

## **APPENDIX H**

### Memorandum of Agreement for Forest Mitigation



Martin O'Malley  
*Governor*

Anthony G. Brown  
*Lt. Governor*



Margaret G. McHale  
*Chair*

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*Executive Director*

**STATE OF MARYLAND  
CRITICAL AREA COMMISSION  
CHESAPEAKE AND ATLANTIC COASTAL BAYS**

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December 12, 2011

Mr. Scott English  
Forester  
Aberdeen Proving Ground  
IMNE-APG-PWE, Bldg. E4630  
Aberdeen Proving Ground, MD 21010


Re: Memorandum of Agreement Between APG, CAC,  
and MD DNR Forest Service

Dear Mr. English:

Thank you for continuing to work cooperatively with the Commission staff on this very important endeavor. Today the Commission signed the Memorandum of Agreement (MOA) and have enclosed a copy for your files and will forward another signed copy to the DNR Forest Service for their files.

As discussed, we will continue to coordinate with your office on the implementation of the MOA.

Sincerely,

  
Lisa A. Hoerger  
Regulations Coordinator

cc: Mr. Steve Koehn, MD DNR Forest Service  
Mr. Todd Beser, APG



**DEPARTMENT OF THE ARMY  
US ARMY ABERDEEN PROVING GROUND  
ABERDEEN PROVING GROUND MARYLAND 21005-5001**

REPLY TO  
ATTENTION OF

**MEMORANDUM OF AGREEMENT  
BETWEEN  
ABERDEEN PROVING GROUND, THE MARYLAND CRITICAL AREA  
COMMISSION AND THE MARYLAND DEPARTMENT OF NATURAL RESOURCES  
FOREST SERVICE**

1. This Memorandum of Agreement (MOA) is entered into by and between the United States Army, Aberdeen Proving Ground (APG), the Maryland Department of Natural Resources Forest Service (DNR Forest Service), the Maryland Critical Area Commission (MD CAC) regarding the establishment and implementation of a comprehensive forest mitigation strategy under APG's Forest Management Plan (FMP) component of the APG Integrated Natural Resources Management Plan (INRMP). The provisions in this MOA compliment principles contained in Executive Order 13508, the Chesapeake Bay Protection and Restoration, the APG Regulation 200-40, the Army Chesapeake Bay Strategy, the Maryland Forest Conservation Act, the Maryland Critical Area Act, the Forest Strategy for Maryland for 2010-2015, the Maryland Statewide Forest Resource Assessment, and the Maryland Wildlife Diversity Conservation Plan.

2. This MOA does not define or determine mitigation requirements under any applicable federal or state laws or regulations, including the Coastal Zone Management Act, the Maryland Critical Area Act, or the Maryland Forest Conservation Act. This MOA's provisions only apply after any necessary forest mitigation requirement has been determined pursuant to any applicable federal or state laws or regulations governing a particular project or action.

**3. PURPOSE.**

a. The purpose of this MOA is to establish an agreement between all parties regarding forest mitigation strategy at APG as a component of APG's overall forest management program. This MOA addresses not only the mitigation efforts of reforestation/afforestation, but also recognizes forest enhancement and forest restoration efforts where silvicultural actions will be undertaken as specified in the FMP component of the APG INRMP. It establishes a tool to calculate, track and sustain forest mitigation when it is required at APG. Prescriptions will address actions such as forest composition, forest density, forest health, and invasive species removal in ways that improve, enhance and sustain the forest ecosystem on a landscape level at APG. This comprehensive approach will allow APG to focus on re-establishing wildlife corridors, greenways, habitat protection areas and enhancing the shoreline area. This MOA also establishes a single point of contact on the APG Garrison staff (IMNE-APG-PWE) for forest mitigation coordination, within the options established below.



b. This MOA specifies how APG will credit mitigation through acts of: 1) selective removal of trees that are identified as invasive or non-historical species and re-establishing in historically climactic species; 2) executing silvicultural actions to enhance and restore existing forests to ensure long-term health and sustainability. Capturing this comprehensive, sustainable, landscape level forest management approach will be quantified in the four categories outlined and prioritized below.

#### **4. BACKGROUND.**

a. APG is located on the northwestern shore of the Chesapeake Bay and consists of 40,178 acres of land and 39,106 acres of water. APG is divided into two areas, APG North and APG South. Graces Quarters, Carroll Island, and Poole's Island are considered part of the APG South, but are separated from the southern peninsula by the Gunpowder and Bush Rivers. The Churchville Test Site is considered part of the APG North, but is noncontiguous. Both APG North and APG South consist of a cantonment area and various test ranges. The cantonment areas include housing, industrial activities, airfields, supply and storage, medical, offices, research and development. Test ranges make up approximately 90 percent of APG and include firing ranges, impact areas, vehicle test courses and munitions storage bunkers and magazines.

b. A little more than 46 percent of APG's area is forest with 3,276 acres of wetland forests and another 14,775 acres of upland forests. Applying criteria used by the State of Maryland in the APG Master Plan, approximately 25 percent of APG is considered an area of intense development with the remaining 75 percent listed as not intensely developed. Home to more than 40 species of mammals, 55 neo-tropical bird species, 58 threatened and endangered vascular plants and more than 40 species of reptiles and amphibians, APG is an ecological treasure. In addition to other endangered species at the proving ground, APG has a healthy and thriving bald eagle population; one that APG has made a concentrated effort to restore and sustain. As of 2009, there were 36 active bald eagle nests and 6 active roosts.

c. APG leadership is committed to preserving and enhancing its natural resources while ensuring its military missions are successfully accomplished. An ongoing problem that threatens APG's coastal and riparian forests is shoreline erosion. Since monitoring began in 1846, as much as 750 feet of shoreline has been lost along the ranges, causing a constant threat to the sustainability of APG's designated mission. Approximately 8.68 miles of shoreline has been restored. Future plantings through forest mitigation within a 100 foot buffer would increase shoreline stabilization and preserve wildlife and fish habitat.

**5. STATEMENT OF MUTUAL BENEFIT AND INTERESTS.** As undeveloped forested lands in the Chesapeake Bay watershed have been reduced significantly, the importance of management efforts to ensure the long-term sustainability of existing forested lands is highlighted. The forests, wetlands, and riparian areas on APG serve a crucial role in reducing Total Maximum Daily Load, protecting water quality and sequestering carbon. The premise of this MOA is to achieve an agreement as to APG's strategy to address its forest mitigation as a comprehensive plan primarily focused on managing existing forested lands, thereby eliminating the approach of mitigating in parcels and fragments. Through these management efforts, APG will not only maintain and sustain the integrity of all of its forest ecosystems but also help to restore and improve the health and water quality of the Chesapeake Bay.



**6. FOREST MITIGATION MECHANISMS AND CREDITS.** This MOA quantifies four forest mitigation mechanisms:

**a. Reforestation/Afforestation.** Through its mitigation efforts, APG will continue to concentrate on planting native trees and shrubs that will promote and maintain a healthy forest community. APG will focus on mitigating areas that will reconnect interrupted wildlife corridors, improve upon or develop living shorelines and increase habitat protection areas and forest communities. Reforestation/afforestation of targeted areas will also continue initiating the establishment of native oak communities that provide several crucial ecological advantages. Oak forests contribute to better water quality, improve the nitrogen cycle and reduce runoff and erosion. Oak provide habitat and food for birds, insects, mammals, amphibians and bald eagles. Mitigation credit for reforestation/afforestation will be granted consistent with the Maryland Forest Conservation Act and the Maryland Critical Area Act. Planting areas will be prioritized for mitigation in the APG FMP. DNR Forest Service and MD CAC coordination will occur prior to mitigation execution. These actions will be accredited as forest mitigation to APG on a 1:1 basis.

**b. Successional Sweetgum Stand Conversion.** Aerial photos from 1932, which included the majority of the Aberdeen Area, but only a small portion of the Edgewood Area, show that 15,459 acres were utilized as cropland and pastures. As former agricultural lands within APG were no longer maintained or mowed they returned to early successional forest communities. These areas have returned as sweetgum monocultures. Heavy deer pressure has prevented oak and other native species such as tulip poplar and hickory from surviving and thriving, while it has created a favorable environment for pure sweetgum stands. Historically however, most of the old growth was forested wetlands and predominantly oak. Sweetgum stands that are 18 years or younger (averaging 1" to 6" in diameter) will be targeted for removal and enhancement with stand conversion replaced to oak, hickory and tulip poplar. Stands will be prioritized for mitigation in the APG FMP. DNR Forest Service and MD CAC coordination will occur prior to mitigation execution. These actions will be accredited as forest mitigation to APG on a 2:1 basis.

**c. Forest Enhancement and Restoration.** APG will implement silvicultural actions as specified in the FMP to restore the forests' ecological integrity. Prescriptions will reduce environmental stress influenced by exotic invasive plants, restore the natural distribution of native trees and shrubs and reduce overstocking to allow for natural regeneration. Numerous APG stands can be characterized as old growth, early successional grassland areas, stands having dense vines in tree crowns, and dense shrub layers dominated by alien woody plants and/or exotic ground cover community. Five invasive plant species, Japanese stiltgrass (*Microstegium vimineum*), autumn olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*), have become very prevalent at APG to the extent that it impacts the overall forest health. By actively managing early successional stands, old growth stands, invasive plant species and implementing

appropriate silvicultural prescriptions; APG will restore the natural distribution of native trees and shrubs, thereby, increasing the acreage of healthy forests on the landscape. Stands will be prioritized for mitigation in the APG FMP. DNR Forest Service and MD CAC coordination will occur prior to mitigation execution. These actions will be accredited as forest mitigation to APG on a 2:1 basis.

d. **Urban Forestry / Tree Canopy Enhancement.** APG will work towards improving its urban forest management and street tree sustainability. Mitigation credit would be provided for the improvement of urban forests and urban tree canopy enhancement. This would include the planting of shade and flowering trees along streets, roads and around buildings on APG. This would also include proper tree management and care along rights-of-way and fencing corridors on APG. DNR Forest Service and MD CAC coordination will occur prior to mitigation execution. APG will receive one acre of forest mitigation credit for every 100, 1.5 to 2.0 inch diameter trees planted.

**7. PRIORITIZATION OF FOREST MITIGATION MECHANISMS.** Individual mitigation efforts will be coordinated between the APG Forester, DNR Forest Service and MD CAC with the guiding principle of prioritization of the above forest mitigation mechanisms being in the following order:

- a. Reforestation/Afforestation;
- b. Forest Enhancement;
- c. Successional Sweetgum Stand Conversion;
- d. Urban Forestry / Tree Canopy Enhancement.

**8. ANNUAL REPORTING.** APG will provide a copy of APG's annual report (including Forest Stand specifics and accompanying GIS maps) to the MD DNR Forest Service and MD CAC that specifies completed mitigation type, quantity, and location in December of each calendar year.

**9. QUALIFICATIONS.**

- a. Forest mitigation in this MOA is applicable to ALL forested areas of APG.
- b. This MOA shall be implemented consistent with applicable federal and state laws. It does not establish any requirement by APG, the Army, the DoD, or the State of Maryland for the payment or obligation of funds, as execution is subject to the availability of funds and no provision herein shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act (31 U.S.C. 1341).
- c. No penalties will be accrued by the Army for not implementing APG's Forest Management Plan.



d. Future military missions may require that completed forest mitigation sites be used for purposes other than forest mitigation. In such cases, the completed mitigation may be relocated and replaced on a 2:1 basis while mitigation for the new site activity(s) will also be addressed.

