectives and Constraints

The primary hazardous fuel consideration in this FMU is the creation of a WUI conflagration barrier to protect the communities neighboring the refuge from fires spreading off the bombing range. Hazardous fuel reduction projects may include prescribed burning, mechanical and herbicide treatments. Specific fuel treatment objectives for this FMU include:

1. Conduct prescribed burning in priority burn units which compose the Stumpy Point WUI conflagration barriers striving for a 3-5 year fire return interval. This includes units in the North Navy Compartment, South Koehring Unit 4.2.4, and Units 4.3.6-8 in the Long Curve Compartment.
2. Pursue funding to construct firebreaks in the DBR East Fire Compartment to facilitate prescribed burning within the next 5 years. This compartment is also part of the Stumpy Point WUI conflagration barrier.
3. Conduct prescribed burning in designated burn units in the remainder of the FMU striving for a 3-8 year fire return interval. Work to develop burn plans for previously unburned units and elevate their burning priority as appropriate.
4. Refuge resources or contractors will annually maintain approximately 18 miles of firebreaks in this FMU for wildfire control and in preparation for prescribed burn treatments as needed.
5. Refuge resources will annually maintain approximately 38 miles of roads in this FMU in preparation for wildfire control, prescribed burn treatments, and road maintenance as needed.
6. Conduct fuel treatments in a manner that minimizes impacts to military operations at the DCBR.

The table below gives examples of potential AMRs for FMU 4. Specific AMR objectives for this FMU include:

1. Protect communities and private structures cooperating with NCDNR and Manns Harbor VFD.
2. Contain fires west of US 264 and south of the farm fields.
3. Minimize impacts to DCBR military operations in selection of an AMR.

FMU 4 Appropriate Management Response

Potential situations	Potential strategies	Potential tactics
<p>Fire occurs in accessible pocosin, swamp and marsh. Potential for significant ground fire is minimal. KBDI is below 400.</p> <p>Fire behavior characterized by low intensity with low to moderate potential for rapid spread. High probability of fire being contained before it affects communities.</p>	<p>Keep fire confined within the nearest prescribed burn unit or compartment by using indirect attack suppression strategy within natural or existing man-made barriers.</p> <p>Use direct attack from the air to slow down the fire from reaching key areas.</p> <p>Use direct attack from the ground where a quick decisive success can be had without high risks to personnel.</p>	<p>Monitor from the ground and air.</p> <p>Locate established containment lines which can be utilized to make effective control lines and improve as needed. Use retardant or water drops from aircraft as needed, to guide the fire or buy time. Burn out from containment lines using ground ignition methods and/or aerial ignition around the edges of communities and other values as well as containment boundaries if it appears that fire may threaten.</p>
<p>Fire occurs anywhere in FMU when strong winds are pushing it across the woodlands and marsh and the threat to high values is imminent.</p>	<p>Use a point protection strategy where needed,</p> <p>Use indirect attack suppression strategy as appropriate to get out ahead of the fire and stop its forward advance.</p> <p>Use direct attack suppression strategy where effective in helping contain the fire.</p>	<p>Use engines and VFD resources to protect values and hold the fire within desired containment boundaries. Use tractor plows to improve natural and man-made barriers where accessible. Use ground and/or aerial ignition to burn out control lines and around values. Use tractor/plows for direct attack on the flanks and head of the fire where feasible and safe. Use aerially applied fire retardant or water to support operations.</p>
<p>Fire occurs in unit when conditions are extremely dry with potential for ground fire being high.</p>	<p>Use a direct attack suppression strategy to try and keep the fire as small as possible. If this fails, must drop back to the nearest logical fire break or barrier and go indirect as needed.</p>	<p>Utilize tractor plows supported by engines and aircraft to provide a direct attack on the fire. Fall back as needed to nearest firebreak or natural barrier and burn out with ground ignition or aerial ignition or combination. Use tractors and engines for holding resources. Reinforce lines with retardant drops if needed.</p>

3.5.3. FMU 4 Values to Protect

Values to Protect	Description	Risk
Threatened & Endangered Species		
red wolf	critical habitat	endangered species
Air Quality		
communities and transportation corridors	potential smoke impacts to air quality and visibility in Dare County	life, human health, socio-economic impacts
WUI		
Stumpy Point	federal CAR	life, property, human health
Natural Resources		
wetlands	sensitive organic soils	natural
Special Designations		
SNHA	significant natural heritage area	natural, wildlife
Recreation		
hunting	public hunting available in FMU	life, human health, recreation
fishing	fishing available in navigable waterways	life, human health, recreation
Right-of-ways		
Utility right-of-way	utility poles and telephone boxes along U.S. 264 and Navy Shell Rd.	community infrastructure
Infrastructure		
U.S. Highway 264	major transportation corridor	highway safety
Dare County Landfill	county landfill	hazardous material
NCDNR DCBR Shop	State offices and equipment	property, government facility
Navy Range	target range, buildings, equipment	property, government facility

3.5.4. FMU 4 Safety Considerations

Soils can be very wet in this FMU, but it has better trafficability overall than most of the other FMUs, although the network of canals and v-ditches can make access difficult. The potential for escapes from poor quality control lines and ground fire potential in the organic soils during high drought periods must be considered when developing initial attack strategies. If ground resources are used, extreme caution should be taken with a trained air-attack qualified pilot or observer as a prerequisite for any ground attack. Power poles along the US 264 and Navy Shell Road can be potentially hazardous during fire operations. The Dare County Landfill adjoining the FMU is a large, potential hazmat danger. Given the proximity to the DCBR, unexploded ordnances may be present in the FMU, especially in the joint-jurisdiction burn units. Coordination of fire operations with range personnel is vital to safety of personnel working on or near the DCBR lands.

The refuge owned portions of this FMU are open to the public. The entire FMU is open to public hunting with dogs. The DCBR is generally open to the public on weekends and the range is managed by the State for public hunting.

US Highway 264 is the major road of concern for traffic hazards caused by smoke. The road also has narrow road shoulders that make unloading heavy equipment a traffic and firefighter safety hazard. Air traffic over the DCBR is restricted, but refuge staff will follow established

protocols for clearing flights through or near the range to avoid any collisions with military aircraft.

3.6. Fire Management Unit 5

3.6.1. FMU 5 Description

FMU 5 (28,720 acres) is between FMU 4 and Alligator River, south of the farm fields and north of Whipping Creek. The Alice Nichols WSA is in the southwest corner of the FMU, extending into FMU 7. The land is very flat and lies from a few inches to 10 feet above sea level. Mineral soils occur as islands within this unit; however, the predominant soils are organic mucks. Some of the wettest and deepest organic soils on the refuge occur within this unit. Vegetation generally transitions moving west to east from low-lying cedar swamps and gum/cypress swamps to loblolly pine and pine/hardwood stands with pine occurring on islands of higher ground amid the wetter cypress or pine-hardwood swamps. Floating bogs have been documented, especially along Milltail and Whipping Creeks.

FMU 5 contains a heavy mix of FMs 5, 7, and 9. FM 4 is mostly found close to the Alligator River. There are large areas of FM 6 along Dry Ridge Road and around the in-holding south of Alligator Road, and a thin strip of FM 6 along the edge of Alligator River.

3.6.2. FMU 5 Objectives and Constraints

Hazardous fuel reduction projects may include prescribed burning, mechanical and herbicide treatments. Specific fuel treatment objectives for this FMU include:

1. Begin prescribed burning in the Sandy Ridge Facility burn unit in the next 3 years to reduce hazardous fuels and ticks in this area.
2. Refuge resources will maintain the firebreak around the Sandy Ridge Facility for wildfire control and in preparation for prescribed burn treatments as needed.
3. Refuge resources will annually maintain approximately 31 miles of roads in this FMU in preparation for wildfire control and road maintenance as needed.

The table below gives examples of potential AMRs for FMU 5. Specific AMR objectives for this FMU include:

1. Contain fires west of Milltail Road and Milltail Creek.
2. Protect the Sandy Ridge Captive Wolf Facility and the residences at East Lake.
3. Consider wilderness values and MIST in selection of AMR for fires occurring in the Alice Nichols WSA.

FMU 5 Appropriate Management Response

Potential situations	Potential strategies	Potential tactics
<p>Small fire burning within very wet areas with very poor access with low potential for escape or damage to values.</p>	<p>Develop MMA and MAPs with trigger points and monitor fire behavior. Use point protection and or partial perimeter control to confine fire within MMA boundary.</p> <p>Use indirect attack suppression strategy.</p> <p>Use direct attack from the air and ground as needed to meet objectives.</p>	<p>Monitor from aircraft. Set trigger points for taking indirect attack suppression action along containment lines.</p> <p>Reinforce containment lines where needed and possible. Use burnout fire with ground or aerial ignition methods if needed to improve lines and remove fuels from the fire. Use aircraft to slow or divert the fire as needed to complete firebreaks or burnout operations.</p> <p>Use direct attack where safe and feasible and is determined to best meet objectives.</p>
<p>Fire occurs during a drought and is consuming large acreages of land, threatening to spread to other parts of the refuge.</p>	<p>Indirect attack suppression strategy using natural and man made firebreaks.</p> <p>Use direct attack where it becomes safest and most effective method.</p>	<p>Use flextracked tractor/plows with aerial resources to burn out containment lines around pre-existing control lines (roads, swamps, etc.)</p> <p>Direct attack with flextracks may be feasible in more accessible locations.</p> <p>If needed, develop a large-scale water handling plan to flood areas adjacent to the perimeter and mitigate risk of escape, using irrigation equipment, volume pumps and other water handling equipment.</p>

3.6.3. FMU 5 Values to Protect

Values to Protect	Description	Risk
Threatened & Endangered Species		
red wolf	critical habitat	endangered species
Air Quality		
Dare County communities and transportation corridors	potential smoke impacts to air quality and visibility	life, human health, socio-economic impacts
WUI		
East Lake	state recognized CAR	life, property, human health, socio-economic impacts
private cabins	in-holdings on Buffalo City Road and Alligator River have structures	life, property, human health, socio-economic impacts
Cultural Resources		
old shingle plant	remains of cedar shingle plant on Buffalo City Road	historical
Sandy Ridge cemetery	old cemetery near wolf pens	cultural
Natural Resources		
wetlands	sensitive organic soils	natural
nesting sites	potential bald eagle	wildlife
Special Designations		
SNHA	significant natural heritage area	natural, wildlife
Alice Nichols WSA	refuge wilderness study area	wilderness attributes
Recreation		
hunting	public hunting available in FMU	life, human health, recreation
Sandy Ridge Wildlife Trail	signs, bridge, boardwalk, observation platform, parking area, bathroom	life, human health, recreation, refuge infrastructure
Milltail Paddling Trails	4 canoe/ kayak trails in Milltail Creek and Sawyer Lake, parking area	life, human health, recreation
fishing	public fishing available in navigable waterways	life, human health, recreation
Right-of-ways		
utility right-of-way	utility poles along Buffalo City Road	community infrastructure
Infrastructure		
U.S. Highway 64	major transportation corridor	highway safety
Air Force Range at DCBR	military target range with buildings and equipment; training missions	property, government facility and interests
Navy Range at DCBR	military target range with buildings and equipment; training missions	property, government facility and interests
Refuge property		
Buffalo City Cabin	refuge housing for interns on Buffalo City Road	life, government facility
Sandy Ridge Captive Wolf Facility	pens, fences, and storage sheds used by red wolf program to house, feed, and care for captive red wolves	endangered species, government facility
Wolf Cabin	refuge housing for interns near wolf pens	life, government facility

3.6.4. FMU 5 Safety Considerations

Location and seasonal or tidal variations in soil moisture can considerably affect trafficability for equipment in this FMU. Several former refuge roads are no longer maintained in this FMU with only two roads extending all the way to the Alligator River. Primary road access would be through the DCBR, which has restricted access. Escape routes and safety zones are very limited. Roads, canals, creeks and rivers are good safety zones. Only well burned, blackened areas should be considered completely safe in the event of a major wind shift because of the potential for re-burn in these fuels.

The FMU is open to the public, but many of the roads are closed to vehicles year round or seasonally. The part of the FMU north of Milltail Creek is open to public hunting with dogs. The FMU south of Milltail Creek is open to hunting without dogs and vehicles are not allowed on the roads. There is a parking lot for the Sandy Ridge Wildlife Trail and Milltail Canoe Trails at the end of Buffalo City Road. This is a state maintained road that could potentially have traffic at any time of day and also provides access to a private hunting cabin and refuge intern housing. The private in-holding along the Alligator River is only accessible by boat. Air traffic over the DCBR is restricted, but refuge staff will follow established protocols for clearing flights through or near the range to avoid any collisions with military aircraft.

3.7. Fire Management Unit 6

3.7.1. FMU 6 Description

FMU 6 (11,240 acres) lies south of the DCBR inside the large curve of US 264. Low pocosin vegetation dominates the center of the FMU with high pocosin along the perimeter. The entire FMU composes the Quaking Bog WSA, also called the 264 Low Pocosin. This unique area is part of an ombrotrophic (nutrient limited) low pocosin that exhibits some of the lowest fertility, and hence the slowest vegetation growth, in the Southeastern United States. Approximately half of this unique plant community extends onto the DCBR. The 264 Low Pocosin, along with the Sheep Ridge Wilderness Area on the Croatan National Forest, is one of the few remaining examples of undrained and undisturbed low pocosin.

The historic vegetation for this FMU was low pocosin or savannah where frequent fires maintained the entire area in early succession. Significant numbers of bogs with insectivorous plants have been found in burn holes resulting from past fires. Older residents of Stumpy Point remember meadows existing in the 1920s and 30s where there are now dense thickets of brush and pond pine. The pond pine that dominates the overstories of the high pocosin areas range in height from 20 to 70 feet with red bay and some loblolly pine mixed in. Understories consist of shrubs, cane, and herbaceous vegetation.

This FMU is dominated by FM 6 in the center with FM 4 surrounding it. FM 3 is found in the marshes near Lake Worth Road. Small areas of FM 9 can also be found by Lake Worth Road and along US 264 near Long Shoal River.

3.7.2. FMU 6 Objectives and Constraints

The lack of firebreaks and roads in this FMU makes it currently unburnable under state smoke management guidelines, and also limits wildfire control suppression objects, especially under drought conditions when concerns are high for organic soils. Specific fuel treatment objectives for FMU 6 are:

1. Continue to investigate and collaborate with fire management partners to find ways to safely reintroduce fire to the 264 Low Pocosin and improve the health of this unique ecosystem.
2. Continue emphasis on burning units in adjacent FMUs in order to ensure containment of fire in the 264 Low Pocosin.
3. Refuge resources will maintain 735 feet of firebreak along the refuge boundary with the private residence south of Lake Worth Road for wildfire control.

The table below gives examples of potential AMRs for FMU 6. Specific AMR objectives for this FMU include:

1. Provide protection for Stumpy Point Community, including property, egress, and ingress in cooperation with NCDNR and Stumpy Point VFD.
2. Keep the fire west and north of US 264, west of Long Curve Rd. and south of Lake Worth and Jackson road, and east of the Air Force impact range and Faircloth Rd.
3. Consider wilderness values and MIST in selection of AMR for fires occurring in the Quaking Bog WSA.