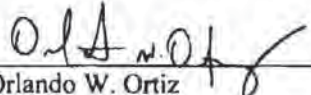
e. Any signing party has the ability to request to modify the mitigation ratios in the future pending all parties' approval.

f. Any federal property owner within the Chesapeake Bay watershed may request to use this MOA to meet their forest mitigation requirements through off-site forest mitigation on APG.

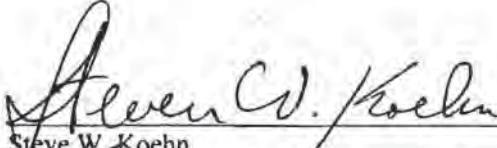
g. This MOA may be terminated at any time by any of the signing parties.

**10. EFFECTIVE DATE.** This agreement becomes effective upon the date of the last approving signature and will remain in effect indefinitely until superseded, rescinded, or modified by written, mutual agreement of both parties.


**11. ACCEPTANCE OF AGREEMENT:**

  
\_\_\_\_\_  
Orlando W. Ortiz  
Colonel, US Army  
Deputy Installation Commander

6 Aug. 2011  
DATE

  
\_\_\_\_\_  
Steve W. Koehn  
Chief, Maryland Department of Natural Resources Forest Service  
Director

9/28/11  
DATE

  
\_\_\_\_\_  
Ren Serey  
Executive Director, Maryland Critical Area Commission

12/12/11  
DATE

# **APPENDIX I**

## Forest Management Plan





# **Cumulative Forest Management Plan**

**August 2020**



Prepared for:

US Army Garrison Directorate of Public Works  
Environmental Division  
Aberdeen Proving Ground, Maryland

**Contract W56ZTN-16-D0003**

**TO: 01478**

Prepared by:

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## EXECUTIVE SUMMARY

Aberdeen Proving Ground (APG) is located in Harford County and eastern Baltimore County, Maryland. It sits near the head of the Chesapeake Bay, the largest, most biologically productive estuary in the world and a national treasure and resource. APG controls 33,486 acres of the bay and consists of 72,406 acres with a land mass of 38,920 acres. Forest comprises of almost 50 percent of the acreage. APG controls 32,060.88 acres of the bay and consists of 72,474 acres with a land mass of 40,287 acres. Forest comprises 45.5 percent of the acreage. Upland forest comprises 15,063 acres while the wetland forest is 3,276 acres. Of the 18,339 acres of forest 17,827.06 acres are stand mapped for a total of 576 stands. This ecologically important land, under DOD stewardship, is home to 58 rare threatened and endangered vascular plants, 55 neo- tropical bird species, more than 40 species of reptiles and amphibians, nearly 250 species of birds, and more than 40 species of mammals.

Army Regulation (AR) 200-1, *Environmental Protection and Enhancement*, provides objectives for the conservation of natural resources on Army installations. Army leadership is committed to conserving and preserving natural resources so they will be available for present and future use. Several federal laws, regulations, and guidelines also apply to Army installations in protecting these resources. The Under Secretary of Defense has directed that ecosystem management will be the tool used by military installations to achieve the goal of effective natural resources management.

APG has one of the largest concentrations of bald eagles in the Chesapeake Bay region. APG attracts a disproportional number of eagles, because the installation has largely undeveloped shorelines close to abundant food resources in the surrounding rivers and Bay. In addition, many of these shoreline areas have restricted access with little human activity. APG's mature forested areas in close proximity to open water provides habitat for roosting, foraging, and nesting eagles. Residential and commercial development of surrounding shorelines in the northern Chesapeake Bay continues to drive an increasing number of eagles to APG.

APG implements a number of conservation measures to avoid, minimize, and/or mitigate impacts to the bald eagle population. One of these conservation measures provides for habitat enhancement in eagle nesting and roosting areas. This effort improves eagle habitat while sustaining the testing and training landscape required by the military mission. It is important to the long-term sustainment of the breeding eagle population that large canopy trees be replaced, either through natural re-generation or plantings. The forest stand improvements enhance native species diversity with plantings of oak, hickory, beech, and tulip poplar; decrease invasive species with spraying and removal; and provide for long-term forest and mission sustainability.

In accordance with these federal laws, regulations, and policies, the Installation Management Command (IMCOM) determined the need to conduct a forest inventory at Aberdeen Proving Ground (APG), Maryland. Prior inventories of a portion of the installation's forests were completed in 2001, 2003, 2009, 2012, 2014, 2016, 2017 and 2019 consisting of 237 stands.

The natural resources managers at APG require this information to implement appropriate conservation measures as required. The GPS data information provides the geographical location that is sufficient for APG natural resource managers to plan forestry and wildlife activities and conduct vegetative community classification, per AR 200-1 requirements.

The forest inventory serves the goals of providing a foundation from which APG can plan and execute its military mission requirements; meeting natural resources management goals; complying with the requirements of AR 200-1 and other Federal, State, and Army regulations applicable to natural resources management. As well as establishing baseline data required for preparation of subsequent revisions of Integrated Natural Resources Management Plans (INRMPs), and meeting legal and policy requirements consistent with current national natural resources management philosophies.

## **Current Land Use and Consequences to Natural Resources**

APG is split into Aberdeen and Edgewood areas, each house a main cantonment area composed of headquarters, training, research, and support areas. These areas are improved, maintained grounds with numerous buildings and roads. Facilities in the cantonment areas include those for administration, housing, airfields, community activities, education, industrial activities, maintenance, medical uses, research and development, and supply and storage. Approximately 90 percent of the total installation is designated as test range, including the APG waters of the Chesapeake Bay and its tributaries. Firing ranges, impact areas, bombing fields, vehicle test courses, warehouses, and munitions storage are located within this area.

The diversity of natural resources at APG, including its size, climate, and location at the edge of the Chesapeake Bay, allows for realistic completion of the installation's mission. Development within the restricted area remains limited to scattered testing facilities and ranges. Natural features such as shorelines, creeks, wetlands, ponds used by waterfowl, and forests are in a relatively natural condition. The nature of the military mission at APG has offered a measure of protection to the natural resources within the installation's boundaries. The presence of the installation has prevented development for residences, industrial use, shipping or boating facilities, or urban use. The natural character of the installation continues to make it a vital habitat for waterfowl, fish, bald eagles, deer, and many other animals and plants.

However, use and development of the land at APG has had some adverse effects on its natural resources. Some fragmentation of forests has occurred when clearing areas for test facilities or building construction has required tree removal. The quantity and quality of interior forest habitat has declined, while disturbance has permitted the proliferation of opportunistic species. Autumn olive (*Elaeagnus umbellata*), an exotic species, was planted long ago at APG to revegetate areas cleared for development, and multiflora rose (*Rosa multiflora*), another invasive species, has invaded many habitats at the installation. Exotic invasive Japanese stilt grass (*Microstegium vimineum*) has become a ground vegetation dominant in many forest stands. Exotic plant species are now so common on the installation that they have become an established part of its ecology. The presence of a security fence around the restricted area and the reintroduction of deer in 1930's led to a population well beyond the caring capacity where deer and the forest can co-exist. During the 1930s, deer from a game farm near Harrisburg, Pennsylvania, were released at APG. During World War II, the deer population grew to numbers which created a hazard to military operations. Between then through 1960 state wildlife personnel trapped over 2,000 deer on APG and released them in various counties across Maryland. Since the 60's the deer presence has increased dramatically. Deer are a major threat to the APG Forest Eco System.



## **Eagle Sensitivity within APG**

APG has one of the largest concentrations of bald eagles in the Chesapeake Bay region. APG attracts a disproportional number of eagles, because the installation has largely undeveloped shorelines close to abundant food resources in the surrounding rivers and Bay. In addition, many of these shoreline areas have restricted access with little human activity. APG's mature forested areas in close proximity to open water provides habitat for roosting, foraging, and nesting eagles. Residential and commercial development of surrounding shorelines in the northern Chesapeake Bay continues to drive an increasing number of eagles to APG.

APG implements a number of conservation measures to avoid, minimize, and/or mitigate impacts to the bald eagle population. One of these conservation measures provides for habitat enhancement in eagle nesting and roosting areas. This effort improves eagle habitat while sustaining the testing and training landscape required by the military mission. In 2012, APG lost over 10% of its eagle nest trees due to storms and natural degradation. It is important to the long-term sustainment of the breeding eagle population that these large canopy trees be replaced, either through natural re-generation or plantings. The forest stand improvements enhance native species diversity with plantings of oak, hickory, beech, and tulip poplar; decrease invasive species with spraying and removal; and provide for long-term forest and mission sustainability. As of 2020 APG supports a large population of bald eagles, tracking over 100 nest locations, averaging 60 successful nests each year. The improved eagle habitat fledged an all-time high of 93 chicks last season.

## **IMPORTANCE OF FORESTS FOR WATERSHED FUNCTION**

GAPG is held by the Government as a valuable military installation and an environmentally sensitive ecosystem that offers a variety of forest cover types, a multitude of herbaceous plants, shrubs, and tree species. Forest stands play a major role in the streams and wetlands water quality. Trees provide soil stabilization and thermal protection. Wooded buffers provide a unique habitat for wildlife and probably are the most important areas within the forest. Riparian ecosystems support a greater diversity of wildlife than adjacent upland forest. Many species are restricted or prefer the stream zone. The increased humidity of these areas is important for herpetofauna, such as lizards, frogs and turtles. Root systems of woody vegetation supply cover for fish and aquatic invertebrates. More than eighty varieties of birds utilize stream side vegetation for summer feeding and nesting.

Forests are important to the Chesapeake Bay, as trees protect and improve water quality by reducing runoff and erosion in streams. Trees and shrubs reduce air pollution, by filtering and removing pollutants from the air. They also provide habitat and food for a variety of fish, birds, mammals, insects and amphibians. Large and connected areas of forest offer the most valuable wildlife habitat.

## **Forests and Watershed Protection**

Numerous studies of watersheds have provided evidence that forest ecosystems provide the best protection for water quality (Carlton 1990; Dunne and Leopold 1978). The health of streams, rivers, and bays is tied to the dynamic well being of the forest. The forest system, including the plants, animals, non-living elements, and their structures are intimately associated with ground and surface water quality and flow patterns. The maintenance of a diverse, multi-layer forest capable of resistance to major disturbances, such as ice and windstorms, and resilient to minor disturbances provides an efficient and effective means of protecting water quality.

Through the continuous maintenance of a forest cover, soils are protected from erosion by:

1. Absence of overland flow;
2. Protection of erodible mineral soil by a thick layer of organic material;
3. High water holding capacity of the organic matter mixed with the upper soil horizon;
4. Dissipation of the energy of rain drops through the interception of canopy and mid-story trees and shrubs;
5. Reduction of the amount of rainwater reaching the ground due to interception by trees and shrubs (2-6% of flood-producing rainfall and 5% of the 40-45 inches of annual precipitation common in the eastern United States);
6. Increased water storage of the forest soil due to reduced transpiration rates during the growing season (18 inches of the 40-45 inches of annual precipitation common in the eastern U.S.); reduced flood damage due to structural protection afforded by riparian forests; and
7. Capturing sediment moving onto the reservoir lands from off site.

Forests also capture a variety of elements and materials that would be otherwise deposited into the streams and reservoirs. These forest systems provide a line of defense against atmospheric deposition of heavy metals and acids and intercept groundwater pollutants entering the reservoir lands from off site and physically and chemically transforming these pollutants to render them harmless.

Forest cover reduces stream and soil temperatures that slow down chemical processes that can lead to an increased release of nutrients associated with water quality degradation and the production of by-products that degrade water and habitat values.

The APG forest is especially valuable due to its oak dominance. Two broad areas of ecological function are supported to a high degree by oak forests:

1. Nitrogen Cycling
2. Stream Water Quality

## Nitrogen Cycling and Stream Water Quality

Although the efficiency of nitrogen cycling in forests is dependent upon many factors including geography, climate, soil types, and forest stand ages (Goodale and others 2002), oak-dominated forests throughout the eastern U.S. typically have tighter control on nitrogen cycling than do beech/maple forests, releasing lower levels of nitrates from organic forest floor litter to adjacent streams (Lovett, et.al. 2004). Oak forests also maintain a higher ratio of carbon to nitrogen in forest floor litter than other deciduous forest types because of high lignin content, which slows the decomposition rate of downed debris, and the movement of soluble nitrogen compounds through the landscape (Finzi et.al. 1998). Lignins also boost forest soils' capacity for storing and releasing water and cycling nutrients by adding very long-lived (hundreds to thousands of years), degradable-resistant biomass to the humus component, which supports myriad microorganisms and chemical processes that bring resource cycling efficiency and stability to the forest ecosystem (Fisher and Binkley 2000). In these ways, oak forests are critical for the maintenance of high stream water quality and productive aquatic habitats at GAPG.

## Wildlife Habitat and Biodiversity

Thousands of years of dominance by oak forest types in the eastern United States has produced myriad interdependent relationships between oak forests and wildlife. At every spatial level, from the tallest trees in the canopy to the smallest plants on the forest floor, mammals, birds, amphibians, reptiles and countless insects and microorganisms feed on and are fed upon by other forest inhabitants in a complex food web that is driven by the presence of oaks (Johnson and others 2002). Native streamside trees and other plants in oak associations add annual pulses of food resources in the form of leaves and woody debris to macro invertebrate communities that support high water quality stream system habitats for aquatic plants, invertebrates, and fish species (Sweeney 1992). Oaks are considered keystone species because of their significant contribution to the structural and biological diversity of the eastern forests and the critical processes that sustain the forest ecosystem (Fralish 2004). As an example, oak forests play a crucial role in the survival of hatchlings of most eastern forest bird species. In the spring, loopers, inchworms, and spanworms, the caterpillar stages of almost 200 species of forest moths, feed on the young leaves of oaks and other plant species in oak forest communities at a time when forest birds are foraging for hatchling food (Wagner 2005). Bird foraging reduces the insect pressure on the forest plants, allowing them to grow to their potential. The forest plants provide sufficient habitat for sustaining generations of birds that will consume other insects throughout the year. Oaks are primary hosts for gall wasps, whose larvae extend the food reserves into the summer and fall (Cornell 1983). From the fall to the winter, oaks continue to provide food in the form of acorn mast, which not only offers food for mammals and game birds, but also over-winters the larvae of acorn weevils that will provide additional food for birds and mammals the following year. In these ways, oak communities anchor a food web that supports a diverse range of higher feeding levels in the forest ecosystem. Historically GAPG was an Oak dominated forest community. *The Maryland Weather Service* reported in 1910 that, "On the necks of land stretching southeast from Baltimore and Harford counties occur tree assemblages to which the above name is given. These "necks" resemble in a general way the peninsulas stretching in a similar direction from Charles and St. Mary's counties, but the difference in vegetation of the two regions seems sufficiently striking to necessitate separating them. To begin with, this association shows a greater number of oaks than any other. White Oak is dominant, though Sweet Gum is almost equally abundant; Chestnut Oak, Willow Oak, Black Oak and Swamp Oak are more numerous here than they are in any other situation. In marked distinction to the "Meadow", Chestnut is frequent, even on low ground, while Hickories, Maple and Black Gum also occur plentifully. On the other hand there is little Pine, Cedar or Holly" (*The Plant Life of Maryland, The Maryland Weather Service. 1910*)

## **PURPOSE OF THE FOREST MANAGEMENT PLAN**

The purpose of this plan is to assess the present condition of the forest; to identify major stressors that could threaten the forest's long-term sustainability; to address management questions, based upon assessment data and observations; to prepare a stand level Forest Management Plan that has as its major objectives the conservation of forest health and regeneration, structural and biological diversity, and economic value for silvicultural operations without diminishing the functional value of the forest for water quality, wildlife habitat, passive recreation, or forest health.

The four major characteristics assessed in this study include; forest cover types by delineated stands, overstory biological and structural characteristics and health, understory biotic and a biotic characteristic, and habitat characteristics and forest products potential.

The management recommendations will prioritize actions for improving forest health and ecological conditions. Management recommendations contain silvicultural recommendations to improve forest health with an emphasis on natural regeneration. The eradication of invasive plants and the reduction of deer population are also prioritized.

## **FOREST INVENTORY METHODS**

Planning for future harvesting was not considered a primary objective of the inventory. The data collected during the inventories provides valuable information to natural resources managers concerning forest health for present and future management activities.

Point sampling with a 10-factor prism was used to identify trees to be sampled in sampling plots. Data sheets developed by the U.S. Forest Service (USFS) were used to collect most of the informational data for years 2001, 2003 and 2009. Data sheets developed by Maryland D.N.R. were used to collect data in 2012, 2013, 2014, 2016, 2017 and 2019. At each sampling plot, trees that fell within the prism's range were tallied for species, diameter, count, quality, product, product height, and crown classification. Some additional data at each plot included a subplot equaling 1/1000th of an acre for a natural regeneration count. In each study year, stands were sampled using line-transect and plot sampling methods. Transects were laid out in the office against topographic gradients, to capture the greatest degree of diversity. Sampling units were spaced equidistant from each other in an alternating pattern.

## DOMINANT SOILS PRESENT

### Soil Types/Categories

*Beltsville Series (BeA, BeB, BeC, BU)*-This soil type consists of very deep, slowly permeable, moderately well drained soils. These soils formed in loamy alluvial and marine sediments; slopes range from 0 to 10 percent. The thickness of the solum ranges from 40-60 inches. A fragipan is at a depth of 12-34 inches.

*Codorous Series (Cd)* - This soil type consists of very deep, moderately permeable, moderately well drained and somewhat poor drained soils. These soils formed in recently deposited alluvial sediments weathered from mostly metamorphic and crystalline rocks. They have clay content in the subsoil that increases as depth increases. They are organic soils and have thick, dark organic deposits. The thickness of the solum ranges from 30-60 inches.

*Elkton series (Ek)* - This series consists of very deep, slowly permeable, poorly drained soils. These soils formed in silty Aeolian sediments and the underlying loamy alluvial and marine sediments. Slopes range from 0 to 2 percent. The thickness of the solum ranges from 40 to 60 inches.

*Fallsington series (Fa)* - This series consists of very deep, moderately permeable, poorly drained soils. These soils formed in loamy alluvial and marine sediments. Slopes are smooth and nearly level and range from 0 to 2 percent. The thickness of the solum ranges from 24 to 40 inches. The content of coarse fragments, mostly round to sub rounded gravel, ranges from 0 to 10 percent in individual horizons.

*Hambrook series (HbA, HbB, HbC, HbE, HU)* - This series consists of very deep, moderately permeable, well drained soils. They formed in loamy alluvial and marine sediments. Slopes range from 0 to 60 percent.

*Lenape series (Le)* - consists of deep, moderately permeable, very poorly drained soils. These soils formed in organic deposits overlying loamy estuarine or marine deposits having a high n value. The thickness of the organic deposit's ranges from 16 to 51 inches.

*Lomgmarsh series (Lo)* – consists of very deep, moderately permeable, very poor drained soils. These soils formed in loamy fluvial sediments overlying sandy alluvial marine sediments. Slopes are 0 to 1 percent.

*Mattapex series (MpA MpB, MpC, MU, MwA)* - consists of deep, moderately well drained soils. These soils are moderately permeable in the subsoil and moderately rapidly permeable and rapidly permeable in the substratum. They formed in silty aeolian sediment and the underlying loamy alluvial and marine sediments. Slopes range from 0 to 10 percent. The thickness of the solum ranges from 24 to 42 inches.

*Nassawango series (NnA, NnB, NnC)* - consists of very deep, well drained soils. These soils are moderately permeable in the subsoil and moderately rapidly permeable and rapidly permeable in the substratum. They formed in silty sediments overlying loamy alluvial and marine sediments. Slope ranges from 0 to 10 percent. The thickness of the soil ranges from 30 to 50 inches.

*Othello series (Ot)* -consists of very deep moderately slowly permeable, poorly drained soils. These soils formed in loess (silty) sediments overlying sandy alluvial and marine sediments. Slopes are smooth and nearly level, ranging from 0 to 2 percent. The thickness of the solum ranges from 24 to 40 percent.



*Pone series (Po)* - consists of very deep, moderately rapidly permeable, very poorly drained soils. These soils formed in loamy alluvial sediments overlying stratified alluvial and marine sediments. Slopes are smooth and nearly level and range from 0 to 3 percent. The thickness of the solum ranges from 26 to 40.

*Romney (RE, RoA, Ud, Ur)* - consists of very deep, moderately slowly permeable, somewhat poorly drained soils. These soils formed in silty sediments overlying loamy marine and fluvial sediments. Slopes are nearly level and range from 0 to 2 percent.

*Woodstown series (WdA, WdB, WdC)* - series consists of very deep, moderately permeable, moderately well drained soils. These soils formed in loamy marine and alluvial sediments. Slopes range from 0 to 10 percent. The thickness of the solum ranges from 24 to 45 inches.

*Zekiah series (Ze)* - consists of very deep permeable, poorly drained soils. These soils formed in loamy fluvial sediments overlying alluvial and marine sediments. Slopes are smooth and nearly level and are 0 to 1 percent.