FMU 6 Appropriate Management Response

Potential situations	Potential strategies	Potential tactics
<p>Small man-caused fire discovered along roadway and burning a short distance into the FMU. Can be readily suppressed with timely IA resources.</p>	<p>Direct attack.</p>	<p>Use ground and aviation resources. Deploy engines with hose lays first to reduce impacts to the area. If the fire is too large, spreading too quickly or out of reach, deploy flextracked fire tractors. Adjust plow depth to the minimum needed to reach moist soil. Drop plow altogether if a crushed line will be adequate.</p>
<p>Small fire is discovered within the interior of this FMU. Conditions are fairly moist with low ground fire potential, though surface fuels are burning.</p>	<p>Develop MMA and MAPs with trigger points and monitor fire behavior. Use point protection and or partial perimeter control to confine fire within MMA boundary.</p> <p>Use indirect attack suppression strategy with full perimeter control to achieve objectives.</p> <p>Direct attack suppression strategy.</p>	<p>Monitor from aircraft. Set trigger points for taking indirect attack suppression action along containment lines.</p> <p>Reinforce containment lines where needed and possible. Use burnout fire by ground or aerial ignition if needed to improve lines and remove fuels from the fire. Use aircraft to slow or divert the fire as needed to complete firebreaks or burnout operations.</p> <p>Use direct attack where safe and feasible and is determined to best meet objectives. Flextracked fire tractors anchor into the fire, plow the flanks, and pinch the head. They will plow several lines around the fire to ensure containment. (This only works with adequate ground moisture to prevent ground fire from burning through lines.)</p>
<p>Fire escapes off one of the ranges and burns into the 264 Pocosin onto refuge lands. Fire already too large for effective direct attack and is moving rapidly toward the highway. Organic soils are too dry for direct attack to be an option for containment.</p>	<p>Indirect attack suppression strategy is needed to contain the fire within the compartment boundaries (USAF and FWS) along Ralph Road, Lake Worth Road, US 264 and the AF Range.</p>	<p>Use aerial and ground ignition backed up with tractor plows and engines for holding to contain the fire within the compartment boundaries.</p> <p>Use aerially applied retardant or water drops to delay the fire or support the containment of the fire.</p> <p>If needed, develop a large-scale water handling plan to flood areas adjacent to the perimeter and mitigate risk of escape.</p>
<p>Fast moving fire discovered moving across the landscape, responding to strong winds. Rainfall or moist ground conditions allow for full range of responses for containment.</p>	<p>Direct attack and/or indirect attack suppression strategy may be used.</p>	<p>Use ground ignition methods to stop the head of the fire along roads or the highway. Tractor plows can contain the flanks and reinforce lines for containment. Aerial resources can be used to support the operations.</p>

3.7.3. FMU 6 Values to Protect

Values to Protect	Description	Risk
Threatened & Endangered Species		
red wolf	critical habitat	endangered species
Air Quality		
Dare County communities and transportation corridors	potential smoke impacts to air quality and visibility	life, human health, socio-economic impacts
WUI		
Stumpy Point	federal recognized CAR	life, property, human health, socio-economic impacts
Natural Resources		
wetlands	sensitive organic soils	natural
heron rookeries	rookeries at Whipping Creek Lake and Swan Creek Lake	wildlife
Special Designations		
SNHA	significant natural heritage area	natural, wildlife
Quaking Bog WSA	refuge wilderness study area	wilderness attributes
Recreation		
hunting	public hunting available in FMU	life, human health, recreation
fishing	public fishing available in navigable waterways	life, human health, recreation
Infrastructure		
U.S. Highway 264	major transportation corridor	highway safety
Air Force Range	military target range with buildings and equipment; training missions	property, government facility and interests
Navy Range	military target range with buildings and equipment; training missions	property, government facility and interests
NCDFR DCBR Shop	State offices and equipment	property, government facility

3.7.4. FMU 6 Safety Considerations

Location and seasonal or tidal variations in soil moisture can considerably affect trafficability for equipment in this FMU and there are no roads. Escape routes and safety zones are very limited and equipment should not be committed without a spotter plane. Only well burned, blackened areas should be considered completely safe in the event of a major wind shift because of the potential for re-burn in these fuels.

Public access is limited to foot traffic because of the lack of roads. The road shoulders along US 264 are very narrow and steep, making it dangerous for vehicles parked along the road. The FMU is open to public hunting with retrieving dogs. Air traffic over the DCBR is restricted, but refuge staff will follow established protocols for clearing flights through or near the range to avoid any collisions with military aircraft.

US Highway 264 is the major road of concern for traffic hazards caused by smoke. The road also has narrow road shoulders that make unloading heavy equipment a traffic and firefighter safety hazard.

3.8. Fire Management Unit 7

3.8.1. FMU 7 Description

FMU 7 (19,400 acres) is in the southwest corner of the refuge and lies in both Dare and Hyde Counties. The far western portion of the FMU, between the Barge Canal and the Intracoastal Waterway, is the Atlantic White Cedar WSA. The three roads in the FMU form the western boundary of the Alice Nichols WSA as it extends along the Alligator River south from FMU 5 to the refuge's south boundary. The remaining portion of the FMU is a relatively small area of refuge land extending east of these roads. Near Whipping Creek and Chip Road pond pine, ranging from 50 to 70 feet high, is the dominant overstory in the high pocosin areas. Pond pine is often mixed with red bay or loblolly pine. Closer to the Alligator River, pond pine stands give way to gum/cypress swamps and cedar swamps as the land gets wetter along the river.

Clusters of RCW cavity trees can be found in the eastern portion of the FMU. Hurricane Isabel in September 2003 severely damaged trees in the areas of known colonies, and these are no longer thought to be active. To date, the refuge has been unable to conduct additional surveys to determine the status and locations of RCWs on Alligator River NWR. Until the refuge completes its refuge-specific RCW management plan, fire management activities will be limited to protection of cavity trees during wildfire suppression actions or those discovered during prescribed burns. Once the species management plan is completed, prescribed fire may be actively used as a tool for under and midstory management. Burn units and firebreaks would be established to facilitate RCW management keeping smoke management, habitat fragmentation, and other species effects in mind.

This FMU contains a variety of fuel types. FM 4 is the dominant fuel model in the pocosins with patches of FM 7 and 5. FM 9 can be found in some large patches associated with the hardwood or cypress swamps. FM 6 can be found as a thin strip along the Alligator River. Periodically there may also be some FMs 10 and 11 when pine beetle outbreaks or blowdowns cause heavier concentrations of dead, downed woody fuels.

3.8.2. FMU 7 Objectives and Constraints

Specific fuel treatment objectives for this FMU include:

1. Refuge resources will annually maintain approximately 14 miles of roads in this FMU in preparation for wildfire control and road maintenance as needed.
2. Over the next 5 years, explore the feasibility and constraints for conducting prescribed burns in this FMU.

The table below gives examples of potential AMRs for FMU 7. Specific AMR objectives for this FMU include:

1. Consider wilderness values and MIST in selection of AMR for fires occurring in the Alice Nichols and Atlantic White Cedar WSAs.
2. Keep the fire east of the Intracoastal Waterway.
3. Consider known RCW cavity trees when making an AMR selection.

FMU 7 Appropriate Management Response

Potential situations	Potential strategies	Potential tactics
<p>Fire occurs near road or other accessible location. Project potential but with low rate of spread.</p>	<p>Direct attack suppression strategy is used to contain and suppress the fire.</p>	<p>Tractor/plows, engines or other resources are used to contain the fire. Aircraft will be used to support operations as requested.</p>
<p>Fire occurs in inaccessible locations within the swamp. Project potential but with low rate of spread.</p>	<p>Develop MMAs and MAPs establishing trigger points. Monitor the fire from the air. Use direct attack from the air with retardant or water to delay or direct the fire as needed. Indirect attack from the ground using point or partial perimeter protection to keep the fire contained within MMA.</p>	<p>Monitor the fire from aircraft, keeping an eye of potential impacts or escape. Establish trigger points for potential actions. Drop retardant or water to keep the fire from moving towards areas with potential values or escape from containment boundaries. Burn out along containment boundaries as needed to keep fire from escaping the compartment. If needed, develop a large-scale water handling plan to flood areas adjacent to the perimeter and mitigate risk of escape, using irrigation equipment, volume pumps and other water handling equipment.</p>
<p>Fire occurs in inaccessible locations within the swamp, but with relatively high rates of spread. Fire will most likely become a project fire no matter what actions are taken especially if soil conditions are dry due to drought or drainage in adjacent agricultural lands.</p>	<p>(See above) Take aggressive immediate actions to improve containment lines and prevent escape from the MMA. Use aircraft as needed for direct attack from the air.</p>	<p>Use tractor plows and engines to improve lines to prevent escape and for holding. If needed, develop a large-scale water handling plan to flood areas adjacent to the perimeter and mitigate risk of escape. Set up irrigation equipment, volume pumps and other water handling equipment.</p>

3.8.3. FMU 7 Values to Protect

Values to Protect	Description	Risk
Threatened & Endangered Species		
red wolf	critical habitat	endangered species
RCW	clusters of RCW cavity trees	endangered species
Air Quality		
Dare County communities and transportation corridors	potential smoke impacts to air quality and visibility	life, human health, socio-economic impacts
WUI		
private farms	farmlands, houses, equipment	life, property, human health, socio-economic impacts
Natural Resources		
wetlands	sensitive organic soils	natural
heron rookeries	rookeries at Whipping Creek Lake and Swan Creek Lake	wildlife
Special Designations		
SNHA	significant natural heritage area	natural, wildlife
Atlantic White Cedar WSA	refuge wilderness study area	wilderness attributes
Alice Nichols WSA	refuge wilderness study area	wilderness attributes
Recreation		
hunting	public hunting available in FMU	life, human health, recreation
Mattamuskeet Ventures	buildings associated with neighboring hunt club	life, property, recreation, socio-economic impacts
Fishing	public fishing available in navigable waterways	life, human health, recreation
Right-of-ways		
utility right-of-way	utility poles along private roads south of refuge boundary	community infrastructure
Infrastructure		
U.S. Highway 264	major transportation corridor	highway safety
Air Force Range	military target range with buildings and equipment; training missions	property, government facility and interests

3.8.4. FMU 7 Safety Considerations

Location and seasonal or tidal variations in soil moisture can considerably affect trafficability for equipment in this FMU. Primary road access would be through the DCBR, which has restricted access, or along private roads through the farming area south of the refuge. Escape routes and safety zones are very limited. Roads, canals, creeks and rivers are good safety zones. Only well burned, blackened areas should be considered completely safe in the event of a major wind shift because of the potential for re-burn in these fuels.

The FMU is open to the public, but the roads are closed to vehicles. This makes the western area accessible to the public by water only. A small portion of the FMU between the DCBR and Whipping Creek Road is open to public hunting with dogs, and vehicles are allowed on

Whipping Creek Road. The remainder of the FMU is open to public hunting but vehicles are not allowed on the roads. Air traffic over the DCBR is restricted, but refuge staff will follow established protocols for clearing flights through or near the range to avoid any collisions with military aircraft.

3.9. Fire Management Unit 8

3.9.1. FMU 8 Description

FMU 8 (4,388 acres) is Pea Island NWR. This unit consists of beach, primary dunes, inter-dunal swales, overwash terraces, high salt marsh, low salt marsh and salt flats. Each of these sites has its own unique association of plant communities with a range of vegetation types and conditions. Portions of the FMU have been burned for the last 20-30 years, but a consistent burn cycle has only been implemented in the last 15 years. Currently, the refuge is striving to burn the FMU on a 3 year fire return interval on the west-side of NC 12. Although the fuels can burn with great intensity under the right conditions, heavy concentrations of fuel occur only in isolated pockets. FM 3 is the primary fuel model both in the marshes and inter-dunal swales. Pockets of shrub thickets scattered throughout the island, high salt marsh, and areas of phragmites are FM 4.

On the south boundary of the refuge, there is a mowed firebreak that is maintained between the refuge and the Mirlo Beach subdivision in Rodanthe, NC. An easement over grass and sand allows vehicle and foot access to this firebreak from a paved subdivision road. The power company is responsible for maintaining a right-of-way under the utility lines that run through the refuge.

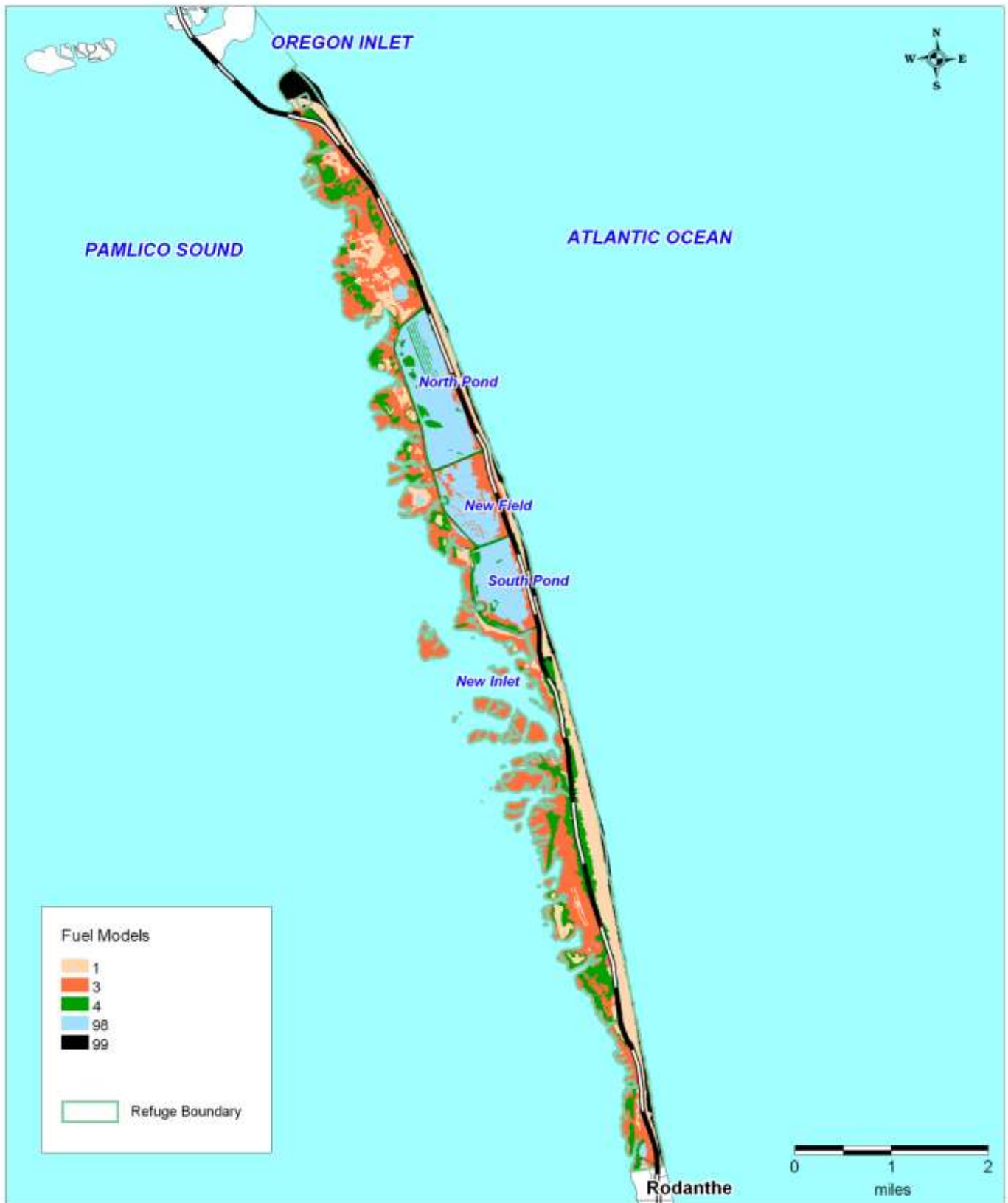
Since 1983, Pea Island NWR has had only 15 fires in 26 years. The largest fire was 100 acres and the smallest fires were 0.1 acre. Before a consistent prescribed burning program was established in the mid-1990s, the average size wildfire was 23 acres. After 1997, the average sized wildfire has been 0.4 acres. The majority of the fires have been human-caused by smoking and equipment use.

3.9.2. FMU 8 Objectives and Constraints

Hazardous fuel reduction projects may include prescribed burning, mechanical and herbicide treatments. The primary uses for prescribed burning are for impoundment, marsh, and maritime shrub management, concentrating on the west-side of NC 12. Sea breezes from the sound or ocean can produce localized winds that defy general and spot weather forecasts, causing complications with smoke management when planning and implementing prescribed burns. Specific fuel treatment objectives for FMU 8 include:

1. Conduct prescribed burns in the FMU, striving for a 3-5 year fire return interval.
2. Annually maintain the Rodanthe firebreak by mowing.
3. Annually maintain vegetation on dikes and around refuge structures as needed.

Figure 9: Pea Island National Wildlife Refuge - Fuel Models



The table below gives examples of potential AMRs for FMU 8. Specific AMR objectives for this FMU include:

1. Protect refuge improvements (buildings, interpretive trails, etc).
2. Keep the fire west of NC 12 and north of Rodanthe. Call for traffic control to manage potential smoke problems.
3. Avoid disturbing soils with plows or discs to prevent spread of exotic species and unnecessary disturbance of marsh or inter-dunal vegetation.
4. Consider wilderness values and MIST in selection of AMR for fires occurring on islands in Pamlico Sound designated as candidate wilderness areas.

FMU 8 Appropriate Management Response

Potential situations	Potential strategies	Potential tactics
Smaller fire occurs in accessible locations along the roads, dikes and marshes along the refuge.	Direct attack strategy. Keep the fire small to prevent the spread.	Using engines, tractor plows or marsh masters, attack with direct attack methods.
Fire occurs in marsh or swales and has spread to 10 or more acres with potential to spread.	Indirect attack strategy to contain the fire within nearest burn unit boundaries.	Using marshmaster, tractor plow with plow disengaged or engines, prepare and burn out along burn unit boundaries or natural and man-made barriers.
Fire occurs in marsh islands or areas where spread is limited by natural or man-made features or past burns.	Monitor. Establish trigger points where actions are needed to mitigate hazards.	Monitor from boat or shoreline. Mitigate for smoke impacts to NC 12 if necessary.

3.9.3. FMU 8 Values to Protect

Values to Protect	Description	Risk
Air Quality		
Dare County communities and transportation corridors	potential smoke impacts to air quality and visibility	life, human health, socio-economic impacts
WUI		
Rodanthe	state recognized CAR	life, property, human health
Cultural Resources		
historic bridge	wooden supports from old bridge at New Inlet	historical
Natural Resources		
wetlands		
dune vegetation	vegetation is important for dune stabilization	resource protection
Special Designations		
SNHA	significant natural heritage area	natural, wildlife
sound-side islands	refuge candidate wilderness areas	wilderness attributes
Recreation		
Interpretive trails	Signs, kiosks, boardwalks, observation platforms, photo blind	life, human health, recreation, refuge infrastructure
boat ramp	unimproved boat ramp at New Inlet	life, property, recreation, socio-economic impacts
Right-of-ways		
utility right-of-way	utility poles and telephone boxes along NC 12	community infrastructure
Infrastructure		
U.S. Highway 264	major transportation corridor	highway safety
Refuge property		
Visitor Center	Pea Island NWR Visitor Center	life, human health, recreation, refuge infrastructure
pump houses	pump facilities for impoundments	government property
Headquarters	office facilities, garage, and storage shed	life, human health, recreation, refuge infrastructure
residence and pads	intern housing and volunteer pads at office	life, human health, recreation, refuge infrastructure
bulkheads	improvements to impoundments	government property
pole shed	equipment storages site behind New Field	government property

3.9.4. FMU 8 Safety Considerations

The beaches are open to the public. With very few formal parking areas, the public normally parks in the highway right-of-way which can inhibit refuge activities. The impoundment areas are not open to the public except for the marked trails that follow the dikes. The remaining portions of the FMU are open to the public and are normally accessed from the highway. There is an unimproved public boat ramp at New Inlet that is used by recreational and commercial boaters and fishermen. This FMU is not open to hunting.

NC Highway 12 is the road of concern for traffic hazards caused by smoke. NC 12 is a two-lane highway that receives heavy traffic year round, but especially from tourists during the summer vacation season. NC DOT is continually working on keeping sand off the highway and is planning on replacing the bridge on the north end of the Island. Bridge construction will magnify any smoke hazards on the road and could constrain fire operations. The traffic along the highway is a safety hazard to firefighters conducting prescribed burn operations along the road shoulders. Also, power poles along the NC 12 and into the burn units can be potentially hazardous during fire operations.

4.0. Wildland Fire Operational Guidance

Fire management operations planned and conducted pursuant to this FMP will follow the policies and guidelines of the *Redbook* and *FWS Fire Management Handbook*.

Table 5: 10-Year Average by Fiscal Year (1998-2007) for Wildland Fire Management Activities on ARNWR and PINWR

Type	Number	Acres
Wildfires*	8.2	695
Prescribed Burns	16.5	8,462
Non-Fire Projects	3.6	41.9

***10-yr average number of wildfire assists is 1.7**

The Fire Management Team for Alligator River and Pea Island NWRs is a combination of fire-funded, maintenance, resource, and management personnel that all work together to support the refuges' fire program. This Fire Management Team works closely with the other refuges and cooperators within the FWS Southeast Region Fire Management District 1 to conduct fire suppression operations and fuel treatment projects on national wildlife refuges and on cooperators' lands within the constraints of formal agreements. Fire-funded personnel that are responsible for district-wide duties are based at Alligator River NWR as well as Pocosin Lakes, Mattamuskeet and Mackay Island National Wildlife Refuges. The duties of all fire staff in District 1, whether District or Refuge employees, include the following:

- work together and with other refuge staff and cooperators to provide the primary staffing necessary for making an appropriate management response on wildfires,
- perform planning and preparedness duties,
- maintain fire facilities and equipment, and
- plan, prepare for and implement prescribed burns on refuge and cooperator lands.

District 1 Personnel:

- District Fire Management Officer (DFMO) – responsible for the overall coordination and oversight for the Fire Management Program in Fire District 1. The DFMO supervises the District fire personnel and the Alligator River NWR fire crew.
- Fire Program Administrative Assistant – responsible for assisting the DFMO in accounting and fire budgeting, and serves as the primary Dispatcher for District 1. Assists with payroll, AD hires, purchases and personnel actions.
- Prescribed Fire Specialist (PFS) – responsible for overall coordination of the prescribed fire program in District 1 and specifically responsible for fire management program coordination at Mackay and Currituck NWRs and Mattamuskeet Complex.
- Wildland Urban Interface Specialist (WUIS) – responsible for administering fire assistance programs with rural fire departments and coordinating wildland fire issues with communities near Refuges. The WUIS also serves as the Fire Planner for the District.

Alligator River NWR Staff:

- Supervisory Forestry Technician (Fire Control Officer) - supervises fire operations at ARNWR/PINWR and serves as an equipment management coordinator and trainer for District 1.
- Three Engineering Equipment Operators – Fire
- Two Forestry Technicians – Fire

Pocosin Lakes NWR Staff:

- Refuge Fire Management Officer - supervises fire operations at Pocosin Lakes NWR and serves as Assistant District FMO when needed. Serves as District 1 Training Officer and subject matter expert on smoke management and fire environment issues.
- Three Engineering Equipment Operators – Fire
- Two Forestry Technicians – Fire

Mattamuskeet NWR Staff:

- One Forestry Technician – Fire

Mackay Island NWR Staff:

- One Forestry Technician - Fire

All wildland fire organizations must have skilled and knowledgeable personnel to perform duties in areas of operations, logistics, plans, and finance and administration. Due to the hazardous fuels and terrain typical in pocosins, it is critical to have experienced personnel with specialized training and abilities to serve as the primary operational firefighters. These individuals must be knowledgeable in fire behavior in these fuel types as well as skills for holding, ignition methods, specialized heavy equipment operations and maintenance, aviation management, radio communications, as well as the use of standard firefighting equipment. The District depends on these firefighters to provide leadership for the collateral duty firefighters and those resources ordered from outside the area to assist in prescribed fire and wildfire operations. We must have personnel skilled in radio programming and helicopter management in the mix, as well as other specialty areas such as metal fabricating, mechanics, hydraulics, etc. Fire Management Team

members are cross-trained to serve in various assignments for which they show an aptitude. Fire-funded personnel will be expected to specialize in more technical fire qualifications, such as helicopter crewmember or aerial ignition specialists. Team members are listed in the Annual Operations Plans.

The *Redbook* and *FWS Fire Management Handbook* spell out the fire management responsibilities for the Regional Director, Regional Fire Management Coordinator, Project Leader, and Refuge Fire Management Officer. Policy also allows for certain authorities to be delegated from the Agency Administrator to the District Fire Management Officer (Appendix G). The remaining fire-funded members of the Fire Management Team have duties established through their position descriptions and annual performance plans. Fire qualification goals and trainings are worked out with individual fire-funded and collateral team members when employees' Individual Development Plans are developed for the year. A current copy of the approved District 1 Fire Staffing Chart and a description of Fire Team responsibilities are included in Appendix H.

Goals for the development of the Refuge Fire Management Team are:

1. Develop Safety as the number one awareness issue with the Fire Program on the Refuge.
2. Develop a High Reliability Organization that will meet most needs for an initial attack fire organization and form the nucleus of a prescribed fire management organization .
3. Maintain an appropriate level of staffing of trained and qualified firefighting personnel to meet the fire management needs of the Refuge, within funding level constraints.
4. Develop and organize available resources on the refuges and within the District capable of safely responding to wildfires on the refuges with a successful control rate of 95%. Refuge and District resources must be capable of interfacing with cooperators and outside FWS resources to successfully control the remaining 5%. The Fire Management Team will be trained and developed to assist other refuges and interagency cooperators locally, regionally, and nationally.
5. Work with District and cooperator resources to field a Type-3 Incident Management Team and contribute resources to regional and national emergencies.
6. Actively seek ways to encourage and develop cooperative relationships with the NCDFR, USFS, Department of Defense, NPS, Volunteer Fire Departments, Emergency Management and local law enforcement agencies. The cooperative relations must be mutually beneficial to all parties in an agreement, result in more effective protection of values from threat or loss from wildfire, and improve safety for all wildland firefighters.

4.1. Appropriate Management Response (AMR)

Safety is the number one priority in all fire suppression actions. The 10 Standard Fire Orders and 18 Watch Out Situations will be the guide in all fire operations. Structural fire suppression is the responsibility of local governments. We may assist with exterior structural protection activities under formal Fire Protection Agreements that specify mutual responsibilities, including funding (*Redbook* 01-3).

A Wildland Fire Situation Analysis (WFSA) or other appropriate analysis process will be prepared for any wildfire that escapes initial attack. Multi-jurisdictional incidents will require a collaboratively developed WFSA that is approved and signed by each of the respective agencies.

The wildfires on PINWR have generally been small in size and duration and managed as Type 4 or 5 incidents. ARNWR has a history of small wildfires (under 5 acres) managed as Type 4 incidents punctuated by larger incidents of varying complexity under a Type 3 umbrella. The extent and severity of ground fire is often the deciding factor in the duration and complexity of an incident. Ground fire of any size may have detrimental effects to the neighboring communities due to health concerns (smoke) and difficulty of containment. It may last for months before it is extinguished by precipitation, and any ground fire suppression will be very expensive due to the duration of the tractor and water moving operations. Suppression costs will always be subordinate to values at risk for fires that escape refuge boundaries and threaten residences, businesses and private timber resources. Increasing WUI areas on or adjacent to both refuges could easily see the complexity of wildfire events increase in the future. Details on refuge fire history can be found in the refuge files or in FMIS.

4.1.1. AMR Direction

An appropriate management response will be made on all wildfires. AMR is the response to a wildland fire that most effectively, efficiently, and safely meets objectives identified in this approved Fire Management Plan. Evaluation and selection of an AMR to a wildfire will include consideration of risks to public and firefighter safety, threats to values to protect, costs of various mitigation strategies and tactics, and potential wildfire benefits.

The response may range across a spectrum of strategic options including the following examples:

- A monitoring strategy would entail periodic reconnoitering of the fire to ensure that it does not threaten key values or escape into another compartment or area.
- Indirect attack strategies use existing or constructed fire breaks to burn out and hold key areas of terrain so that the fire cannot escape from a particular compartment or area.
- Direct attack strategies use ground and/or aviation resources directly engaged in the immediate fire environment in order to contain or slow the fire to prevent it from escaping an area or affecting key values to protect.
- A point protection strategy is often used to protect high values when a fast moving fire threatens and time is critical.

At times, more than one or perhaps all these strategic responses may be required in combination to meet the needs for an AMR. Often burning out sections of an area or an entire compartment will be the most effective strategy to ensure containment. Tactical operations to accomplish an AMR may include the use of aircraft, low ground pressure fire tractors, tracked brush cutters, engines, boats, and fire crews using hand tools, ignition devices or portable pumps. Due to accessibility and the volatile nature of pocosin and marsh fuels, only tactics that can ensure the safety of all assigned personnel and that pose a good probability for success will be selected for an AMR.

Smoke impacts to Smoke Sensitive Areas (see Section 4.2.1.5.) will be a consideration when choosing an AMR. Potential smoke impacts can include visibility hazards and/or public health impacts. When smoke impacts are expected, fire managers will attempt to work with interagency partners to monitor smoke and inform the public of any associated hazards.

Because of heavy fuels and organic soils in pocosins, once a fire is contained it still has a high probability for escape. Specific steps must be taken to ensure the success of holding resources. Often the first step is to widen firelines with multiple tractors plowing lines around the perimeter. Sometimes vegetation is masticated with chippers or sheared and piled with dozers with KG blades to widen the control lines. Next, if conditions are fairly dry in the upper soil and duff layer, sprinkler systems will be installed using irrigation equipment and pumps deployed from nearby canals. If an area can be flooded using landscape-scale water management techniques, this will be the next option. Hose lays with engines and portable pumps are used if the area is not extremely dry or has predominantly mineral soils. These methods may be used separately or together on any fire to attempt to achieve successful holding operations. Regardless of the type of AMR, leaders must ensure that decisions are timely and actions are decisive. All actively burning wildfires will be monitored, and then staffed as needed until declared controlled or out.

All wildfires will be supervised by a qualified Incident Commander (IC) who will be responsible to:

- Assess the fire situation and make a report to dispatch as soon as possible.
- Use guidance in this FMP and/or a delegation of authority and associated WFSAs to determine and implement an AMR.
- Determine organization, resource needs, strategy and tactics.
- Brief incoming and assigned resources on the organization, strategy and tactics, weather and fire behavior, LCES, season and historic ERCs, and radio frequencies.
- Order additional resources needed to implement the AMR through District Dispatch.
- Manage the incident until relieved or the fire is suppressed.