### Species commonly found throughout APG

\* denotes invasive/non-native species

Species	Overstory	Understory	Ground
grape ( <i>Vitis</i> )			X
black oak ( <i>Quercus velutina</i> )	X		X
swamp white oak ( <i>Quercus bicolor</i> )	X		X
chestnut oak ( <i>Quercus prinus</i> )	X		
Swamp chestnut oak ( <i>Quercus michauxii</i> )			
northern red oak ( <i>Quercus rubra</i> )	X		
pin oak ( <i>Quercus palustris</i> )	X		
scarlet oak ( <i>Quercus coccinea</i> )	X		
southern red oak ( <i>Quercus falcata</i> )	X		
white oak ( <i>Quercus alba</i> )	X		X
willow oak ( <i>Quercus phellos</i> )	X		X
red maple ( <i>Acer rubrum</i> )	X	X	X

Norway maple ( <i>Acer platanoides</i> ) *	X		
tulip tree ( <i>Liriodendron tulipifera</i> )	X		
hickory ( <i>Carya</i> )	X		X
black gum ( <i>Nyssa sylvatica</i> )	X	X	X
sweetgum ( <i>Liquidambar styraciflua</i> )	X	X	X
American chestnut ( <i>Castanea dentata</i> )	X		
flowering dogwood ( <i>Cornus florida</i> )	X		X
American beech ( <i>Fagus grandifolia</i> )	X		X
ash ( <i>Fraxinus</i> )	X		
black cherry ( <i>Prunus serotina</i> )	X		X
American holly ( <i>Ilex opaca</i> )	X	X	X
sweet pepperbush ( <i>Clethra</i> )			X
black highbush blueberry ( <i>Vaccinium fuscatum</i> )		X	X
Canadian serviceberry ( <i>Amelanchier canadensis</i> )	X		X
Japanese honeysuckle ( <i>Lonicera japonica</i> ) *		X	X
honeysuckle ( <i>Lonicera</i> )*			X
multiflora rose ( <i>Rosa multiflora</i> ) *		X	X
barberry ( <i>Berberis</i> ) *		X	X
greenbrier ( <i>Smilax</i> )		X	X
sassafras ( <i>Sassafras albidum</i> )	X		X
black walnut ( <i>Juglans nigra</i> )	X		
black locust ( <i>Robinia pseudoacacia</i> )	X		

Virginia pine ( <i>Pinus virginiana</i> )	X		
eastern poison ivy ( <i>Toxicodendron radicans</i> )			X
cottonwood ( <i>Populus</i> )	X		
blackberry ( <i>Rubus</i> )			X
wine raspberry ( <i>Rubus phoenicolasius</i> ) *			X
sweet bay ( <i>Magnolia virginiana</i> )	X		
elderberry ( <i>Sambucus</i> )			X
viburnum ( <i>Viburnum</i> )			X
bayberry ( <i>Morella</i> )			X
common persimmon ( <i>Diospyros virginiana</i> )	X		X
autumn olive ( <i>Elaeagnus umbellata</i> ) *			X
privet ( <i>Ligustrum</i> ) *			X
osage orange ( <i>Maclura pomifera</i> )	X		
sycamore ( <i>Platanus</i> )	X		
Princess tree ( <i>Paulownia tomentosa</i> ) *	X		

## INDIVIDUAL STAND NARRATIVES

### Forest Map 1, Stand 1-5, 10.80 Acres

#### Overstory Summary Narrative

Data collected in 2009 states this stand is dominated by Willow oak with associate species being; Sweet gum, Black cherry, Red maple, Swamp white oak, Southern red oak, Locust and Black gum. Grass and Blueberry were found in the understory. Phragmites are on the forest edge.

This stand is a mixture of sawtimber 12" – 23.9" and pole timber 6" – 11.9".

This stand is adequately stocked with 80% canopy closure.

This stand has 180 trees per acre.

#### **Recommendations**

-Heavy deer pressure.

-Many trees are unacceptable. Restocking is recommended as the stand is in poor condition.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
1-5	commercial TSI control invasives examine stand for commercial harvest	10.80

## **Forest Map 1, Stand 1-6, 11.65 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Willow oak and Sweet gum with associate species being; Holly, Sweet gum, Black gum and Red maple. Holly, Blueberry and Greenbrier were found in the understory.

This is a mature stand with most trees averaging 24" d.b.h. and some Willow oaks 30" – 36" d.b.h.

This stand is adequately stocked with 70 - 75% canopy closure.

This stand has 140 trees per acre.

### **Recommendations**

- This site contains an Eagle Buffer follow APG Eagle restrictions.
- Extremely heavy deer pressure.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
1-6	commercial TSI control invasives examine stand for commercial harvest	11.65



## **Carroll Island: Forest Map 2, Stand 2-4, 54.16 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum, Red maple, Yellow poplar, Willow oak and Southern red oak with associate species being; Black oak, Hickory, Black gum, Chestnut oak, White oak and Persimmon. Sweet bay, Blueberry, Holly, Huckleberry and Greenbrier were found in the understory. Invasive plants include Microstegium.

This is a large sawtimber stand.

This stand is over stocked with 80% canopy closure.

### **Recommendations**

- This site contains an Eagle Buffer follow APG Eagle restrictions.
- Favor oak in the understory, thin stand.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
2-4	commercial TSI	54.16
	control invasives	
	examine stand for commercial harvest	

## **Forest Map 2, Stand 2-5, 18.49 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Willow oak and Chestnut oak with associate species being; Holly, Black gum, White oak, Red maple, Black oak, Hickory, Sweet gum and Southern red oak. Black gum and Holly were found in the understory.

This stand is a mixture of sawtimber 12" – 23.9" and pole timber 6" – 11.9".

This stand is adequately stocked with 70 - 80% canopy closure.

This stand has 120 trees per acre.

### **Recommendations**

- This site contains an Eagle Buffer follow APG Eagle restrictions.
- Extremely heavy deer pressure with noticeable browse lines and no tree regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
2-5	commercial TSI	18.49
	control invasives	
	examine stand for commercial harvest	

## **Forest Map 2, Stand 2-6, 24.31 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Willow oak and Sweet gum with associate species being; Cherry, Red maple, Holly, Pin oak, Southern red oak and declining Locust along with Black gum in very poor condition (possible military damage). Greenbrier, Holly and Blueberry were found in the understory.

This stand is a mixture of sawtimber 12" – 23.9" and pole timber 6" – 11.9". A few 24" trees throughout stand.

This stand is over stocked with 90 - 100% canopy closure.

### **Recommendations**

- Stand is generally over stocked, mortality in co-dominant species and heavy suppression.
- Recommend reducing stock to favor oaks.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
2-6	commercial TSI control invasives examine stand for commercial harvest	24.31

## **Edgewood Area: Forest Map 3, Stand 3-2, 27.7 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by Sweetgum and Red maple. Associate species include Willow oak, Walnut, Cherry Hickory, Virginia pine, White oak, Tulip poplar and Southern red oak. The understory is comprised of Barberry, Holly and Viburnum. None of the plots have regeneration, microstegium is dense. The current Canopy closure is 68 %, open gaps are present and areas of 95% closure. The high stocking is causing the bleeding canker in the Sweetgum dominating the stand.

This young saw timber stand has the following diameter distribution:

Mature	26"+	4%
Saw timber	11-23.9"	82%
Pole	6-10.9"	15%
Small tree	2-5.9"	1%

Currently the stand contains 157 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 188 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 58% of the trees are acceptable.

### **Recommendations**

- Single Tree Selection, favoring high quality crop trees
- Cut vines in crop trees

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 188 B.A. and should be reduced to a B.A. of 90 sq.ft. which is all acceptable trees. The initial thinning will involve removing 98 sq.ft. of unacceptable saw timber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 28 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
3-2	TSI- single tree selection	27.7	2020
	Collect Data/Prepare new plan		2035

## **Edgewood Area: Forest Map 3, Stand 3-3, 16.5 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand borders the bay along the eastern boundary and was a homestead at one time. Mature trees and structures are still present. The stand is dominated by numerous pioneer species such as, Boxelder maple, Sweetgum, Walnut, Locust, Red maple, Cherry and Ash. The mature trees mostly oaks are in decline with a Willow Oak being 65" D.B.H. The understory is comprised of Barberry, Ailanthus and dense microstegium, highly invasive understory. None of the plots have regeneration, microstegium is dense. The current Canopy closure is 85%. The site is highly disturbed.

This saw timber stand has the following diameter distribution:

Mature	26"+	19%
Saw timber	11-23.9"	42%
Pole	6-10.9"	22%
Small tree	2-5.9"	7%

Currently the stand contains 110 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 100 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 80% stocking level. From a tree form and vigor stand point, 12% of the trees are acceptable.

### **Recommendations**

**-Restoration /Mitigation** potential, for Critical Area

-Control the invasive understory and remove all unacceptable over story stock. Plant Oak species on a 20' x 20' spacing with a five-foot tree shelter. Maintain a 6' diameter circle around each planted tree to control ground completion.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
3-3	Restoration mitigation	16.5	as needed
	Collect data/prepare new plan		2031

Note: The entire site will not be available to plant.

## **Graces Quarters Area: Forest Map 3, Stand 3-5, 15.57 Acres**

### **Overstory Summary Narrative**

Data collected in 2003 states this stand is dominated by Sweet gum with associate species being; Yellow poplar, Red maple, White oak, Black cherry and Loblolly pine. No information was collected on the understory.

This small sawtimber stand has an average diameter of 8.8

Currently the stand contains 273.49 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 135 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 89.2% stocking level. From a tree form and vigor stand point, 55% of the trees are acceptable.

The acceptable sawtimber volume currently is 6,523 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

#### **-Timber Stand Improvement**

The thinning will involve reducing crown competition by lowering the basal area and the number of trees per acre. A thinning will increase the growth rate to the higher quality trees. Reduce Basal area to 70 sq.ft. per acre of acceptable growing stock. Favor oak and poplar as crop trees when viable.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
3-5	commercial TSI collect data/prepare plan	15.57

## **Graces Quarters Area: Forest Map 3, Stand 3-6, 14.51 Acres**

### **Overstory Summary Narrative**

Data collected in 2003 states this stand is dominated by Sweet gum with associate species being; Red maple, Yellow poplar, Virginia pine and White oak. No information was collected on the understory.

This pole stand has an average diameter of 8.5”.

Currently the stand contains 299.2 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 89.7% stocking level. From a tree form and vigor stand point, 56% of the trees are acceptable.

The sawtimber volume currently is 1,383 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- Commercial TSI
- Reduce Basal area to 70 sq.ft. per acre of acceptable growing stock.
- Favor oak and poplar as crop trees when viable
- Collect data on forest health and regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
3-6	commercial TSI	14.51
	collect data/prepare plan	

## **Graces Quarters Area: Forest Map 3, Stand 3-7, 24.32 Acres**

### **Overstory Summary Narrative**

Data collected in 2003 states this stand is dominated by Sweet gum with associate species being; Chestnut oak, Yellow poplar, Red maple, White oak, Holly, Black cherry, Black oak and Black gum. No information was collected on the understory.

This large sawtimber stand has an average diameter of 12.3

Currently the stand contains 99.87 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 108.3 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 64.6% stocking level. From a tree form and vigor stand point, 51.7% of the trees are acceptable.

The acceptable sawtimber volume currently is 11,702 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- Let stand go through natural succession as it is narrow and provides a long linear buffer to the bay.
- Manage towards Old growth, stand is approximately 180 years old.
- Collect data on forest health and regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
3-7	collect data/ prepare plan	24.32



## **Gracie's Quarters Area: Forest Map 3, Stand 3-8 35.54 Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. The stand is dominated by Sweetgum, Tulip poplar with high quality oaks such as Willow, Southern red and White oaks with in the stand. The understory is comprised of Blueberry, Viburnum and Holly. None of the plots have regeneration, the current Canopy closure is 90 %. The stand is grossly over stocked with a BA of 167.