The FMP and a delegation of authority with an associated WFSAs from the agency administrator can provide a general strategy to an IC, who has discretion to select and implement appropriate tactics within the limits described for the FMUs (see Sections 3.2-3.9). Each wildland fire is unique with its own set of weather, fire behavior, resource, and event variables that must be taken into consideration by the IC when choosing an AMR. Impacts to the land and cost considerations will always be considered in fire management planning, but will take second priority to firefighter and public safety. All resources, including mutual aid resources, will report to the IC (in person or by radio) and receive an assignment prior to tactical deployment. If the fire escapes initial attack or the situation shows that the fire will become a long duration incident, a complexity analysis will be completed and an appropriate incident management team ordered to manage the extended attack fire through an agency administrator's delegation of authority. A WFSAs will be prepared to guide the incoming IC in executing an appropriate management response to the incident.

The statewide interagency Master Agreement and the AOP for interagency resources in the District spell out how non-refuge resources will respond to wildland fires on Alligator River and Pea Island NWRs. Through annual cooperative meetings, refuge staff will make cooperators and partners aware of the AMR options for these refuges.

- **Cost Effectiveness**

Maximizing the cost effectiveness of any fire operation is the responsibility of all involved, including those that authorize, direct, or implement these operations. Cost effectiveness is the most economical use of the suppression resources necessary to accomplish mission objectives. Accomplishing fire operations objectives safely and efficiently will not be sacrificed for the sole purpose of “cost saving.” Care will be taken to ensure that suppression expenditures are commensurate with values to be protected, while understanding that other factors may influence spending decisions, including the social, political, economic, and biophysical environments. Hazardous fuels projects will be planned for the most economical, effective, and safe treatment that is commensurate with the values to protect.

Pea Island’s fire history and associated suppression costs have been efficient and reasonable for the fuels involved. Pea Island has never had a project fire, mostly because of the extensive fuels treatment burning conducted. Alligator River’s fire history, however, has involved several large, project fires as well as smaller, expensive wildfires. The majority of these suppression costs can be attributed to wildfires developing ground fire that is expensive and time-consuming to extinguish as well as the need for specialized tracked equipment that can be expensive to repair and subject to damage in terrain with heavy woody debris.

A template for Cost Share Agreements is included in the interagency Master Agreement. For the most part, a pro-rata sharing of costs in proportion to the jurisdictional acres involved is the usual model for apportioning large fire suppression costs.

- **Anticipated Policy Changes**

A number of revisions to the *Interagency Strategy for the Implementation of Federal Fire Management Policy* (2003) are expected to be adopted during the 5-year life expectancy of this Plan. Those which could impact AMR strategy options on the refuges include:

- assessment of all wildfires using the Wildland Fire Decision Support System (WFDSS) and discontinuation of the WFSAs,
- converted prescribed fires which are declared wildfires will be given the same assessment as any other wildfire (Element 18, *Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide*, 2008).

These policy changes have been considered during the preparation on the FMP. Their adoption and implementation would not be a departure from AMR strategy currently discussed in the FMP and would be noted during the yearly updates of the FMP without necessitating a revision of the FMP.

4.1.2. Preparedness

- **Fire Management Planning**

Fire staff will annually update the FMP and appendices as needed and review pre-incident planning to resolve as many logistical and operational questions as possible in advance of a major incident. District staff will update the District Station Aviation Plan every two years or as needed to update the Aerial Hazards Maps and incorporate policy changes. All interagency agreements will be reviewed to ensure currency and relevancy to the fire management needs of the refuges and our partners.

- **National Fire Danger Rating System (NFDRS)**

The NFDRS is a set of numeric indices that describe the potential over a given geographic area for fires to ignite, spread, and require fire suppression action. Fire weather information is integrated with fuel and topographic information to calculate NFDRS indices. To establish the initial indices for the District, weather data for the years 1998-2008 from the Alligator River NWR (ALR) and Pocosin Lakes NWR (POR) RAWS (Remote Access Weather Station) were processed with the FireFamily Plus program (See Figure 10). This program identifies staffing level breakpoints for use in the District's Step-up Plan.

Of the indices available through the NFDRS, Burning Index (BI) has been selected as the basis to rank fire danger in the Service's Southeast Region. Burning Index therefore provides the basis for increased readiness and determining staffing class levels. BI, defined as flame length times 10, is designed to reflect the difficulty in controlling a new fire start. It is driven by the variables of wind speed and fine dead fuel moisture, which in turn are directly related to relative humidity. BI (and all NFDRS outputs) relate only to the potential of an initiating fire that spreads, without crowning or spotting, through continuous fuels on a uniform slope. Additional NFDRS indices, such as Energy Release Component (ERC) and Keetch-Byrum Drought Index (KBDI) will be used in determining Step-up Plan staffing levels.

- **Step-up Plan**

Step-up Plans are designed to direct incremental preparedness actions in response to increasing fire danger. "Staffing Levels" delineate those actions. The level of fire danger is expressed as a "Preparedness Level", which is determined by incremental measures of burning conditions, fire activity, and resource commitment. The refuges' predetermined responses to increased fire danger for a burning period follows District 1's Step-up Plan found in Appendix A. Staffing levels correlate directly to preparedness levels and the terms are used interchangeably. Fire managers will participate with interagency partners in sharing and coordinating weather station information relating to fire danger assessments. The District Dispatch Office will keep Refuge and District personnel apprised of fire danger and weather conditions, ensuring all stations are aware of current fire danger and are taking appropriate actions. This function will be monitored by the District FMO to ensure responsiveness and consistency in the program.

If National and Regional preparedness levels reach 4 or 5, the District may step-up a level in preparedness as a result. This will also signal that prescribed burning activities may need to be postponed or receive Regional concurrence.

Figure 10: Graphs of the Mean NFDRS values (BI, ERC, and KBDI) calculated using Fire Family Plus software. Weather data uses an average of the ALR and POR RAWS with equal weighting (1998-2008).



- **Emergency Preparedness**

During the fire season there will be short-term weather events and increased human activity that increase fire danger beyond what may be predicted for the Step-up Plan. These types of events cannot be planned or budgeted and may call for lengthening the duty day, extending the work week, or detailing extra resources to meet the anticipated danger. The District FMO has the authority to make this decision with notification to the Regional Fire Management Coordinator. Limitations on utilizing emergency preparedness funds are listed in the *Redbook* Chapter 10 and the *FWS Fire Management Handbook*.

- **Severity**

Severity funds are available subject to the National Fire Coordinator's approval whenever there is a longer term high fire danger event, such as a drought that extends or prolongs the normal fire season or causes a severe strain on normal refuge activities due to higher staffing requirements, or an above average wildfire activity that has a "drawdown" effect on local suppression forces. Severity requests will be done on a District basis. Severity funds may be requested whenever the KBDI exceeds the 532 level and or staffing needs exceed those that can be supported by the District. If ongoing wildfires are tying up resources (FWS and cooperators) for extended periods of time, and the local refuges are having difficulty meeting minimum staffing needs, they may request severity funds at lower KBDI levels.

All incoming resources arriving on severity details (as with all other incidents) will be briefed prior to being assigned. This briefing will cover this FMP as well as local fire cards, expected fire behavior, tactics, communications and other necessary information.

- **Training and Qualifications**

All firefighters will participate in formal and informal wildland fire training opportunities. Each employee has an IDP which is developed annually with their supervisor to determine training and development needs. Available local, regional and national training courses are reviewed and employees are scheduled to attend training necessary for their positions in the Fire Management Team. Position Task Books are the primary tool for documenting a firefighter's qualifications in the various incident management positions. Opportunities for key assignments to develop employees' skills and abilities will be sought as a high priority each year. The Interagency Fire Program Management (IFPM) Guide provides minimum qualifications standards for 14 key wildland fire positions. These are explained in the "IFPM Qualifications Standards and Guide "White Paper" signed between the USDA and USDOJ in May 24, 2004. The *National Interagency Incident Management System Wildfire Qualification System Guide* (also known as 310-1) lists the interagency approved fire qualifications for wildland fire positions used in the Incident Command System. This publication is updated every few years and can be found at http://www.nwcg.gov/pms/docs/pms-310-1_2008.pdf

Local training will be offered each year that is geared to increase the safety awareness, technical skills and qualifications of FWS and cooperator firefighters in District 1. All training is oriented towards meeting the NWCG standards. The District Fire Management Team consisting of leadership from all the refuges meets annually to determine local training needs and assign priorities for sponsoring local training. Often, one or two 200-level courses are taught yearly by

district firefighters. The NCDFR offers 200 and 300-level training courses across the state, most of which meet NWCG requirements. Additional training needs are obtained by sending personnel to interagency training coordinated through the State and Regional Coordination Centers or cooperators. As a minimum, the Annual Firefighter Safety Refresher training is offered prior to the Spring Fire Season.

- **Readiness**

Prior to the beginning of the established fire season, a readiness evaluation must be conducted to evaluate detection, communication, dispatch and response capabilities. The FMO will use the *Fire and Aviation Preparedness Review Guide* provided by BLM as a format to determine and document pre-season readiness. This document can be found at http://www.blm.gov/nifc/st/en/prog/fire/fireops/preparedness/preparedness_review.html.

Fire facilities and equipment will be maintained in readiness condition year-round on the refuges because of the nature of fire occurrences and prescribed burning activities. All fire equipment including vehicles, heavy equipment, portable and volume pumps and other equipment used in initial action or extended attack fires will be inspected monthly and repaired as needed. A fire cache inventory will be kept up-to-date reflecting the items in the cache at all times with an annually updated list kept in the Dispatch Office. Normally the cache will be replenished after each wildfire and prescribed burn season. Orders reflecting emergency needs will be made any time.

The Dispatch office at Alligator River NWR serves as the District Dispatch Office for the entire Fire Management District. The District Dispatch Office will be staffed on all PL-III (Preparedness Level III) days or higher during the fire season and on demand during the remainder of the year. A description of Dispatch duties is included in the Appendix and the AOP includes a discussion on how the Office will interact with our interagency partners.

- **Community Assistance**

The DFMO will work with the District Wildland-Urban Interface Specialist (WUIS) to identify community assistance projects and grant programs (e.g., Rural Fire Assistance, Ready Reserve, or Firewise) for funding consideration. The District WUIS will also work with refuge staff, communities and cooperators to establish Community Wildfire Protection Plans (CWPP) and/or Firewise Communities/USA Mitigation Plans that detail project actions and responsibilities for community protection. Cooperators will be consulted for project prioritization and coordination of efforts. The District WUIS will work with refuge staff to ensure implementation of any funded projects.

- **Fire Season**

Wildfires can occur on the refuges at any time of year. The primary season of consistent high fire danger is from March 1 through May 31, with a second, usually less severe period occurring from October 1 through November 30. Often the majority of wildfire ignitions will fall in between these seasons during the summer periods when evapotranspiration of soil moisture exceeds rainfall, producing droughty conditions. It is primarily drought which influences wildfire conditions and can cause extended fire seasons. Late spring and summer is the time of year when lightning starts fires. Historically, some of these fires burned nearly all summer long until they ran out of fuel or were rained out. Alligator River and surrounding refuges have documented many such lightning-caused fires from May through August. Having a bombing range in the middle of a refuge has had its effect as there have been fires related to plane crashes and military operations on or adjacent to Alligator River NWR during the past 20 years.

Figure 11: The total number of fires by month on ALR and POR. Fire data is from FMIS from 1998-2008. (Note: Multiple fires from a grading operation and road work operations on ALR were combined for the analysis.)

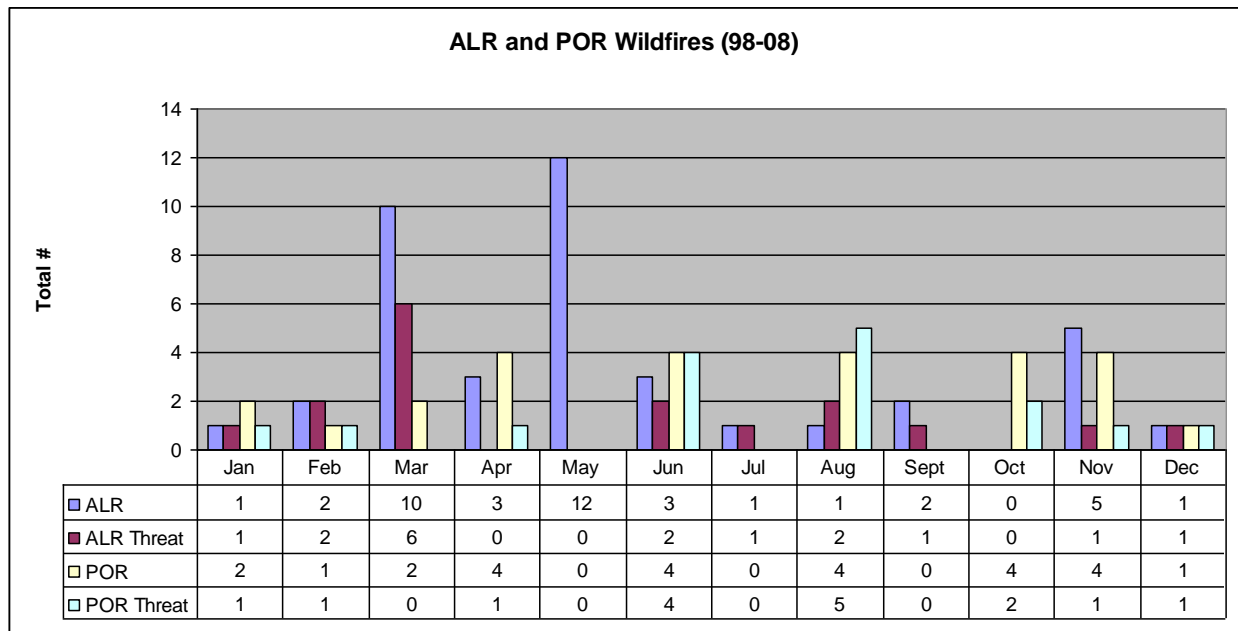


Table 6: Annual Refuge Fire Preparedness Activities

Activities – Complete before end of month	J	F	M	A	M	J	J	A	S	O	N	D
Fire Equipment Inspections	x	x	x	x	x	x	x	x	x	x	x	x
Update Interagency Fire Agreements/AOPs	x											
Inventory Fire Engine and Cache		x										
Annual Refresher Training			x									
Pre-Season Engine Preparation and Inventory			x							x		
Weigh Engines to verify GVW Compliance			x									
Prepare Pre-season Risk Analysis			x									
Equipment Preparation and Maintenance			x									
Annual Medical Examinations										x	x	
Semi-annual Fitness Testing				x						x		
Annual Work Plan for upcoming FY						x						
Prescribed Fire Plans Preparation					x	x	x	x	x			
Weather Station Maintenance and Calibration										x		
PLDO Annual Refresher										x		
Complete Training Analysis										x		
Weather Station Maintenance and Calibration										x		
Review and Update FMP and Appendices												x
Winterize Fire Management Equipment												x
Aircraft Pre-Accident Plan	x						x					

4.1.3. Detection

Fires are primarily discovered through aerial detection flights or called into 911 by local citizens. Refuge resources will not normally be used exclusively for detection purposes, but during periods of frequent fire activity or at Staffing Levels IV or V, refuge personnel may be repositioned at strategic locations on refuge lands to discourage arsonists and to shorten response time to fires started in flashy fuels.

No fire team in Eastern North Carolina would be complete without a competent air-attack qualified pilot in a light, maneuverable aircraft. In addition to being a competent aviator, the pilot must be skilled in fire suppression tactics, fire behavior in local fuels, and directing ground resources by two-way radio communication. The pilot especially needs to be knowledgeable of equipment capabilities in heavy fuels with marginal trafficability in wetland soils.

The NPS pilot and aircraft stationed at the Cape Hatteras National Seashore (NS) have in the past met this criteria. As long as the NS maintains a pilot position with fire qualifications, this pilot and aircraft will be used for performing aerial detection flights in the District. Detection flights are done once or twice daily on PL-III or higher days during the regular fire season and on an intermittent basis during the remainder of the year. Once a smoke is spotted, the pilot contacts the District Dispatch Office to report the location and give a size-up of the fire. Often the pilot will direct personnel into the fire, watching for their safety serving the function of a lookout. If additional air resources are needed, a qualified air attack pilot will be requested.

Refuge detection flights will be coordinated with detection flights flown by the NCDFR to avoid duplication. NCDFR pilots are trained to report any fires or smokes that they discover on Refuge lands when flying their regular patrol flights. When NPS aircraft is unavailable, vendor aircraft that meet the DOI National Business Center – Aviation Management Directorate requirements may be ordered through contract arrangements to assist with aerial detection and wildfire response. A qualified aviation manager will be used as required and needed to direct the flights.

4.1.4. Dispatch, Initial Response and Initial Attack

All wildland fires will be reported to the Dispatch Office at Alligator River NWR. Usually human-caused wildfires will be located either on a road shoulder, dike or sound shore, but lightning fires can show up anywhere and are often a good distance off the highway. As a minimum, one Initial Attack Incident Commander or a Type-6 engine with two firefighters will be sent to size up the fire and take action as needed. If the fire cannot be easily seen from the road or other access point, then a helicopter will be dispatched if available, or else reconnaissance aircraft from the NPS or NCDFR will be requested. Another option is for an aerial observer to board an approved contract aircraft to scout out the fire. The resource which arrives first is responsible for providing Dispatch with an accurate fire size-up and determining an AMR. The interagency Incident Response Pocket Guide (IRPG) carried by each firefighter contains a fire size-up checklist. Often, the FMO or FCO will be consulted on choosing an AMR unless a pre-determined response, posted in the Dispatch Office, is already in place due to

environmental considerations and fire behavior. The AOP contains a checklist for fire size-up as well as initial attack response considerations.

Once the fire is adequately sized up and an AMR determined, the on-scene IC will request any additional resources that are needed to accomplish the AMR. A pre-determined initial attack taskforce will often be available on stand-by during PL-IV and higher days and will be quickly dispatched. The closest resource concept will be utilized in all urgent wildfire dispatch operations. Refuge and cooperator resources will be requested and dispatched per the AOP.

Occasionally, due to the location of the fire, intense fire behavior, and/or threats to values to protect, a fire, using the NWCG Complexity Analysis, may be classified at a complexity higher than the currently responding resources are qualified to handle. At this point, the Refuge fire management staff and agency administrator will review and begin the procedures for initiating large fire management right away.

4.1.5. Extended Attack and Large Fire Management

Extended attack procedures consist of completing a Wildfire Complexity Analysis and a Wildfire Situation Analysis to determine the best options for managing an extended attack wildfire. The WFSA will be completed to evaluate and compare alternative fire management (AMR) strategies based upon previously listed FMU Wildfire Control Objectives - selected safety, environmental, social, economical, political, and resource management objectives. In other words, the values at risk, including firefighter safety, public and private property and natural resources will all be considered, as well as the limits to suppression, such as trafficability, access, fuels and fire behavior. From this analysis, the most practical wildfire management alternative (AMR strategy) will be selected based on cost effectiveness and chance of success. The selected wildfire management alternative (AMR strategy) will use a variety of tactics on different portions of the fire perimeter to manage the incident. The WFSA will be approved by the appropriate level of authority, depending on estimated costs (*Redbook*, Chapter 11).

The complexity analysis will assist the FMO and Agency Administrator in establishing the IC level and type of IMT required. If the complexity rates out as a Type 4 team, the local unit will continue to manage the incident. If it shows a Type 3 complexity, a Type 3 IC will be assigned or requested through Dispatch. The IC will develop an appropriate Type 3 organization to handle the needs of the incident. If a Type 2 or Type 1 complexity level is indicated, the appropriate incident management team will be ordered through Dispatch.

When multi-jurisdictions are involved, the FWS will consult its partners during the Complexity Analysis process, and order the corresponding level team. Unified Command will be recommended.

4.1.6. Aviation Operations

All fire-related aviation operations will follow applicable guidelines of the DOI National Business Center – Aviation Management Directorate. The Aviation Plan will provide local refuge aviation direction, policy and guidance that is consistent with national agency and interagency policy. It will also contain the station pre-accident plans, risk assessments, and Aviation Hazards Map. This plan should be updated every two years or as needed to update the Aerial Hazards Maps and incorporate policy changes, and can be found in Appendix B.

4.1.7. Reviews and Investigations

Reviews and investigations are used by wildland fire and aviation managers to assess and improve the effectiveness and safety of organizational operations. Brief descriptions of various reviews and associated procedures and requirements, including those for serious wildland fire accidents, entrapments, and fire trespass are listed in the *Redbook* Chapter 18.

Incident Commanders and Single Resource Bosses will ensure After Action Reviews (AARs) take place in a timely manner and that any significant issues are brought to the attention of the District FMO or Refuge Manager.

4.1.8. Reports

An Individual Fire Report (DI-1202) will be filed electronically within 10 days of a fire being declared out for the following types of fires:

- all wildfires on FWS and FWS-protected lands,
- wildfires threatening our lands on which we take action,
- all false alarms responded to by refuge staff, and
- all converted prescribed fires. When a fire exceeds prescription, it must be converted to a wildfire and a separate new report filed to report acres burned by the wildfire from the time of declaration to the time of being declared out.

These reports are required regardless of who takes action; e.g., FWS engine, cooperator, or contractor. When we take initial attack off refuge lands, the agency with jurisdiction where the fire occurred will file a report and we will file a limited report to document our response and to support potential billing to non-federal entities.

4.2. Hazardous Fuels Management

All fuel treatment projects (prescribed burning, herbicide, mechanical) will follow all management directions as outlined in the CCPs (FWS 2006, FWS 2008) and all applicable Department, Service, and fire management policies. A hazardous fuel project complies with NEPA requirements if (a) the field office's approved FMP or planning documents and the accompanying EA adequately discuss the action; or (b) a categorical exclusion covers the activity. If an individual proposed project does not meet the above requirements, it will require

further environmental review or permits before implementation. All hazardous fuel treatments will contribute to the overall refuge management goals and objectives as outlined in Section 3.

The temperature in the world's climate is predicted to increase above natural levels in the coming decades. As the climate warms, sea levels are also predicted to rise at increasingly rapid rates. This could impact the coastal environments of both refuges and highlights the importance of maintaining coastal wetlands in a healthy, productive state. Use of prescribed fire and other fuel treatments will help maintain the health of these ecosystems, particularly in the marshes along the sound shore. Healthy marsh grasses hold soils in place with their root systems and catch and filter sediment during high tides or storm surges, thus reducing sound shore erosion.

Scientists have also predicted that as the earth's climate warms, the frequency and severity of wildfires will increase across the globe. The use of fuel treatments to reduce fuel loads and aid in wildfire control becomes increasingly important in minimizing the severity and rate of spread of wildfires for the protection of natural resources and of communities surrounding the refuges. The refuge will continue to monitor changes in the scientific community's knowledge regarding climate change/ sea level rise and adapt management decisions as appropriate.

Prescribed burning and non-fire fuel treatments all contribute to the refuge wildfire preparedness efforts. Alligator River burn units were established to create a conflagration barrier in strategic locations in order to prevent fires that follow the historic trend of responding to strong winds and push through the refuge at rapid rates of spread and threaten adjacent communities. Roads, dikes, canals, and cut firebreaks provide a system of fuelbreaks on the refuges. These fuelbreaks require regular treatments such as mowing road shoulders and dikes, day-lighting canals, and cutting firebreaks to keep their effectiveness as fuelbreaks and allow cost effective maintenance.

Overall goals for hazardous fuels management are to:

1. Develop a prescribed burning regimen for all appropriate lands on the refuges in order to burn in a cyclic pattern during an established rotation period.
2. Maintain two landscape scale conflagration barriers on ARNWR between the DCBR and the communities of Stumpy Point, East Lake, Mashoes and Manns Harbor by prioritizing burn units in strategic locations for frequent burn cycles to reduce hazardous fuels on refuge and cooperator lands.
3. Conduct prescribed burns on an average of 20,000 acres per year while striving to burn 10 – 30,000 acres annually over the next 5 years in order to meet habitat management and fuel treatment objectives on both refuges.
4. Maintain annually the approximately 54 miles of firebreaks and 140 miles of roads that compartmentalize the 75 prescribed burn units and 8 FMUs for both refuges during the 5-yr planning period.
5. Develop an understanding of the conditions in which the various sites and fuel types on the refuges can be safely burned, meet resource objectives, and meet other constraints such as smoke management guidelines.

4.2.1. Prescribed Fire Program for Hazardous Fuels and Habitats

Prescribed fire implementation will follow the standards set forth in the *FWS Fire Management Handbook*, the *Redbook* and the *Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide 2008* (abbreviated *Prescribed Fire Guide*, www.nifc.gov/fire_policy/rx/rxfireguide.pdf).

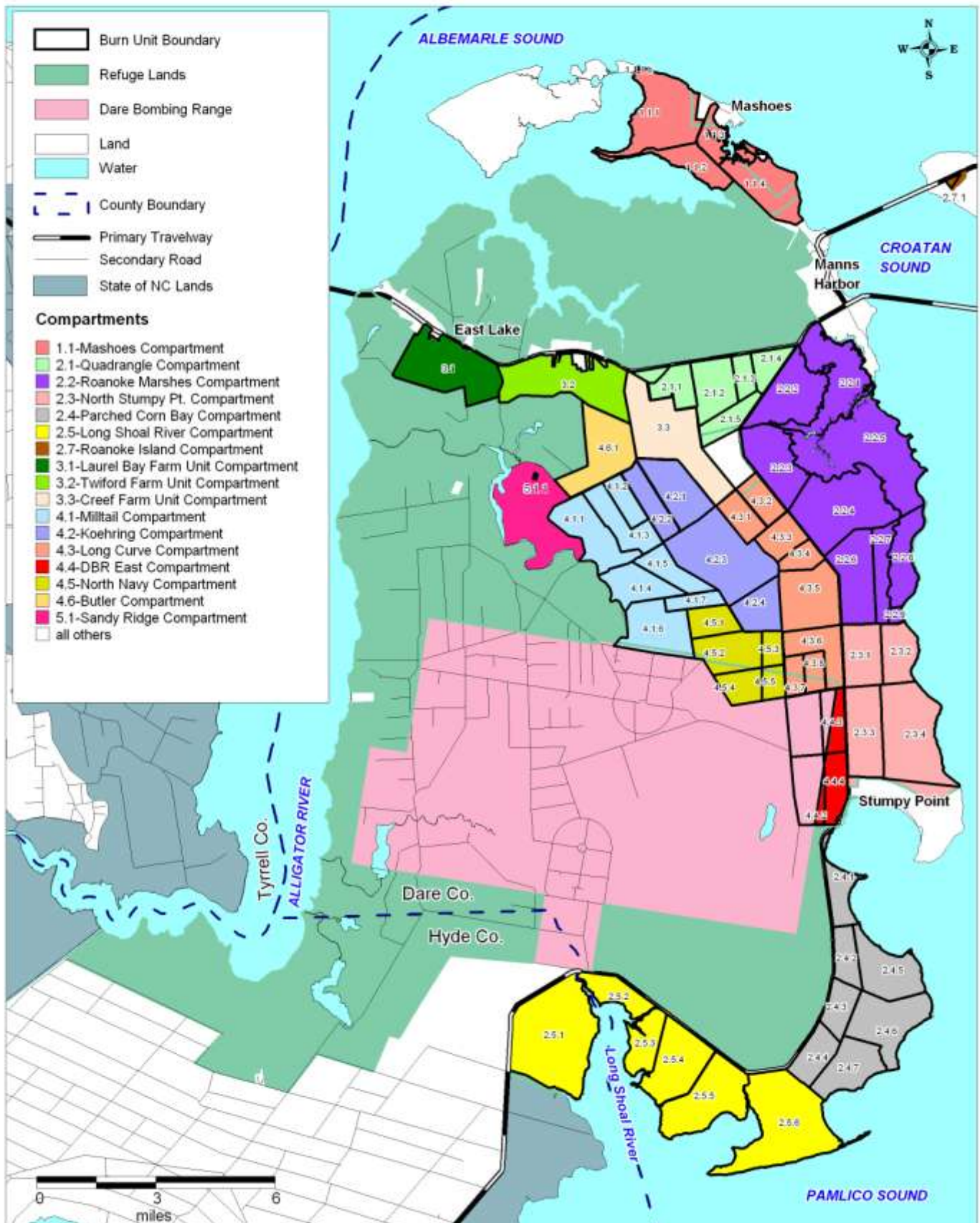
4.2.1.1. Overview of Prescribed Fire Program

Currently, the majority of the burns are conducted between October and February. While the use of prescribed fire may be desired throughout all seasons of the year, the combination of atmospheric conditions for excellent smoke dispersal and timing of the burn to achieve optimum fire effects on fuels or habitat seldom coincide. Considerations such as red wolf denning and whelping seasons as well as waterfowl and neotropical migratory songbird nesting can influence when an area is burned or require additional restrictions in the Prescribed Fire Plan (PFP) to lessen harmful impacts to these species. Allowable burn dates will be determined by burn unit and detailed in that unit's PFP.

Many of the FMUs have been divided into Fire Compartments and then further subdivided into Burn Units. Roughly 72,000 acres at ARNWR and 3,000 acres at PINWR are slated to be treated with fire. Burn Unit rotation is based on management objectives, but typically ranges between 3-8 years. Management flexibility is used during evaluation of the annual work plan when individual burn unit rotations can be examined to see if resource, weather, or fuel conditions warrant a more frequent or a less frequent burn interval. Water levels, weather, soil moisture, and seasonality will play a role in the scheduling of burns; therefore, the actual annual prescribed burn acreages for the refuge will vary considerably. Based on a 3 to 5 year fire interval to maintain plant and wildlife habitat and minimize fuel build-up, approximately 14,000 to 24,000 acres on both refuges should burn each year. Approximately 66% of the treatments (9,240 to 15,840 acres) will be accomplished in the WUI and 34% (4,760 to 8,160 acres) accomplished in non-WUI areas.

A 5-year average for treated unit size is 540 acres (range 1 to 3,000 acres). Prescribed fire complexity ranges from low to high across these Burn Units with the majority of the prescribed burns as moderate complexity (RXB2) burns. A few burns are high complexity because of WUI considerations, the complexity of the organization, or fire behavior concerns. The Alligator River farm fields and the occasional debris burn are considered low complexity (RXB3) due to the number and organization of the resources used and the chance of escape. A PFP may include multiple complexity analyses with different complexity levels so that the appropriate complexity level may be used based on changes in burning conditions, ignition methods, or available resources.