This large saw timber stand has the following diameter distribution:

Mature	26"+	13%
Saw timber	11-23.9"	59%
Pole	6-10.9"	17%
Small tree	2-5.9"	11%

Currently the stand contains 198 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 167 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a100+% stocking level. From a tree form and vigor stand point, 62% of the trees are acceptable.

The stand contains some very mature willow oaks 48 inch with quality 30-40-inch oaks also present making up 11 percent of the composition.

### **Recommendations**

- Single Tree Selection/restoration favoring high quality crop trees of Poplar and Oak.
- Stand in Critical area

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 167 B.A. and should be reduced to a B.A. of 90 sq. ft. which is all acceptable trees. The initial thinning will involve removing 77 sq. ft. of unacceptable, matures, saw timber, pole timber, small trees as well as some acceptable quality trees.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
3-8	Restoration / TSI	35.54
	Collect data/prepare new plan	

## **Gracie's Quarters Area: Forest Map 3, Stand 3-9 56.86 Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. The stand is dominated by Sweetgum, Tulip poplar with high quality oaks such as Willow, Southern red, Chestnut oak, Pin oak and White oaks with in the stand. Mid story trees consist

Of Hickory, Holly, Cherry and Black gum. The understory is comprised of Blueberry, Serviceberry and a sparse population of Green briar. None of the plots have regeneration, the current Canopy closure is 82%. The stand is grossly over stocked with a BA of 180.

This large saw timber stand has the following diameter distribution:

Mature	26"+	12%
Saw timber	11-23.9"	64%
Pole	6-10.9"	14%
Small tree	2-5.9"	10%

Currently the stand contains 214 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 80 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a100+% stocking level. From a tree form and vigor stand point, 64% of the trees are acceptable.

The stand contains some very mature old trees making up 12 percent of the composition.

### **Recommendations**

- Single Tree Selection/restoration favoring high quality crop trees of Poplar and Oak
- Bleeding canker in some Sweetgum
- Wetland present
- Stand in Critical area
- Stand has an Eagle nest and buffer

From a management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 180 B.A. and should be reduced to a B.A. of 90 sq. ft. which is all acceptable trees. The initial thinning will involve removing 90sq.ft. of unacceptable, matures, saw timber, pole timber, small trees as well as some acceptable quality trees.

If permitted girdling would help create dead snags.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
3-9	Restoration / TSI	56.86
	Collect data/prepare new plan	

## Gracie's Quarters Area: Forest Map 4, Stand 4-1, 23.58 Acres

### Overstory Summary Narrative

Data was collected in 2011, this stand is dominated by Tulip Poplar and Sweetgum with associate species being; Black cherry, Sycamore, Black gum, Red oak, Ash, Hickory and Red maple. The understory is sparse and comprised of Red maple, Black gum, Hickory, Cherry, Multiflora rose, and Microstegium.

This small sawtimber stand has an average stand diameter of 24 inches with the following diameter distribution breakdown:

Mature	26"+	5%
Sawtimber	11-23.9"	75%
Pole	6-10.9"	18%
Small tree	2-5.9"	2 %

Currently the stand contains 164 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 179 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 52% of the trees are acceptable.

The acceptable sawtimber volume currently is 10,000 – 12,000 bd. ft. per acre; once the undesirables are removed the stand will increase in volume, as more crop tree space is available.

### Recommendations

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer.
- This site is in the Critical Area and the harvest plan should be completed.
- This site contains an Eagle Buffer follow APG Eagle restrictions.

From a timber management point of view this stand is in need of a commercial selective harvest. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 179 B.A. and should be reduced to a B.A. of 80 Sq.ft. The initial thinning will involve removing 99 sq.ft. of unacceptable sawtimber and pole timber. The undesirables can be utilized for pulpwood with the thinning producing approximately **220 cords** within the 20 acres of harvestable acreage. Following the commercial pulp or fuel wood sale the alien and invasive plants should be controlled or Poplar regeneration will not germinate a readily.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
4-1	Commercial TSI	20.00
	Control invasives	23.58
	Prepare new Plan	23.58

## **Edgewood Area: Forest Map 5, Stand 5-8, 31.84 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by mature Tulip poplar and mixed Oak species. Oak species include Willow oak, Southern red oak, Pin oak and White oak. Associate species include Sweetgum and Red maple. The understory is comprised of Barberry, Blueberry and Holly. The largest tree measured was a 49-inch Tulip poplar. This stand borders the bay and is very important for water quality. The regeneration plot survey found advanced regeneration in 0% of the plots. Currently, shade (Canopy closure) is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	13%
Sawtimber	11-23.9"	71%
Pole	6-10.9"	12%
Small tree	2-5.9"	4%

Currently the stand contains 100 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 150 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 57% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- Manage for Old Growth

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursuing Old Growth in this mature stand by designating legacy trees, increasing growth to the larger trees, creating standing dead, create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes; favoring all species and create down woody debris often found in Old growth forest.

Researchers have found that there is no one specific condition to aim for as a condition of old growth, instead it's found more valuable to increase the number of characteristics associated with these types of forest communities. Structural objectives and silvicultural techniques used to achieve structural enhancement may include:

Multiple Canopy: Single tree selection using a target diameter, release advance regeneration, encourage new regeneration associated with natural forest type.

Create snags and down woody debris: Girdle trees of various sizes that are unacceptable, felling and leaving trees of healthiest trees with large diameters.

Accelerate growth in legacy trees: Full or partial crown release. A total of 64 square feet of unacceptable growth is spread out among all size classes.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
5-8	Single Tree Selection	31.84
	Manage for Old Growth	

## **Edgewood Area: Forest Map 5, Stand 5-9, 32 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum, White oak, Southern red oak and Tulip poplar with scattered Black cherry. Associate species include Black gum, Persimmon, Sassafras, Holly and Red maple. The understory is comprised of Barberry, Blueberry, Greenbrier, Pepperbush and Bayberry. Mature Poplar and Oaks are scattered through and account for 12% of the stocking as shown below. This stand borders the bay and is very important for water quality and has numerous man-made drainage patterns. The regeneration plot survey found advanced regeneration in 10% of the plots. Currently, shade (Canopy closure) is 95%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	12%
Sawtimber	11-23.9"	63%
Pole	6-10.9"	19%
Small tree	2-5.9"	6%

Currently the stand contains 124 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 133 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 37% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- This site is Eagle sensitive; either in buffer or nesting zone
- Shelterwood harvest

Currently the stand has a BA of 133 with only 40 sq. ft. of acceptable growing stock with regeneration being almost none existent. In order to remove the undesirable stock and open the canopy and ground layer for regeneration, the shelterwood should involve removing 3 sq. ft. of UGS matures, 52 sq. ft. UGS sawtimber, 21 sq. ft. pole UGS and 8 sq. ft. of small UGS.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
5-9	Shelterwood harvest	32
	Control invasives	
	Monitor natural regeneration	

## **Edgewood Area: Forest Map 5, Stand 5-10, 37.31 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum, White oak, Southern red oak, Tulip poplar and Willow oak. Associate species include Black gum, Black cherry and Red maple. The understory is comprised of Barberry, Blueberry, Greenbrier, Holly and Grapevine. Grapevine is hindering crown development; a canker is present in numerous Sweetgum. Mature Oaks are scattered throughout, a large 60-inch White oak recently blown down. These mature trees account for 8% of the stocking as shown below. This stand borders the bay, a large wetland marsh and is very important for water quality. The regeneration plot survey found advanced regeneration in 0% of the plots. Currently, shade (Canopy closure) is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	8%
Sawtimber	11-23.9"	75%
Pole	6-10.9"	14%
Small tree	2-5.9"	3%

Currently the stand contains 112 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 161 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 49% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- This site is Eagle sensitive; either in buffer or nesting zone
- Shelterwood harvest

Currently the stand has a BA of 161 with only 79 sq. ft. of acceptable growing stock with regeneration being almost none existent. In order to remove the undesirable stock and open the canopy and ground layer for regeneration, the shelterwood should involve removing 2 sq. ft. of UGS matures, 57 sq. ft. UGS sawtimber, 21 sq. ft. pole UGS and 2 sq. ft. of small UGS.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
5-10	Shelterwood harvest	37.31
	Control invasives	
	Monitor natural regeneration	

## **Edgewood Area: Forest Map 6, Stand 6-4, 35.07 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Tulip Poplar and Sweetgum with associate species being; Black cherry, Sycamore, Red oak, Ash, Hickory, Sassafras and Red maple. The understory is comprised of Spicebush, Holly, Pawpaw, Tree of Heaven, Wine berry, Multiflora rose, and Microstegium. No regeneration noted in the large canopy gaps after blow down. Highly invasive and alien understory is hindering regeneration along with the intense deer browse.

This large sawtimber stand has the following diameter distribution breakdown:

Mature	26"+	29%
Sawtimber	11-23.9"	52%
Pole	6-10.9"	16%
Small tree	2-5.9"	3 %

\*Majority of Mature trees are unacceptable

Currently the stand contains 108 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 122 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, only 37% of the trees are acceptable.

The acceptable sawtimber volume currently is 7,000 ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer.
- This site is in the Critical Area and the harvest plan should be completed.
- This site contains an Eagle Buffer follow APG Eagle restrictions.

From a timber management point of view this stand is in need of regeneration harvest. Yellow-poplar is a prolific seeder, and large crops are produced almost annually, a combination single tree selection and small less than ½ group selections will aid in regeneration. The Stand is marked in the same manner as with single-tree selection cut, the only difference being that small openings are created in the stand. Single-tree selection cutting occurs between the openings. The majority of the trees are unacceptable, leaving all acceptable sawtimber and pole timber as well as the higher quality matures trees will leave a residual basal area in the single tree selection areas of 60 sq.ft. per acre.

Controlling invasives and alien plants directly after the harvest is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
6-4	Single tree/small group harvest	35.07
	Control invasives	
	Prepare new plan	

## **Edgewood Area: Forest Map 6, Stand 6-7, 31.59 Acres**



## **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Southern Red Oak \*55", White Oak \* 45", Tulip Poplar \* 47" and Sweetgum \* 36" with associate species being; Black cherry, Black Oak, Willow oak \* 43", Sassafras, Hickory and Red maple. This stand has trees over 200 years old. The understory is comprised of Blueberry and dense Microstegium. Little to no regeneration noted in the large canopy gaps after blow down. Oak regeneration was very sparse and mostly under one foot in height. Highly invasive and alien understory is hindering regeneration along with the intense deer browse.

\* Largest diameter in the stand by species.

This very mature stand has the following diameter distribution breakdown:

*Mature	26"+	42%
Sawtimber	11-23.9"	32%
Pole	6-10.9"	23%
Small tree	2-5.9"	3 %

Currently the stand contains 108 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 132 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 95% stocking level. From a tree form and vigor stand point, only 29% of the trees outside of the mature class are acceptable.

## **Recommendations**

### **Manage towards Old Growth:**

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursuing Old Growth in this mature stand by, designating legacy trees, increase growth to the larger, create standing dead, create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes, favoring all species and create down woody debris often found in Old growth forest.

Researchers have found that there is no one specific condition to aim for as a condition of old growth, instead find it more valuable to increase the number of characteristics associated with these types of forest communities. Structural objectives and silvicultural techniques used to achieve structural enhancement may include;

**Multiple Canopy:** Single tree selection using a target diameter, release advance regeneration, encourage new regeneration associated with natural forest type

**Create snags and down woody debris:** Girdle trees of various sizes that are unacceptable, felling and leaving trees of healthiest trees with large diameters.