Figure 12: Alligator River National Wildlife Refuge - Prescribed Burn Units



4.2.1.2. Effect of National and Regional Preparedness Levels

There can be certain situations at local, regional or national levels which can result in prescribed burning operations on the refuge being limited or curtailed. At District Preparedness Levels 4 and 5, Burn Bosses must consider the District's Staffing Level before igniting a burn. Resources must be available to meet criteria described in the Step-up Plan. The Southern Area Multi-Agency Coordinating Group (SAMAC), in consultation with agency fire coordinators, determines Regional Preparedness Levels based on wildland fire activity within the Southern Area and the need for fire suppression resources. At Regional Preparedness Level 4 or 5, the Regional Director must approve all prescribed burns. Prescribed fires may be ignited during National Preparedness Level 4 or 5 only as specified in the *National Interagency Mobilization Guide*. National and Regional Preparedness Levels can be determined by checking the National Situation Report at: <http://www.nifc.gov/nicc/sitreprt.pdf>.

4.2.1.3. Project Planning

All prescribed fires must have a written plan that is reviewed and approved by the Refuge Manager, and reviewed by another qualified Burn Boss for technical accuracy. The PFP should ideally be prepared and developed by an interdisciplinary team in which at least one member has successfully completed the Service's Prescribed Fire Planning and Implementation course or the NWCG Prescribed Fire Burn Boss training courses. The PFPs will follow the template and guidance in the *Prescribed Fire Guide*, Service and regional policy.

Fire and refuge management staff will develop an annual prescribed fire program of work that targets specific Burn Units for a given year. The specific treatments within the program of work will be reviewed by the Refuge Biologist to determine the potential for conflicts between fuel management and other biological objectives. The FMO will work with the Biologist to address any conflicts (e.g., change in season of burn, exclusion of management area, etc.). The Biologist may request treatments be reviewed by other subject matter experts if necessary. A red wolf Biologist will always be contacted prior to a burn on ARNWR, but particularly close coordination is needed for burns conducted during the red wolf whelping season (March – June) to determine potential impacts to dens.

Several other constraints influence project planning on the refuges. Utilizing appropriate wind direction to keep smoke off NC 12 and safety for the public and firefighters on the highway are major concerns for prescribed burning at Pea Island NWR. Risk of ground fire and escaped fires are the dominant factors influencing the use of prescribed fire in organic soils and overgrown pocosin shrub habitat at Alligator River NWR. Size of the burning compartment and access within the compartment are additional issues that have to be addressed as a prescription is prepared. The compartment must be sufficiently broken down into manageable burn units in order to meet smoke management guidelines. Access to the compartments must be adequate to ensure the safety of firefighters and deployment of contingency forces. Many of the large, unbroken expanses of wildland fuels have been broken down into smaller burn units and treated with prescribed burns over the past 10 years. However, there are other areas which still challenge refuge staff. Developing PFPs with burn windows that address the concerns and issues for these remaining unburned compartments is a priority. The Refuge fire organization must be

available and ready with completed burn plans, specified resources for operations and contingencies whenever burn windows occur.

4.2.1.4. Project Implementation

Upon approval of the burn plan, burn unit preparation can begin. Prescribed fire preparation activities may include identifying and preparing containment lines around the burn unit perimeter. Special considerations for holding and firing will be minimized by pre-burn activities such as treating snags along the fire breaks or mechanical removal of heavy fuel accumulations near structures or other areas of high fiscal or resource value. Preparatory burns, as discussed in the PFP, may be used to take advantage of wet conditions within the blocks and treat the fuels along the edges exposed to the wind and sun in advance of the main burn. Any pre-burn treatment that can be completed to improve the safety and effectiveness of the burn will be explored and implemented.

During the development of the PFP, the number of operational and contingency resources are determined and documented. All Service personnel on a prescribed burn will be NWCG or Service qualified for the position that they are assigned. Cooperators, contractors, and casual hires (AD) may be used to implement prescribed fires. ADs must meet Service standards. Cooperators, such as members of Volunteer Fire Departments, must have appropriate qualifications certified by their agency. Those who supervise Service employees during prescribed fires must meet Service standards. The Service recognized Prescribed Fire Crew Member (RXCM) position, with a moderate fitness rating, may be used on refuge lands under procedures outlined in the *FWS Fire Management Handbook*. The approved exception form is included in the Appendix. Since the RXCM qualification can not be used for suppression, all PFPs will address the use of RXCM in relation to contingency resources.

A Burn Boss, qualified at the appropriate complexity level, is responsible for implementing the prescribed burn in accordance with the approved Prescribed Fire Plan. This includes any public or agency notifications, completion of the Go/ No-Go Checklists, smoke management requirements, obtaining spot weather forecasts, and conducting an operational briefing. Cooperators must be contacted and often must be available to participate at the operational and/or contingency levels. Availability of helicopters and other specialty equipment must be assured. The presence or availability of contingency resources is an element within the Go/ No-Go checklist.

The public will be informed of prescribed fires through news releases, interpretive messages, and educational programs. Individual prescribed fires should not be conducted without informing those agencies and members of the public likely to be impacted.

A prescribed fire will be converted to a wildfire by those identified in the PFP when that person(s) determines that the contingency actions have failed or are likely to fail and cannot be mitigated by the end of the next burning period. A prescribed fire will be converted to a wildfire when the fire has spread outside the project boundary, or is likely to do so, and cannot be contained by the end of the next burning period. A prescribed fire can be converted to a wildfire for reasons other than an escape. An AMR will be made to such incidents and a formal analysis

(Complexity and WFSA) undertaken as required by policy. The Refuge Manager will be notified of an escaped prescribed fire, as identified in the burn plan.

4.2.1.5. Smoke Management

The refuge must comply with all applicable Federal, State, and Local air pollution control requirements, as specified within Section 118 of the Clean Air Act, as amended (42 USC 7418). To do this, it must take aggressive action to manage smoke from prescribed burns to minimize impacts and maintain air quality. Since fires are not point sources, but rather tend to be spatially distributed singular events, temporary impacts to visibility must be recognized, expected and managed. All refuges are required to obtain necessary permits for prescribed fires, comply with the national ambient air quality standards (NAAQS) both inside and outside refuge unit boundaries, and protect visibility in Congressionally-mandated Class I areas. These are federally mandated programs that are enforced nationwide with program implementation primarily carried out by state and local air quality agencies. Swanquarter NWR, located approximately 25 miles to the southwest, is the only Class I area in the vicinity of Alligator River and Pea Island NWRs.

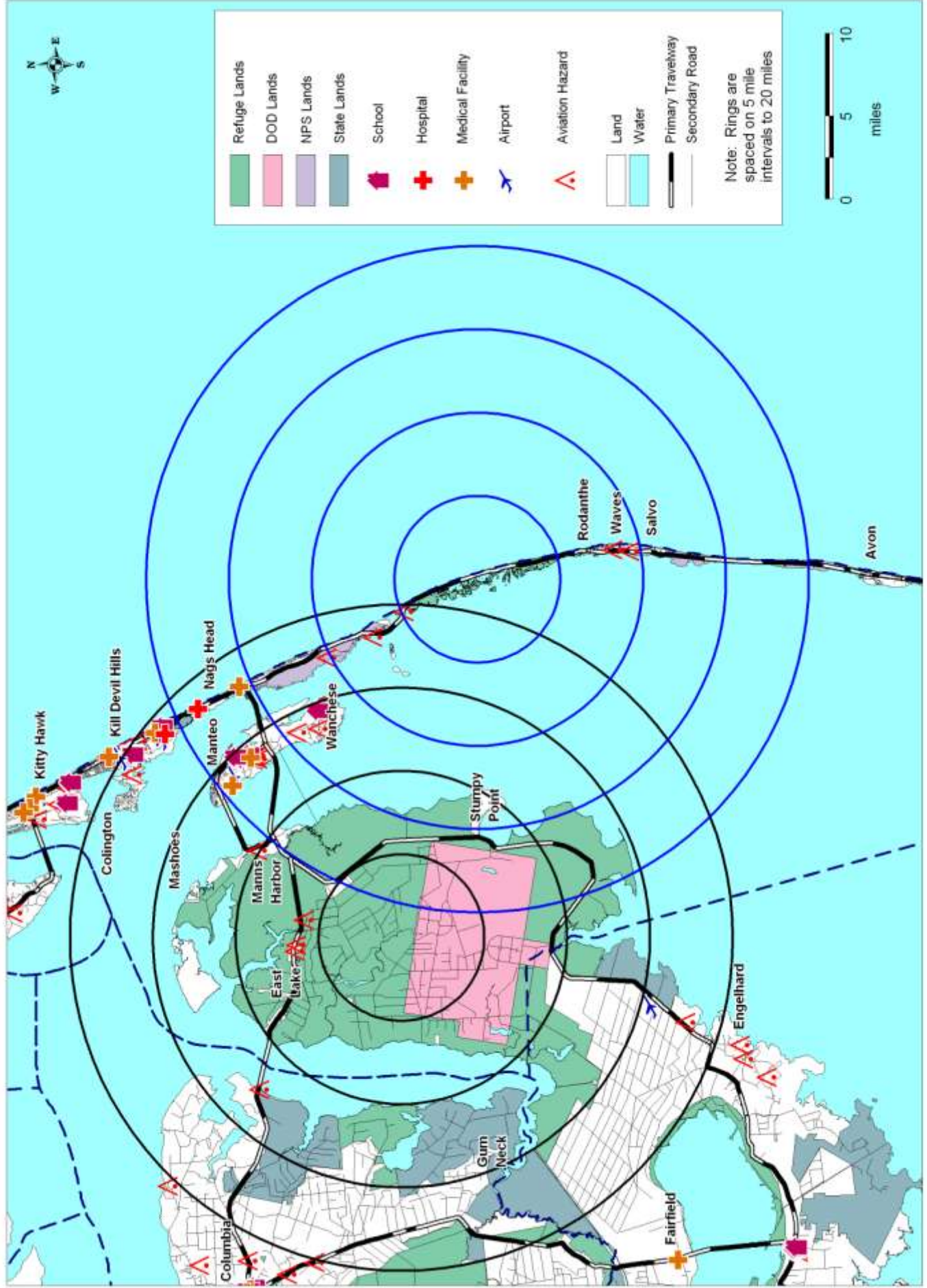
Smoke management is always a major consideration when smoke-sensitive areas (SSA) such as communities, hospitals, airports, and highways are nearby. During the writing of a PFP, a smoke management map is prepared that shows the location of all critical smoke sensitive areas within 20 miles of the proposed burn. During burning, strategies and tactics will be used that minimize smoke production as a public safety hazard. The appropriate tactics for a Burn Unit will be discussed in the Smoke Management section of the PFP where the SSAs will be classified by sensitivity to visibility or particulate matter concentration and actions developed to address them. Figure 14 shows a generic smoke hazards map for the refuges. The *Smoke Management Guide for Prescribed and Wildland Fire* (2001) is a useful reference for PFP preparers. Examples of possible smoke management tactics are:

- Mop up within 50 feet of any control line adjacent to major roads or residential areas.
- Place smoke ahead signs along any public road that may have visibility impaired by the fire's smoke.
- Notify law enforcement agencies if visibility is impaired along any public road.
- Position law enforcement personnel at appropriate locations to alert motorists of smoke impacted areas.
- Ground fire will be aggressively extinguished if it becomes a threat to air quality to the extent refuge management directs.

Figure 13: Pea Island National Wildlife Refuge - Prescribed Burn Units



Figure 14: Smoke Hazard Map



On the day of the burn, the fire weather forecast will be evaluated to ensure that the burn can proceed within prescribed weather parameters, including atmospheric conditions for smoke dispersal. All PFPs shall include the following minimum smoke management considerations:

1. Identified SSAs in the Smoke Management Section of the PFP will be addressed in light of predicted weather and atmospheric conditions. Wind direction and velocity shall either provide for transport of smoke and pollutants away from critical SSAs, or the smoke will be adequately diluted or dispersed before reaching the SSAs. Smoke dispersion models such as V-Smoke or Blue-Sky/RAINS are recommended for this analysis.
2. NCDNR Smoke Management Guidelines (SMG) will be followed unless an Operational Evaluation Burn (OEB) is implemented.
3. No burning shall be undertaken if an authorized governing agency has issued an air pollution health advisory, alert, warning or emergency for the refuge or surrounding metropolitan areas.
4. Burn Bosses will use firing techniques and timing that minimize smoke impacts to the public and accomplishes the burn's objectives.
5. Smoke will be monitored during prescribed burns. If smoke threatens a SSA, the appropriate authorities will be notified and conditions monitored to assess potential impacts.

4.2.1.6. After Action and Escaped Fire Reviews

The Burn Boss will ensure an informal AAR is conducted for each operational period on a prescribed fire (*Redbook*, Chapter 17). This AAR will focus on performance standards to enable agency administrators and firefighters to discover for themselves what happened, why it happened, and how to sustain strengths and improve on weaknesses. Certain events or a culmination of events that may affect future prescribed fire implementation and/or policy should be submitted via the Rollup documentation (found at <http://www.wildfirelessons.net>). The questions to answer in conducting an AAR are:

- What did we set out to do (what was planned)?
- What actually happened?
- Why did it happen that way?
- What should be sustained? What can be improved?

All prescribed fires converted to a wildfire will have an investigative review initiated by the Refuge Manager or Project Leader. The level and scope of the review will be determined by policy and procedures of the *Redbook* and the *FWS Fire Management Handbook*.

4.2.1.7. Reports

The completion of an approved Prescribed Fire Plan is the primary documentation that a prescribed fire has been attempted or completed. The PFP will specify information to be included in the project file. Various documents that record weather data or public comments will be attached to the completed plan, which includes a record of observed fire behavior and the kind and amount of resources committed to the burn. The Burn Boss will document the conditions

under which the burn was conducted in order to evaluate how closely the prescribed fire conformed to planned fire behavior, what unanticipated difficulties were encountered during the action, and how well the prescribed fire accomplished the desired results. All completed burn plans and associated documents will be kept in a binder as a permanent record of the burn day activities. The Burn Boss will ensure this information is placed in the project file.

On the day of the burn, the refuge Dispatch Office will notify NCDFR that a prescribed burn is planned and provide that person with the size, time of ignition and the location of the burn. The District Dispatch office will also be responsible for reporting daily prescribed burning activities to the State Coordination Center. Within **ten days** following the completion of a prescribed burn an Individual Fire Report (DI-1202) will be electronically submitted into the Fire Management Information System (FMIS). Prescribed fire accomplishments must also be reported to the National Fire Plan Operations and Reporting System (NFPORS) in the same time frame as FMIS.

4.2.2. Non-Fire Hazardous Fuels Treatment Program

4.2.2.1. Overview

The reduction of hazardous fuels contributes favorably to refuge management objectives and includes not only prescribed burning, but also mechanical and herbicide treatments. Past non-fire fuel treatments have been largely mechanical and included firebreak construction and maintenance, mowing road shoulders, and small thinning treatments around structures. Mechanical projects have also included installation of culverts across ditches and canals to provide access to a burn unit as a prerequisite to prescribed burning and access for wildfire control. Herbicide treatments on the refuges have traditionally focused on invasive species control, but have not been coordinated as fuel treatments. These efforts are being better organized and documented between programs as both hazardous fuel and resource objectives are being met. In the future, herbicides will also be used to treat vegetation in firebreaks to improve the efficiency of mowing to manage vegetation and reduce maintenance costs.

The ten-year annual average for reported non-fire fuel treatments is 3.6 treatments for 42 acres. As project reporting and coordination between refuge program areas continues to improve and the use of non-fire fuel treatments expands, Alligator River and Pea Island will see a jump in the number of acres treated by non-fire methods. Table 7 summarizes the projected annual WUI and non-WUI, non-fire fuel treatments for the next 5 years on both Alligator River and Pea Island NWRs.

Table 7: Projected Annual Non-Fire Fuel Treatments

Refuge	WUI acres	Non-WUI acres
Alligator River	420	70
Pea Island	2	17

Refuge fire management staff will develop an annual program of work that targets specific treatment areas. Non-fire treatments may be conducted during any season of the year depending on the specific management objectives. Herbicide treatments will use only refuge approved

herbicides documented in a Pesticide Use Proposal. All non-fire fuel treatments will be coordinated with other refuge program areas and CCP step-down plans, such as Invasive Species Management Plan, to increase efficiency of treatments and decrease any administrative or biological conflicts. Specific treatments within the program of work will be reviewed by the Refuge Biologist and may be reviewed by other subject matter experts if necessary.

Projects are generally moderately complex in terms of planning and implementation with most of the complexity involving the specialized mechanical equipment needed to hold up on organic soils. A variety of equipment is utilized in non-fire fuel reduction activities. Typical equipment may include mowers, chippers, grinders, roller choppers, dozers, and mulchers. Herbicides could be applied using back-pack sprayers, the marsh master, or aircraft. Specialized equipment that better meets the needs and protects refuge resources and sensitive sites are continually being developed, tested and employed as appropriate.

Within **ten days** following the completion of a non-fire fuels treatment, a web-based fire report will be electronically submitted into FMIS. Prescribed fire accomplishments must also be reported to NFPORS in the same time frame as FMIS. In addition to the fuels reduction project accomplishments being reported in NFPORS, an annual pesticide report is required to document the application of specific herbicides, biological agents, and active ingredients.

4.2.2.2. Treatments

Mechanical fuel reduction activities will be used as needed and where appropriate to reduce hazardous fuel accumulations in firebreaks, roads, refuge administrative sites, visitor use areas and wildland-urban interface areas. Herbicide applications may also be used to kill or retard vegetative growth on these sites as well as target invasive species. Biological agents may be used to selectively affect vegetative species. Prescribed fire and non-fire techniques may be used individually or in tandem to provide the best resulting effect in the fuel reduction effort.

The Fire Management Units have been divided into Burn Units whose boundaries are delineated by roads, constructed firebreaks, canals, and dikes. The network of 140 miles of roads and 54 miles of firebreaks not only makes prescribed burning possible, but it also is very important for wildfire control. Over the last 5 years, most of the refuge roads on Alligator River NWR have been graveled which has improved access for refuge fire equipment. Mowing the road shoulders continues to be an important mechanical treatment for control of hazardous fuels. Where needed, firebreaks were cut next to existing canals or v-ditches to reinforce these pre-existing firelines. Firebreak maintenance is done annually primarily using mechanical means, but any method (herbicides or burning) may also be used if appropriate. Occasional mechanical treatments to day-light the ditches to remove overhanging vegetation are also important for wildfire control. Regular mowing of dikes at both refuges is also important for wildfire control. Pea Island has had at least two fires in the last decade started by refuge vehicles on the dikes.

Over the years, refuge staff has found some Burn Units difficult to access safely or in a timely manner. Some mechanical treatments for hazardous fuels may simply be access improvement projects that would allow fire staff greater access to a Burn Unit for prescribed burning, and thereby increase the safety and efficiency of that project or improve access to an area for control

of wildfires. Such projects might include installation of culvert crossing or bridges or the cutting of short access routes. Future mechanical projects, which may also be funded at least in part as hazardous fuels projects, could include hydrological restoration projects which install flashboard risers and culverts to control water table depth in the peat soils of the Alligator River NWR.

Other mechanical treatments in the next 5 years may include thinning and mulching vegetation around refuge housing, public use facilities, or other administrative areas to increase their protection from wildfires. WUI mechanical projects in and around communities may increase defensible space. In areas where smoke management severely restricts the potential for using prescribed burning to reduce hazardous fuels, non-fire treatments may be used to achieve management objectives. On Alligator River NWR, any fuel thinning or biomass removal projects must carefully consider impacts to the wetland, organic soils. Low ground pressure, tracked equipment generally results in the least impact to the root mat, but can greatly increase the cost of work.

The invasive species control efforts on the refuges not only benefit the habitat, but also create a fuel model change. Phragmites is the primary non-aquatic target for control and is generally considered a Fuel Model 4. Successful control would result in a Fuel Model 3 with restoration of the native marsh grasses. Herbicide treatments are the first phase of Phragmites control, but these treatments are then often followed up with a prescribed fire treatment. Other herbicide fuel treatments may be done during restoration of Atlantic White Cedar stands, hardwood stands, or other vegetation on the refuges which can contribute to hazardous fuel reduction. Firebreak maintenance on the refuges may also include herbicide treatments to improve the efficiency of mowing, reduce woody vegetation, and reduce maintenance costs.

4.2.3. Process to Identify Hazardous Fuel Treatments

The objectives identified in the National Fire Plan and in the *10-Year Comprehensive Strategy* result in a range of specific strategies identified in this plan. The Southern Wildfire Risk Assessment (SWRA) can be used to categorize the risk of wildland fire to communities, and this document addresses strategies that contribute to protection of those communities in the vicinity of the refuges. Projects in the WUI receive the highest priority. District fire staff will work collaboratively across the District and in coordination with our fire management partners to prioritize fuels projects in the District and on each refuge.

The refuge has collaborative relations for fire management operations with the NC Division of Forest Resources, the NC Wildlife Commission, The Nature Conservancy, the US Forest Service, the Department of Defense, local volunteer fire departments (VFDs) and adjoining counties' Emergency Management offices. Partners are consulted during project development for areas of collaboration and efficiencies.

Figure 15: Alligator River NWR Wildland-Urban Interface Areas

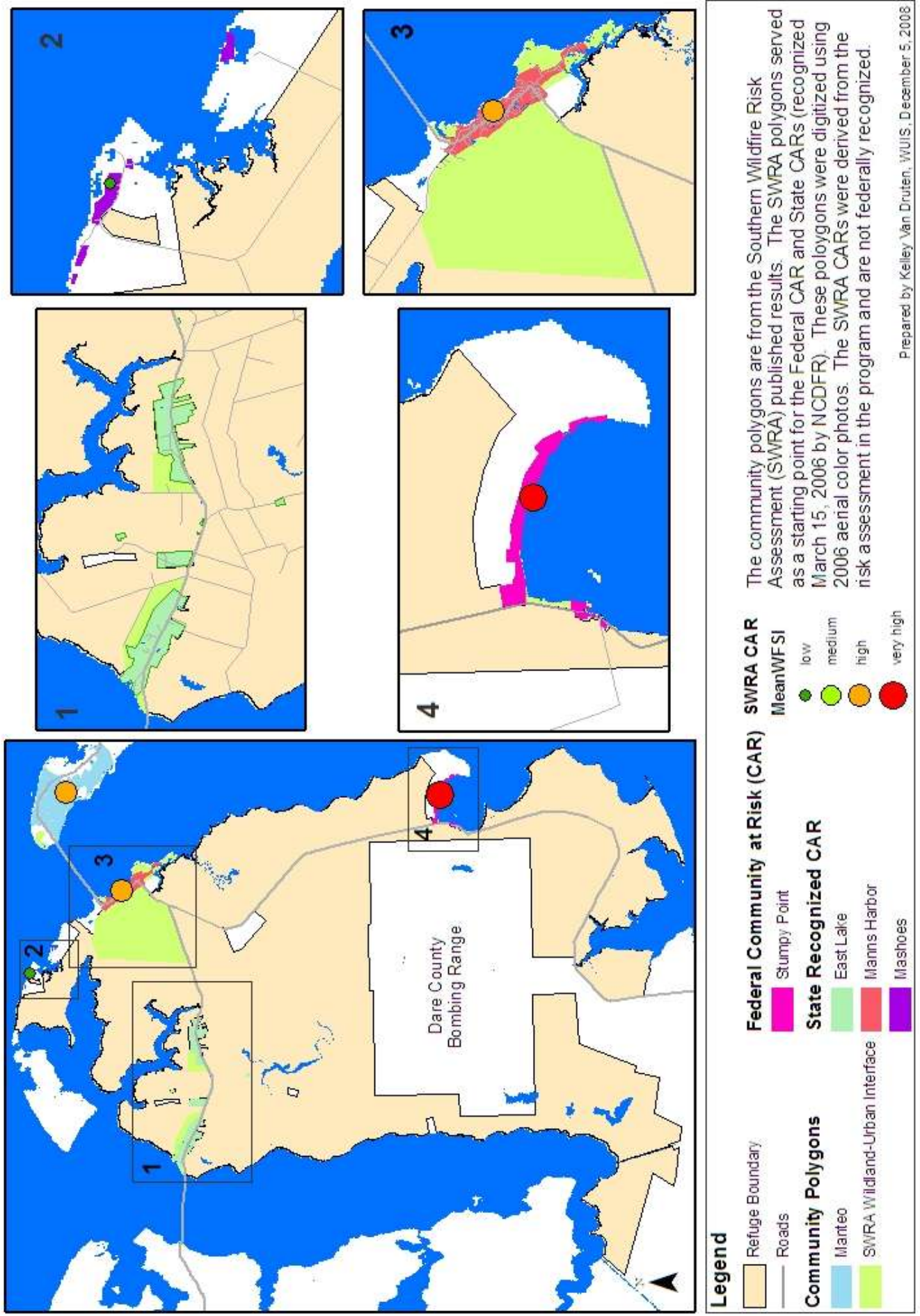


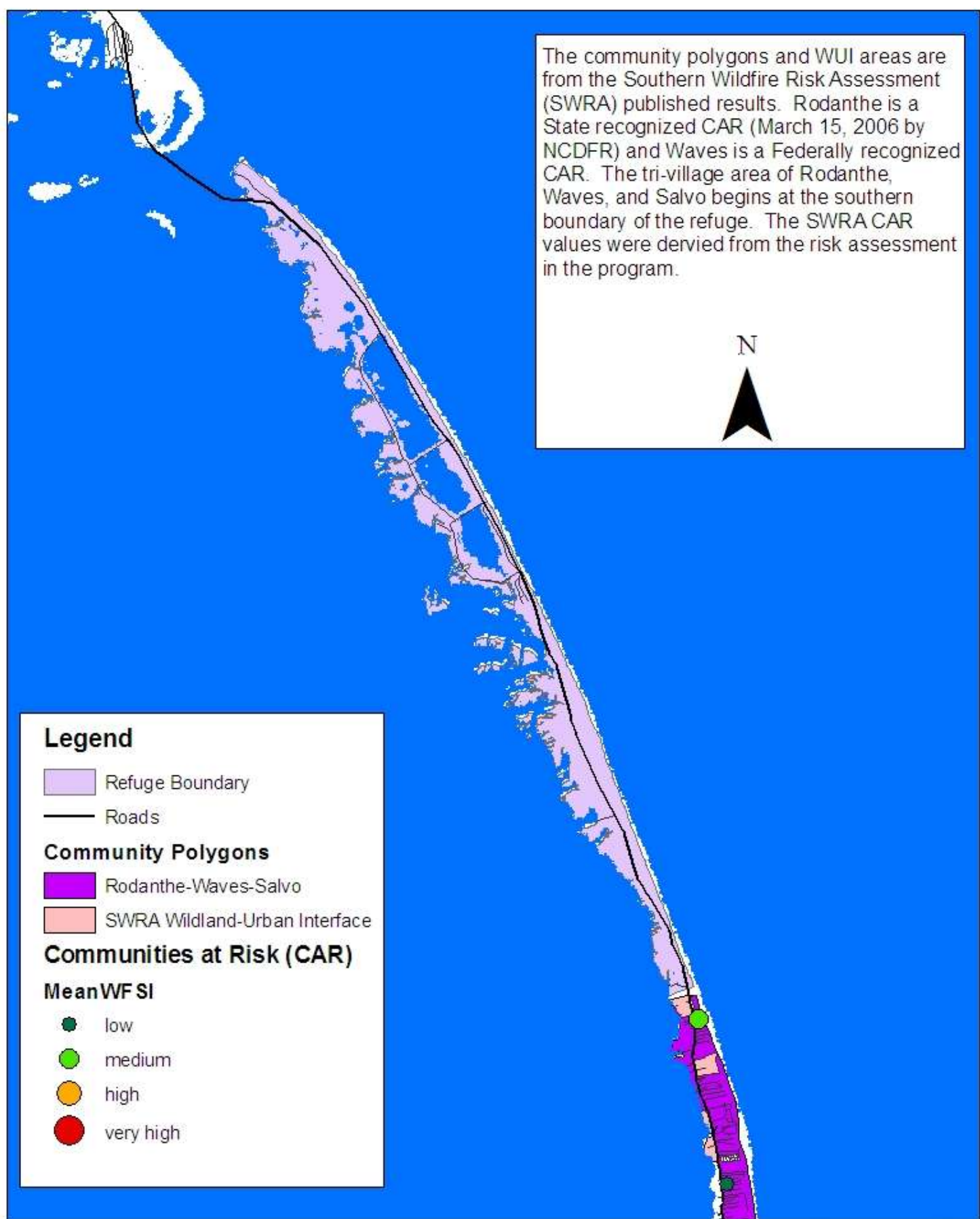
Figure 16: Pea Island NWR Wildland-Urban Interface Areas

The community polygons and WUI areas are from the Southern Wildfire Risk Assessment (SWRA) published results. Rodanthe is a State recognized CAR (March 15, 2006 by NCDFR) and Waves is a Federally recognized CAR. The tri-village area of Rodanthe, Waves, and Salvo begins at the southern boundary of the refuge. The SWRA CAR values were derived from the risk assessment in the program.



Legend

- Refuge Boundary
- Roads
- Community Polygons**
 - Rodanthe-Waves-Salvo
 - SWRA Wildland-Urban Interface
- Communities at Risk (CAR)**
- MeanWF SI**
 - low
 - medium
 - high
 - very high



4.3. Emergency Stabilization and Rehabilitation

The US Fish and Wildlife Service takes responsibility for taking prompt action to determine the need for and to prescribe and implement emergency treatments to minimize threats to life or property or to stabilize and prevent unacceptable degradation to natural and cultural resources from the effects of a wildfire on refuge lands (*Redbook* 2008). Damages resulting from wildland fires are addressed through four post wildfire activities: wildfire suppression activity damage repair, emergency stabilization, burned area rehabilitation, and long-term restoration. Departmental and Service emergency policy and guidance for these post wildfire activities are found in the *Redbook* (2008), 620 DM 3, 095 FW 3.9, and the *Interagency Burned Area Emergency Response Guidebook* (2006). District fire staff will attempt to coordinate and/or inform our fire management partners on our activities.

4.3.1. Wildfire Suppression Activity Damage Repair

Wildfire suppression activity damage repairs are planned actions taken to repair damages to resources, lands, and facilities resulting from wildfire suppression actions, and are documented in an Incident Action Plan. These actions are usually implemented immediately after the containment of the wildfire by the Incident Management Team before the Team is demobilized. If necessary, engineers, hydrologists or other specialists will be consulted to determine the extent of damages incurred to refuge resources and facilities from suppression activities.