**Accelerate growth in legacy trees:** Full or partial crown release

Once canopy gaps are created by girdling poorly formed trees, plant 200 trees per acre (with a 6-foot shelter height) of Oak and Poplar to aid in regeneration of this stand that plays a major role in protecting the bay.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
6-7	Active manage for Old Growth	31.59
	Plant bare root seedlings/ shelter	
	Control invasives	
	Prepare new Plan	

## Edgewood Area: Forest Map 6, Stand 6-10, 26.15 Acres

### Overstory Summary Narrative

Data was collected in 2011, this stand is dominated by Southern red oak \*48", White oak 56", Swamp white oak, Tulip poplar and Sweetgum with associate species being; Black cherry, Black oak, Willow oak, Chestnut oak, Black gum, Hickory and Red maple. This stand has trees over 200 years old. The understory is comprised of Blueberry, Wine berry, Barberry and dense Microstegium. Oak regeneration averaged approximately 5,000 small seedlings per acre but consistent coverage is not present and most trees are under one foot in height. Highly invasive and alien understory is hindering regeneration along with the intense deer browse.

\* Largest diameter in the stand by species.

This very mature stand has the following diameter distribution breakdown:

Mature	26"+	42%
Sawtimber	11-23.9"	44%
Pole	6-10.9"	13%
Small tree	2-5.9"	1 %

Currently the stand contains 80 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 111 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 85% stocking level. From a tree form and vigor stand point, only 34% of the trees outside of the mature class are acceptable.

### **Recommendations**

#### **-Manage towards Old Growth:**

Actively pursue Old Growth in this mature stand by, designating legacy trees, increase growth to the larger, create standing dead, create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes, favoring all species and create down woody debris often found in Old growth forest. Structural objectives and silvicultural techniques used to achieve structural enhancement may include;

**-Multiple Canopy:** Single tree selection using a target diameter, release advance regeneration, encourage new regeneration associated with natural forest type

**-Create snags and down woody debris:** Girdle trees of various sizes that are unacceptable, felling and leaving trees of healthiest trees with large diameters.

**-Accelerate growth in legacy trees:** Full or partial crown release

Once canopy gaps are created by girdling poorly formed trees, shelter 200 existing high-quality seedlings per acre (with a 6-foot shelter) so the regeneration can become established without the deer pressure. Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

STAND

ACTIVITY

ACRES

6-10	actively manage for Old Growth Shelter existing seedlings Control invasives Prepare new Plan	26.15
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## **Forest Map 6, Stand 6-11, 24.65 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow Poplar and Sweet gum with associate species being; Cherry and Locust. Very few Holly and blueberry were found in the understory. Invasive plants include Microstegium, Multiflora rose, Barberry and Grapevine.

This is a small sawtimber stand 12” – 23.9” with scattered mature trees.

This stand is adequately stocked with 90% canopy closure.

This stand has 180 trees per acre. Basal area 150.

### **Recommendations**

-This site contains an Eagle Buffer follow APG Eagle restrictions.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
6-11	commercial TSI	24.65
	control invasives	
	examine stand for commercial harvest	

## **Forest Map 6, Stand 6-12, 23.55 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow Poplar and Sweet gum with associate species being; Red maple, Southern red oak, Hickory, Black gum, Locust and Black oak. Holly, Ash, Blueberry and Sassafras were found in the understory. Invasive plants include Microstegium, Honeysuckle, Multiflora rose and Grapevine.

This is a mature sawtimber stand 12" – 23.9"

This stand is over stocked with 90% canopy closure.  
This stand has 140 trees per acre.

### **Recommendations**

-This site contains an Eagle Buffer follow APG Eagle restrictions.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
6-12	commercial TSI	23.55
	control invasives	
	examine stand for commercial harvest	

## **Forest Map 6, Stand 6-13, 12.43 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow Poplar, White oak and Sweet gum with associate species being; Holly, Hickory, Black oak and Black gum. Holly, Hickory, Dogwood, Greenbrier and blueberry were found in the understory. Invasive plants include Microstegium, Honeysuckle and Grapevine.

This is a mature sawtimber stand 12" – 23.9"

This stand is over stocked with 20 - 80% canopy closure with large gaps.

This stand has 180 trees per acre. The basal area is 150.

### **Recommendations**

-Potential to be managed as an old growth forest. (50" + diameter White oak, 250 years old.)

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
6-13	commercial TSI control invasives examine stand for commercial harvest	12.43

**In 2016 MLE performed restoration activities.** This 12.43-acre forest enhancement site is in the Critical Area. This stand also contains a 6-acre planting which spans between stands 6-13 and 6-14 for a total of 1200 trees.

The stand is dominated by Tulip poplar, and mature Oaks; with associate species being Red maple and Sweetgum. The understory contains dense areas of Holly, shading the forest floor and Greenbrier, which was treated due to its dense population.

Mar-Len Environmental, Inc. (MLE) removed unacceptable growing stock; allowing sunlight to filter to the forest floor. Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Red maple and Sweetgum were targeted for removal to help restore the natural forest ecosystem.

## Forest Map 6, Stand 6-14, 37.36 Acres

### Overstory Summary Narrative

Data collected in 2009 states this stand is dominated by Yellow Poplar and Sweet gum with associate species being; Cherry, Southern Red Oak, Holly, Pin oak, Red maple, Sassafras and Willow oak. Holly, Serviceberry, Greenbrier and blueberry were found in the understory. Invasive plants include Microstegium, Honeysuckle, Multiflora rose and Grapevine.

This is a mature sawtimber stand 12” – 23.9”

This stand is over stocked with 80-85% canopy closure.  
This stand has 170 trees per acre. The basal area is 170.

### **Recommendations**

Release the grapevine from the canopy.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
6-14	commercial TSI	37.36
	control invasives	
	examine stand for commercial harvest	

**In 2016 MLE performed restoration work.** This forest enhancement site is in the Critical Area. This stand also contains a 6-acre planting which spans between stands 6-13 and 6-14 for a total of 1200 trees.

The stand is dominated by Tulip poplar, and mature Oaks; with associate species being Red maple and Sweetgum. The understory contains dense areas of Holly, shading the forest floor.

Mar-Len Environmental, Inc. (MLE) removed unacceptable growing stock; allowing sunlight to filter to the forest floor. Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Red maple and Sweetgum were targeted for removal to help restore the natural forest ecosystem



## **Edgewood Area: Forest Map 7, Stand 7-1, 30.80 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by Southern red oak, White oak, Chestnut oak, Pin oak, Tulip poplar, and Northern red oak. The understory is comprised of Sassafras, Serviceberry, Blackgum, Red maple, Paw paw, Blackberry, and Holly. This stand borders the bay to the North and currently has 1900 seedlings per acre. The regeneration plot survey found advance regeneration in only 50% of the plots; shade (Canopy closure) 85%, deer and invasives are major factors.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	33%
Sawtimber	11-23.9"	43%
Pole	6-10.9"	17%
Small tree	2-5.9"	3%

Currently the stand contains 184 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 111 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 95% plus stocking level. From a tree form and vigor stand point, 71% of the trees are acceptable. The sawtimber volume currently is 11,000 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available. Portions of the stand are forested wetlands that should be avoided.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer along Bay.
- This site is in the Critical Area and the harvest plan should be completed.
- Eagle buffer / FID AREA

Stand is overstocked at 95% stocking and a BA of 116. Ideal stocking in this Oak dominated stand is to have a BA of 80 sq. ft. per acre; this will involve removing 15 ft. per acre of mature trees, 15 sq. ft. per acre of unacceptable sawtimber, and 16 sq. ft. of unacceptable pole timber. The residual stand/stocking, after the harvest, will allow the current Oak regeneration to become established.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
7-1	Control invasives	30.80
	Selective Harvest	
	Prepare new Plan	

## **Edgewood Area: Forest Map 7, Stand 7-2, 54.82 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by Swamp chestnut oak, White oak, Willow oak, Sweetgum, Tulip poplar, Walnut, and Paulownia. The understory is comprised of Blackgum, Red maple, Paw paw, Blackberry, Spicebush, Blueberry, Paulownia, and Holly. This stand borders the bay for 2400 feet. The regeneration plot survey found advance regeneration in 0% of the plots; shade (Canopy closure) 80%, deer and invasives are major factors. Microstegium, Tear thumb, Barberry, and Honeysuckle are common in open gaps throughout the stand.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	40%
Sawtimber	11-23.9"	44%
Pole	6-10.9"	14%
Small tree	2-5.9"	2%

Currently the stand contains 90 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 117sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 80% plus stocking level. From a tree form and vigor stand point, 41% of the trees outside of the mature class are acceptable. Mature trees exist in the stand; a 54-inch Paulownia, 56-inch Northern red oak, and a 54-inch White oak were located.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer along Bay.
- This site is in the Critical Area and the harvest plan should be completed.
- Eagle buffer

The stand is under stocked in quality trees, and most matures are in decline. Within the gaps, invasive plants exist, preventing regeneration. The stand is in need of restoration to improve water quality, and to support Eagle habitat. The vines and invasive plants should be eradicated and the openings planted in Oak and Poplar species. Once the invasive plants are controlled in the understory the native seed should become established. This is a priority restoration site, due to its location to the bay and Eagle nest.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
7-2	Forest restoration	54.82
	Prepare new Plan	

## **Edgewood Area: Forest Map 7, Stand 7-3, 20.76 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by Sweetgum and Tulip poplar. The associate species include White oak, Pin oak, Willow oak, Southern red oak, Hickory, and Loblolly pine. The understory is comprised of Blackhaw, Winterberry, Greenbrier, Paw paw, Blueberry, Paulownia, and Holly. This stand borders the bay for 1200 feet. The regeneration plot survey found advanced regeneration in 0% of the plots; shade (Canopy closure) 80%, deer and invasives are major factors. Japanese honeysuckle vine dominates the understory.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	12%
Sawtimber	11-23.9"	72%
Pole	6-10.9"	13%
Small tree	2-5.9"	3%

Currently the stand contains 85 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 137sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 33% of the trees outside of the mature class are acceptable. The acceptable sawtimber volume is 8,000 bd. ft. per acre.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer along Bay.
- This site is in the Critical Area and the harvest plan should be completed.
- Eagle buffer

From a timber management point of view this stand is in need of a commercial thinning. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 137 B.A. and should be reduced to a B.A. of 55 Sq.ft. which is all acceptable trees and matures. The initial thinning will involve removing 82 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 24 cords per acre. The invasives should be controlled prior to harvest.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
7-3	Control invasives	20.76
	TSI	
	Prepare new Plan	

## **Edgewood Area: Forest Map 8, Stand 8-2, 53.23 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by mixed Oak species which include; White oak, Southern red oak, Willow oak and Chestnut oak. Associate species include Sweetgum, Tulip poplar and Red maple. The understory is comprised of Sweet pepperbush, Blueberry, Greenbrier, Azalea and Aralia. Mature Oaks account for 15% of the stocking as shown below. The entire length of the stand borders the bay. The regeneration plot survey found advanced regeneration in the seedling group to equal 140 per acre and of the sapling group 38 per acre. Currently, shade (Canopy closure) is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	15%
Sawtimber	11-23.9"	50%
Pole	6-10.9"	27%
Small tree	2-5.9"	8%

Currently the stand contains 180 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 109 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 49% of the trees are acceptable.