Following every suppression action on the refuge that requires the use of hand tools or control lines or causes other surface damage, the affected sites will be repaired. The tractor-plow unit will remain the most common method of establishing firelines to serve as control lines on initial attack operations on ARNWR wildfires. This method is the most effective and efficient resource in suppressing wildfires in the thick brush and organic soils of ARNWR. However, the resulting line, if left open and exposed to the elements, can cause accelerated oxidation of organic soils and be more prone to ground fire following the next ignition. Following every fire on the refuge, plow lines and hand lines will be repaired by pulling the berms back into the line in areas where utilizing equipment would not cause further damage. In most cases, firelines on PINWR will be a combination of walk-down lines (smashed vegetation) and wet lines that will not require rehabilitation. If tractor-plows are used, rehabilitation of plow lines will receive the same consideration at Pea Island as at Alligator River.

Grass seed will not normally be sown on plow lines, but rather they will be allowed to re-vegetate naturally. Emergency seeding and control techniques will be used in areas where erosion control is necessary (e.g.; heavily disturbed areas like ICPs, parking areas, pump sites, and etc). Wetlands will be protected as needed. Snags will be removed if they pose a threat to life or property, but otherwise preserved for cavity nesting wildlife.

4.3.2. Emergency Stabilization (ES)

Emergency stabilization are planned actions to stabilize and prevent unacceptable degradation to natural and cultural resources, to minimize threats to life or property resulting from the effects of a wildfire, or to repair/replace/construct physical improvements necessary to prevent degradation

of land or resources. ES actions must be taken within one year following containment of a wildland fire and documented in a Burned Area Emergency Response Plan (BAER Plan). Monitoring for treatment effectiveness will be conducted on all approved treatments and the results described in an annual or final report.

Natural recovery is the preferred ES treatment for the refuges. No specific actions have been undertaken to date to stabilize an area or implement a BAER Plan; however, it is recognized that under certain possible scenarios, stabilization treatments could be implemented. Allowable actions permitted on the refuge that may be deemed necessary to stabilize an area under an emergency response include:

1. Assessments:
 - Burned area assessments will identify post-fire threats to federally listed or proposed threatened and endangered species and what, if any, cost effective stabilization measures can be implemented to prevent further post-fire condition degradation.
2. Cultural Resources:
 - Site stabilization and Protection
 - NHPA Section 106 Compliance
3. Non-native Invasive Control:
 - Assessments to determine the need for treatment. Contingent upon location of known infestations, possibility of new infestations due to management actions, and suspected contaminated equipment use areas.
 - Treatments to prevent detrimental invasion by non-native species (not present on the site).
 - Treatment of invasive plants introduced or aggravated by the wildfire. The treatment objective when the population is aggravated is to maintain the invasion at no more than pre-wildfire condition.
 - Treatments to prevent permanent impairment of designated Critical Habitat for Federal and State listed, proposed or candidate threatened and endangered species.
4. Re-vegetation:
 - Stabilize a site and minimize water or wind erosion
 - Reduce invasion of non-native invasive plants
 - Prevent Critical Habitat for federally listed threatened and endangered species from being more impaired than if nothing was done
 - See *Interagency Burned Area Emergency Response Guidebook* (2006) for further information
5. Federal Field Unit Infrastructure:
 - Emergency stabilization of improvements and minor facilities (e.g., signs, kiosks, guardrails, and others as listed in Section 3) burned or damaged by wildfire is

appropriate only for public health and safety reasons. If it is not an immediate threat to public health, it will be reviewed under the Burned Area Rehabilitation Plan

- HAZMAT and Facility Assessment and Stabilization
- Emergency Road Repairs and Maintenance - Road closure is preferable unless the road is needed to provide immediate access to essential activities (e.g., hospital and post office access, threatened and endangered species management, communication systems). Damages due to suppression activities to roads will fall under “Wildfire Suppression Damage Activity Repair” as stated above.

6. Burned Area Emergency Response Team (BAER TEAM) and Plan Development:

- An ad-hoc team of Agency Administrator (Project Leader), refuge staff and any additional personnel necessary will form an initial Burned Area Emergency Response Team. If warranted, a National BAER Team will be ordered to meet the refuge’s needs. The team, under the guidance of the Agency Administrator will:
 - a. determine the need for burned area assessments
 - b. determine what further expertise is needed to conduct assessments
 - c. develop a Burned Area Emergency Response Plan with identified treatments
 - d. Track treatments in NFPORS
 - e. implement treatments
 - f. monitor effectiveness of treatments
 - g. write report based on monitoring results including a final report

4.3.3. Burned Area Rehabilitation (BAR)

Rehabilitation refers to efforts taken within three years of containment of a wildland fire to repair or improve wildfire-damaged lands unlikely to recover naturally to management approved conditions, or to repair or replace minor facilities damaged by wildfire. These efforts are documented in a separate Burned Area Rehabilitation Plan (BAR Plan).

Natural recovery is the preferred rehabilitation treatment for the refuges. No specific Burned Area Rehabilitation Plans have been implemented to date following wildfires; however, it is recognized that under certain possible scenarios, rehabilitation treatments could be necessary. Allowable actions permitted on the refuge that may be deemed necessary to rehabilitate an area following wildfires include:

1. Cultural Resources:

- BAR funds are used to ensure burned area rehabilitation treatments conform to Section 106 of the National Historic Preservation Act (NHPA). Funds can not be used for restoration of any cultural resource or heritage sites.
- Additional limitations are listed in the *Interagency Burned Area Emergency Response Guidebook* (2006).

2. Non-native Invasive Control:

- BAR funds can be used to control non-native invasive plants in burned areas only if an approved management plan and existing program is in place addressing non-native species control.
- Remaining allowable actions are the same as ES – see above.

3. Re-vegetation:

- Allowable actions are the same as ES – see above.

4. Forest Management:

- Forest management may be considered if the ecosystem is unlikely to recover naturally from wildfire damage (not regenerate for 10 years following fire) as prescribed by a certified silviculturalist. The use of BAR funds to plant trees must be addressed in an approved land management plan (see 620 DM 3). Tree planting is limited to the following:
 - a. facilitating the succession and stabilization of forest ecosystems.
 - b. reestablishing habitat for federally listed threatened or endangered species, or other special status species.
 - c. reintroducing or reestablishing native tree species (i.e. Atlantic White Cedar) and seed sources lost in a stand replacement fire.

5. Minor Facilities:

- The repair or replacement of minor improvements and facilities (e.g., kiosks, fences, interpretive or boundary signs, recreation facilities, trails, permanent long-term monitoring plots or other as listed in Section) burned or damaged by wildfire to pre-fire specifications is authorized with the use of BAR funds only if these improvements or facilities are necessary for implementing an approved land management plan. It does not include the construction of new or upgraded facilities that did not exist before the fire. BAR treatments and maintenance of BAR improvements beyond 3 years from wildfire containment is funded with other program funding. Minor facility repair or replacement must be addressed in the BAR plan.

6. Burned Area Rehabilitation Team and Plan Development:

- An ad-hoc team of Agency Administrator (Project Leader), refuge staff, and any additional personnel necessary will form a Burned Area Rehabilitation Team. The team, under the guidance of the Agency Administrator will:
 - a. Allowable actions are the same as ES – see above

4.3.4. Long Term Restoration

Restoration includes continuing the rehabilitation beyond the initial three years or the repair or replacement of major facilities damaged by the wildfire. Land management plans and other funding sources are available to continue the rehabilitation efforts beyond three years.

4.4. Prevention, Mitigation and Education

The *Master Agreement* states that all parties will work cooperatively on prevention and education efforts. District fire staff will attempt to coordinate and/or inform our fire management partners on our activities.

Human-caused fires are not a significant ignition source for the refuge. A fire prevention program will be developed in coordination with the NCDNR as needed to address specific occurrences or arson outbreaks. Instead, education programs will emphasize the refuge fire program and incorporate the importance of prescribed fire and fuels management in both preventing wildland fire and as a management tool to meet refuge habitat objectives. Community education programs will also include steps area residents and property owners can take to reduce possible damages to their homes and property from wildfires through programs such as Firewise.

Fire operations on the refuges can be very noticeable, and questions from the public about what is happening and how it concerns their welfare are to be expected. The refuge must be prepared to protect the public during fire operations and inform them of the purpose and techniques of our fire management program. The refuge will continue to promote public understanding of wildland fire, both the natural role of fire in the ecosystem and the associated risks of living in that environment. The refuge will promote community assistance through education and coordination with county planning and zoning departments to promote firewise construction and landscaping principles and initiatives in fire-sensitive land use planning. In addition, efforts would be made to explore the initiation or facilitation of WUI Councils or Firewise/Firesafe organizations in communities surrounding the refuge. Outreach and public education efforts by the refuge fire management program will supplement other refuge outreach programs.

Opportunities will be sought to inform the public through local, state and national media in wildfire incidents of significant interest. During wildfire incidents, a Service and/or NCDNR Public Information Officer (PIO) will be utilized to maintain media contacts and educate the public on the natural role of fire. Cooperative relations with other agencies on the incident will be highlighted as appropriate to educate the public on the cooperative and efficient system of firefighting.

When appropriate, a dual message should be presented by refuge staff that informs the public that the Service will apply an Appropriate Management Response to all wildfires, yet will use prescribed fire to reduce the threat of wildfires and manage resources. Through the judicious use of managed fire, better habitat for wildlife can be created while maintaining fire-influenced ecosystems and improving forest health. The primary message to convey to the public is that the Service takes a proactive approach to wildland fire which includes the use of fire as a management tool.

Specific fire outreach strategies are:

- Purchase fire prevention & education materials for use at public events.
- Provide talks and demonstrations to schools, civic groups and refuge visitors explaining the use of fire for hazardous fuels reduction and resource management.
- Prepare news releases at the commencement of prescribed fire season describing units that are to be burned and additional news releases describing accomplishments. News releases can be coordinated on a District level.
- Utilize permanent or temporary displays in areas of public use on the refuge to explain events that shape the refuge fire management program.
- Facilitate community-based wildfire mitigation efforts (i.e., Community Wildfire Protection Plans and Firewise Community USA mitigation plans) that encompass hazard fuel reduction actions, prevention and education efforts, and actions to reduce structure ignitability.
- Coordinate with county planning and zoning departments and home owner associations to promote the adoption of firewise principles in all new construction and subdivision plans. Initiate or facilitate a WUI Council or Firewise/Firesafe organization.
- Utilize PIOs during wildfire events to keep the public informed of significant incident events and to explain the natural role of fire in the ecosystem.

5.0. Monitoring and Evaluation

5.1. Fire Management Plan

5.1.1. Annual FMP Review

This FMP will be reviewed annually and updated as needed, upon local agency administrator approval. A checklist of FMP elements included in the appendix will be initialed by the FMO and signed by the Refuge Manager to ensure that a yearly review has been completed. Revisions of FMPs with Regional review and concurrence are required every five years. FMPs may be revised more frequently if significant changes on FWS or adjacent lands occur or following completion of a new or significantly revised CCP or habitat management plan.

5.1.2. Fire Management Plan Terminology

Terms in the FMP are defined by the National Wildfire Coordinating Group, located at <http://www.nwcg.gov/pms/pubs/glossary/index.htm>. Any terms used in the FMP and not found in the glossary are defined below.

High Reliability Organization (HRO) - an organization that has succeeded in avoiding catastrophes in an environment where normal accidents can be expected due to risk factors and complexity.

Wikipedia contributors, 'High reliability organization', *Wikipedia, The Free Encyclopedia*, 28 September 2008, 06:16 UTC, <http://en.wikipedia.org/w/index.php?title=High_reliability_organization&oldid=241479620> [accessed 15 October 2008]

Point protection - Providing direct protection with available resources to a single defensible value at risk.

Conflagration Barrier – area of fuel treatments strategically designed to significantly slow a wildfire originating in the interior of the Albemarle peninsula from spreading to the communities of Stumpy Point, Manns Harbor, Mashoes, or East Lake.

5.2. Treatment Effectiveness

5.2.1 Fire Effects Monitoring

During all prescribed burns, periodic weather and fire behavior observations will be made and recorded. The Prescribed Fire Burn Boss will complete an evaluation of each prescribed burn. This evaluation will include the information on weather and fire behavior, a narrative of firing procedures, smoke behavior and/or problems, a cost analysis of the burn, and any significant equipment problems. The evaluation will also assess to what degree the objectives of the burn were met, and any recommendations for future burns in that particular Burn Unit.

A first order fire effects monitoring plan is currently under development (planned completion of 2009). This step-down plan will provide a monitoring protocol that will help determine if prescribed burn objectives were met. Monitoring results could influence the fire return frequency, fire ignition techniques, and prescription parameters.

Non-fire fuel reduction activities are typically designed to reduce the level of hazardous fuels and to alter vegetation structure and composition to meet refuge resource objectives. Post-treatment assessment will include documentation in NFPORS and FMIS of fuel reduction and vegetative change from the treatment. Depending on the management objectives of the project, the level of post treatment effects monitoring may be similar to that of suppression or prescribed fire. The fuel reduction project plan should specify the level and elements that will be monitored.

5.2.2. Prescribed Fire Research

There are many gaps in our knowledge of the role of fire in freshwater and brackish marshes, pocosin and pond pine wetlands, and other associated wetland ecosystems in the coastal plain of North Carolina and other states on the eastern seaboard. Research is needed to increase our knowledge of the historic role and the management of fire in these fire-dependent ecosystems, as well as what changes should be anticipated in light of climate change and sea level rise.

Research focal areas include:

- Developing new and fine tuning existing products for modeling and predicting smoke behavior and plume development.
- Understanding fuel conditions favorable for large fire growth.
- Understanding the conditions that lead to and sustain ground fire development in a wide range of pocosin soils.
- Understanding fire effects on various plant communities in pocosin ecosystems.
- Understanding fire effects in areas affected by sea level rise.
- Understanding fire effects on carbon sequestration in the various coastal ecosystems.

Appendices

- A. Fire Operations
 - 1. 2008 FWS-NCDFR Cooperative Plan (Annual Operations Plan)
 - 2. List of Additional Resources
 - 3. FY 2008 Regional Dispatch Plan
 - 4. District 1 Step-up Plan
 - 5. Fire Card
- B. Aviation
 - 1.1. Station Aviation Plans
 - 1.2. Air Operations Addendum to Annual Prescribed Fire Plans
 - 2. Pre-Accident Plan
 - 3. Alligator River Flight Hazard Briefing
- C. Medical Dispatch Plan
- D. Fire Transitional Documents
- E. Pre-Attack Plan
 - 1. Vendors List
 - 2. Extended Attack Organization
 - 3.1. Alligator River Values to Protect Map
 - 3.2. Pea Island Values to Protect Map
 - 4. Endangered Species Considerations
- F. Standard Operating Procedures for Safety
- G. Delegation for District 1 FMO
- H. Fire Staffing Plan
 - 1. District 1 Approved Fire Staffing Chart
 - 2. Fire Team Positions and Responsibilities
 - 3. District 1 Firefighting Qualifications
- I. RXCM Exception
- J. Smoke Management Guidelines
 - 1. State Smoke Management Guidelines
 - 2. Guidelines for Operational Evaluation Burns
 - 3. Smoke Hazards Map
- K. Job Hazard Analyses
- L. Agreements List
- M. Stumpy Point CWPP
- N. References and Literature Cited
- O. Burn Table
- P. Peat Deposit Map
- Q. Annual FMP Review Checklist
- R. Environmental Assessment
- S. Draft Plan Comments and Service Responses