Access to the site is difficult due to the number of wetlands in and around the stand.

### **Recommendations**

- This site is in the MD defined Critical Area
- Shelterwood harvest

In order to release and increase Oak and Poplar regeneration the UGS should be removed. Currently the stand has a BA of 109 with only 54 sq. ft. of acceptable growing stock with regeneration being almost none existent. In order to remove the undesirable stock and open the canopy and ground layer for regeneration, the shelterwood should involve removing 2 sq. ft. of UGS matures, 27 sq. ft. UGS sawtimber, 23 sq. ft. pole UGS and 8 sq. ft. of small UGS.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
8-2	Shelterwood harvest	53.23
	Control invasives	
	Monitor natural regeneration	

## Edgewood Area: Forest Map 8, Stand 8-8, 66.25 Acres

### Overstory Summary Narrative

Data was collected in 2017. This stand borders the bay along its entire eastern boundary; 3,612 ft. along the Maryland defined Critical Area. The stand shows signs of severe anthropogenic activity. Sweetgum is the most prevalent species with associate species being Red maple, Locust, Sycamore, Holly, and Persimmon, Black cherry, Willow oak and Paulownia. The native understory is comprised of Blueberry and Bayberry. None of the field plots had native regeneration. The invasive plant community, such as Japanese honeysuckle, Multiflora rose, Mile a minute vine, Wineberry and Oriental bittersweet along with numerous dead and down trees makes the site almost impassible. Crowns of the trees are often covered in vines including native Grapevine. The current canopy closure is sparse at 15 percent closure; which has allowed the invasive plants to take over.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	5%
Sawtimber	11-23.9"	70%
Pole	6-10.9"	24%
Small tree	2-5.9"	1%

Currently the stand contains 148 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 94 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 70% stocking level. From a tree form and vigor stand point only 20% of the trees are acceptable. This stand is considered degraded and should be restored as it provides valuable water shed protection.

### **Recommendations**

- In the MD defined Critical Area
- Site restoration as need to for mitigation, control invasives and replant.
- Site needs UXO scan prior to any restoration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
8-8	Restore Forest	5 acres increments.

\*\* Time table cannot be established

## **Edgewood Area: Forest Map 8, Stand 8-9, 31.2 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by Sweetgum, Willow oak and Pin oak. Associate species include Persimmon and Red maple. The understory is comprised of Blueberry, Barberry, Wine berry and Microstegium. Only one plot had an Oak seedling, the remaining plots had no regeneration. The current Canopy closure is 85 %. The high stocking is causing stress on the Sweetgum dominating the stand. This stand is the critical area and borders a marsh and plays a major role in protecting water quality.

This timber stand has the following diameter distribution:

Mature	26"+	1%
Saw timber	11-23.9"	83%
Pole	6-10.9"	15%
Small tree	2-5.9"	1%

Currently the stand contains 200 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 156 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 115 stocking level. From a tree form and vigor stand point, 62% of the trees are acceptable.

### **Recommendations**

- Single Tree Selection, favoring high quality Oak crop trees and Sweetgum.
- Cut vines in crop trees

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 156 B.A. and should be reduced to a B.A. of 90 sq.ft. which is all acceptable trees. The initial thinning will involve removing 66 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre. This stand has good access and can be easily managed.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
8-9	TSI-single tree selection	31.2	2020
	Collect data/prepare new plan		2035

## **Edgewood Area: Forest Map 8, Stand 8-10, 9.97 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by mixed Oak and Sweetgum. Oaks include White oak, Pin oak, Willow oak, Southern red oak, Swamp chestnut oak with Red maple and Paulownia. The understory is comprised of Greenbrier, Blueberry, Blackgum, and Holly. This stand borders the bay along its northern boundary. The regeneration plot survey found advanced regeneration in 0% of the plots; shade (Canopy closure) 70%, and deer are major factors.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	18%
Sawtimber	11-23.9"	54%
Pole	6-10.9"	28%
Small tree	2-5.9"	0%

Currently the stand contains 80 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 110sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 85% plus stocking level. From a tree form and vigor stand point, 41% of the trees outside of the mature class are acceptable. The acceptable sawtimber volume is 4,000 bd. ft. per acre.

### **Recommendations**

-This site is in the Critical Area.

This site is too sensitive for management, hydric soils and forested wetlands are common throughout.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
8-10	Inspect for health	9.97
	Prepare new Plan	

## **Edgewood Area: Forest Map 8, Stand 8-11, 16.34 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by mature timber with Tulip poplar and mixed Oak species. Associate species include Sweetgum, Hickory, and Red maple. The understory is comprised of Greenbrier, Blueberry, Blackgum, and Holly. This stand is directly adjacent to the H Field range. The regeneration plot survey found advanced regeneration in 0% of the plots; however, 8-10 ft. tall Oak saplings are common in the stand and will be released during a thinning. Currently, shade (Canopy closure) is 80%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	29%
Sawtimber	11-23.9"	53%
Pole	6-10.9"	15%
Small tree	2-5.9"	3%

Currently the stand contains 110 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 143sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 35% of the trees outside of the mature class are acceptable. The acceptable sawtimber and mature volume is 11,550 bd. ft. per acre.

### **Recommendations**

- This site is in the Critical Area
- TSI & old Growth
- Eagle buffer

From a timber management point of view this stand is in need of a commercial thinning. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 143 B.A. and should be reduced to a B.A. of 77 Sq. ft which is all acceptable trees. The initial thinning will involve removing 66 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre.

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursuing Old Growth in this mature stand by, designating legacy trees, increase growth to the larger, create standing dead, create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes, favoring all species and create down woody debris often found in Old growth forest.

Researchers have found that there is no one specific condition to aim for as a condition of old growth, instead find it more valuable to increase the number of characteristics associated with these types of forest



communities. Structural objectives and silvicultural techniques used to achieve structural enhancement may include;

- Multiple Canopy: Single tree selection using a target diameter, release advance regeneration, encourage new regeneration associated with natural forest type
- Create snags and down woody debris: Girdle trees of various sizes that are unacceptable, felling and leaving trees of healthiest trees with large diameters.
- Accelerate growth in legacy trees: Full or partial crown release

Once canopy gaps are created by girdling poorly formed trees or removing by TSI, the existing regeneration should flourish. Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
8-11	TSI Manage for Old Growth Prepare new plan	16.34

## **Edgewood Area: Forest Map 9, Stand 9-6, 16.46 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by Willow oak, White oak, Southern red oak, Tulip poplar, Sweetgum, and Red maple. The midstory contains big leaf magnolia, Persimmon, Sassafras, and Black gum, with an understory comprised of Blueberry, Blackberry and Pepperbush. This stand borders a large marsh to the South and shows signs of damage from Hurricane Sandy. The regeneration plot survey found advanced regeneration in 0% of the plots; due to shade (Canopy closure) is 80% and invasive plants such as Barberry and Microstegium. Wetland pockets are common in the stand.

This large sawtimber stand has the following diameter distribution:

Mature	26"+ 15%
Sawtimber	11-23.9" 57%
Pole	6-10.9" 14%
Small tree	2-5.9" 14%

Currently the stand contains 110 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 131sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 48% of the trees outside of the mature class are acceptable. The acceptable sawtimber is 8,000 bd. ft. per acre. Once the undesirables are removed the stand should increase in volume as space is available.

### **Recommendations**

- Logging roads should be maintained for access and fire control
- Flag off 100 ft buffer
- This site is in the Critical Area and a harvest plan should be completed
- TSI
- Eagle buffer

From a timber management point of view this stand is in need of a commercial thinning. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 131 B.A. and should be reduced to a B.A. of 70 Sq.ft. which is all acceptable trees and matures. The initial thinning will involve removing 61 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
9-6	Control invasives	16.46
	TSI	
	Prepare new plan	

## **Forest Map 9, Stand 9-12, 29.13 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow poplar, White oak, Red oak, Black cherry and Red maple with associate species being; Yellow poplar, White oak, Red oak, Black cherry and Red maple. Holly, Dogwood, Blueberry and Greenbrier were found in the understory. Invasive plants include Microstegium and Barberry.

This is a sawtimber stand 12" – 23.9"

This stand is over stocked with 80% canopy closure.

This stand has 120 trees per acre.

### **Recommendations**

-This stand provides FID habitat and should maintain a basal area of 90 ft<sup>2</sup>/ac average with at least 70 percent canopy closure at all times.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
9-12	commercial TSI	29.13
	control invasives	
	examine stand for commercial harvest	

## **Edgewood Area: Forest Map 10, Stand 10-1, 41.18 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011. This stand is dominated by Tulip Poplar with associate species being; Sweetgum, Black cherry, Black gum, Red oak, Ash, Hickory and Red maple. The understory is comprised of Holly, Spicebush, Honeysuckle and dense Microstegium. Down wood is common, as is uprooted trees. This stand borders the bay, but is deteriorating and not sustainable in its current state. The regeneration plot survey found advance regeneration in only 7 % of the plots; shade, deer and invasives are major factors.

This large saw timber stand has the following diameter distribution:

Mature	26"+	31%
Sawtimber	11-23.9"	60%
Pole	6-10.9"	6%
Small tree	2-5.9"	3 %

Currently the stand contains 95 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% plus stocking level. From a tree form and vigor stand point, 28% of the trees outside of the mature class are acceptable. The majority of the mature trees are in poor condition, however; high quality seed trees are present.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer.
- This site is in the Critical Area and the harvest plan should be completed.

From a sustainable management point of view this stand is in need of regeneration. The establishment of a new forest stand from the partial removal of the overstory is needed. Each harvest if done in a series is a shelterwood treatment. The essential characteristic is that the new forest stand is being established naturally before the complete overstory trees from the original forest stand are removed. Remove 80 sq.ft. of Basal area in the first cut leaving 50 square feet comprised of the acceptable saw timber and the highest quality mature trees as seed trees. The site will need to be treated to remove the invasive plant community to allow the seed to germinate. Twenty years after the new stand is establish the residual large sawtimber and matures can be removed or left to create a two aged forest system.

Following the harvest, the alien and invasive plants should be controlled or Poplar will not germinate as readily.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
10-1	Shelterwood	41.18
	Control invasives	
	Prepare new Plan	

## **Edgewood Area: Forest Map 10, Stand 10-4, 32.2 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by Sweetgum and Tulip poplar. Associate species include Persimmon, Sassafras, Black gum, Cherry, Paulownia, Willow oak and Red maple. The understory is comprised of Bayberry, Barberry, Multiflora rose and Microstegium. No regeneration within the plots. The current Canopy closure is 85 %. This stand is the critical area and borders a marsh along the entire western boundary and plays a major role in protecting water quality. This stand shows signs of anthropogenic activity and has large abundance of downed wood.

This timber stand has the following diameter distribution:

Mature	26"+	15%
Saw timber	11-23.9"	74%
Pole	6-10.9"	7%
Small tree	2-5.9"	4%

Currently the stand contains 103 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 133 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 stocking level. From a tree form and vigor stand point, 58% of the trees are acceptable.

### **Recommendations**

- Single Tree Selection, favoring high quality Oak crop trees and Sweetgum.
- Cut vines in crop trees
- Restoration/Mitigation

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 133 B.A. and should be reduced to a B.A. of 77 sq. ft. which is all acceptable trees. The initial thinning will involve removing 56 sq.ft. of unacceptable saw timber, pole timber and small trees. The trees can be utilized for pulpwood and low-grade logs, the thinning producing approximately 18 cords per acre. This stand has good access and can be easily managed, however; due to past use the site may be sensitive to large scale activity. Restoration/Mitigation along the bay is also an option for future silvicultural activity. Control the invasive understory and remove all unacceptable over story stock. Plant Oak species on a 20' x 20' spacing with a five-foot tree shelter. Maintain a 6' diameter circle around each planted tree to control ground completion. Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
10-4	TSI single tree selection	32.2	2020
	Collect data/prepare new plan		2035

## **Edgewood Area: Forest Map 10, Stand 10-9, 110.49 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. An important buffer and FIDS habitat area; there is over 6300 feet of forest along the wetlands, marshes, and Bay. This stand is dominated by Tulip poplar and mixed Oak. Oaks include Southern red oak, Pin oak, Northern red oak, Chestnut oak, White oak, and Willow oak. The understory is sparse, and consists of Blackhaw, Hornbeam, Serviceberry, and Blackgum. The 30 regeneration plots show advanced regeneration in only 16% of the plots; due to shade (canopy closure) is 80% and deer pressure.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	19%
Sawtimber	11-23.9"	70%
Pole	6-10.9"	9%
Small tree	2-5.9"	2%

Currently the stand contains 95 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 131sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand 100% plus stocking level. From a tree form and vigor stand point, 58% of the trees outside of the mature class are acceptable. The acceptable sawtimber is 12,000 bd. ft. per acre.

### **Recommendations**

- Logging roads should be maintained for access and fire control
- Flag off 100 ft buffer
- This site is in the Critical Area and a harvest plan should be completed
- TSI & Old Growth
- Eagle buffer& FIDS

From a timber management point of view this stand is in need of a commercial thinning. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 131 B.A. and should be reduced to a B.A. of 80 Sq.ft. which is all acceptable trees and matures. The initial thinning will involve removing 51 sq.ft. of unacceptable sawtimber, pole timber, small trees, and poor quality matures.

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursuing Old Growth in this mature stand by designating legacy trees, increase growth to the larger, create standing dead, create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes, favoring all species and create down woody debris often found in Old growth forest.

Researchers have found that there is no one specific condition to aim for as a condition of old growth, instead find it more valuable to increase the number of characteristics associated with these types of forest

communities. Structural objectives and silvicultural techniques used to achieve structural enhancement may include;

- Multiple Canopy: Single tree selection using a target diameter, release advance regeneration, encourage new regeneration associated with natural forest type
- Create snags and down woody debris: Girdle trees of various sizes that are unacceptable, felling and leaving trees of healthiest trees with large diameters.
- Accelerate growth in legacy trees: Full or partial crown release

Once canopy gaps are created by TSI and poorly formed trees are removed, Oak and Poplar regeneration should have a better chance to become established, however deer management is needed.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
10-9	TSI Manage toward Old Growth Prepare new plan	110.49

## **Edgewood Area: Forest Map 10, Stand 10-11, 50.53 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. An important Eagle buffer and roost area Cooper's Creek is the largest roost in the Edgewood area. Two major storms have caused massive tree damage, and this stand is in need of restoration. Due to this damage; our data reflects only the forested areas. This stand is dominated by Tulip poplar, with associated species being Willow oak and Southern red oak. The understory consists of Blackhaw, Blueberry, and Blackberry. The 17 regeneration plots show no advanced regeneration; due to shade (canopy closure) 90% in the forested areas, and dense invasive plant cover, such as Microstegium, and Mile a Minute weed prohibit regeneration in the openings where storm damage has occurred.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	34%
Sawtimber	11-23.9"	53%
Pole	6-10.9"	11%
Small tree	2-5.9"	2%

Currently the stand contains 61 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 109 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 80% plus stocking level. From a tree form and vigor stand point, 32% of the trees outside of the mature class are acceptable. The acceptable sawtimber is 10,000 bd. ft. per acre.

### **Recommendations**

- Logging roads should be maintained for access and fire control
- Flag off 100 ft buffer
- This site is in the Critical Area and a harvest plan should be completed
- TSI & Salvage Harvest
- Restoration\*
- Eagle buffer & FIDS

All downed timber was removed that is still viable. From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 109 B.A. and should be reduced to a B.A. of 70 Sq.ft. which is all acceptable trees and matures. The initial thinning will involve removing 36sq.ft. of unacceptable sawtimber, pole timber, small trees, and all viable down wood.

Following the salvage harvest, the invasive plant community needs to be controlled so the sight can be replanted. The oldest blow down area along the Eastern shore, near the Eagle nest approximately 6 acres, needs to be planted with 300 trees per acre, predominately Poplar and Oak. The remaining blow down area (14 +/- acres) should be planted with 70 to 100 trees per acre, in large gaps areas.



Poplar regeneration should have a better chance to become established, however deer management is needed.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
10-11	TSI & Salvage	43
	Prepare new plan	50.53

In December, 2013 APG restored part of the Forest Community in Coopers Creek Eagle Nest site at N-Field. The area was dramatically impacted by storm damage. The majority of the trees on site were blown down and covered with a dense layer of invasive plants. Approximately 710 +- trees were planted and sheltered on approximately 6.7 acres.

This Tulip Poplar dominated site was planted with mixed oaks suited for moist to wet soils. These oaks will have a longer life span, than poplar and will withstand high winds and storms with in the critical area, along the bay.

**Activities:**

- Re-opened 1,600 ft of existing access road that was closed due to storm debris.
- Flagged site outer boundaries.
- Laid out a trail system within the planting for future maintenance.
- Staked each individual planting location.
- Performed UXO at each plating location and road access location.
- Removed Downed trees and invasive plants.
- Scarified soil to allow Tulip Poplar and other native seeds to come in contact with the soil.  
(This will promote native plant regeneration).
- Removed downed trees to create road access
- Secured dig permit
- Planted and sheltered each tree

Note: The project benefited Eagle Habitat, Water Quality, and Mission Sustainability; the site is in the Critical Area.

## **Forest Map 10, Stand 10-16, 5.15 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Ash, Locust, Persimmon, Black cherry, Red maple, Sycamore, Yellow poplar and Pin oak. Honeysuckle, Grapevine, Holly and Blueberry were found in the understory. Invasive plants include Microstegium, Honeysuckle and Grapevine.

This is a pole timber stand 6" – 11.9"

This stand is adequately stocked with 75% canopy closure.

This stand has 140 trees per acre.

### **Recommendations**

-May need to replant after reevaluating fire damage.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
10-16	commercial TSI control invasives examine stand for commercial harvest	5.15

## **Forest Map 10, Stand 10-17, 57.80 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum and Red maple with associate species being; Yellow poplar, Pin oak and Black cherry. Blueberry, Greenbrier and Holly were found in the understory. Invasive plants include Honeysuckle, Barberry and Multiflora rose.

This is a mixed stand, sawtimber 12" – 23.9", pole timber 6" – 11.9" (average 8" – 20")

This stand is adequately stocked with 90% canopy closure.

This stand has 140 - 160 trees per acre.

### **Recommendations**

-Heavy deer browse, even Greenbrier browsed.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
10-17	commercial TSI	57.80
	control invasives	
	examine stand for commercial harvest	

## **Edgewood Area: Forest Map 11, Stand 11-1, 13.1 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by Sweetgum, Red maple and Tulip poplar. Associate species include Holly, Hickory, Cherry, Walnut, Oaks and Black gum. The understory is comprised of Barberry, Multiflora rose, Greenbrier, Bittersweet and Microstegium. No regeneration within plots. The current Canopy closure is 90 %.

This stand is the critical area and borders a marsh and plays a major role in protecting water quality, with a large portion of the acreage in the 100-foot buffer.

This timber stand has the following diameter distribution:

Mature	26"+	26%
Saw timber	11-23.9"	61%
Pole	6-10.9"	13%
Small tree	2-5.9"	0%

Currently the stand contains 127 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 126 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 98% stocking level. From a tree form and vigor stand point, 73% of the trees are acceptable, which include 43 % matures. This stand has numerous blowdowns and areas of construction rubble. Since regeneration is so poor restoring the site by planting within natural or created gaps would benefit the stand long term.

### **Recommendations**

- Manage towards old growth
- Establish regeneration by planting and controlling the understory.

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursuing Old Growth in this mature stand by designating legacy trees, increasing growth to the larger trees, creating standing dead, create canopy gaps to aid in natural regeneration or establishing regeneration.

There is no one specific condition to aim for as a condition of old growth, instead it's found more valuable to increase the number of characteristics associated with these types of forest communities. Structural objectives and silvicultural techniques used to achieve structural enhancement may include: Accelerate growth in legacy trees: Full or partial crown release. A total of 73 square feet of unacceptable growth is spread out among all size classes. Controlling invasives and alien plants is imperative to natural regeneration success and aids in planted regeneration growth. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
11-1	Single Tree Selection	13.1	2020
	Restoration/mitigation plantings		2020
	Prepare new plan		2035

## **Edgewood Area: Forest Map 11, Stand 11-2, 75 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by mixed Oak, Hickory and Tulip poplar. Oaks include Willow oak, White oak, Chestnut, Southern red, Northern red, Swamp chestnut and Pin oak. Associate species include Sweetgum and Red maple. This stand has nice quality Oak and Poplar and shows signs of being harvest 25 plus years ago. The understory is comprised of Blueberry, Sweet pepper bush, Holly and Serviceberry. Advance regeneration was found within 83 percent of the plots with an average of approximately 4,800 per acre and scattered Oaks in the 15-20-foot height class. The current Canopy closure is 85 %. This stand is the critical area and borders a marsh on three sides and playing a major role in protecting water quality. Scattered forested wetland dot this stands landscape.

This timber stand has the following diameter distribution:

Mature	26"+	23%
Saw timber	11-23.9"	58%
Pole	6-10.9"	13%
Small tree	2-5.9"	6%

Currently the stand contains 120 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 149 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 64% of the trees are acceptable.

The saw timber volume currently is 12,000 bd. ft. per acre; removing mature and low-quality saw timber will produce approximately 6,000 per acre.

### **Recommendations**

- Aid in releasing natural regeneration, as future seed trees
- Reduce deer browse to ensure sustainability of the forest.
- Shelter wood harvests reduce the basal area to 65 sq. feet per acre of good seed trees.
- Collect data 15 years later for survey of regeneration to see if remaining saw timber can be removed.
- Keep residual stand with advancing regeneration or remove residual crop trees in a final harvest in the shelter wood series the over story removal of residuals which will release established regeneration from competition with the existing over story.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
11-2	Shelterwood Cut	75	2020
	Re-inspect Harvest		2030

## **Edgewood Area: Forest Map 11, Stand 11-9, 16.11 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Sweetgum (95%) with associate species being; Persimmon. The understory is sparse and comprised of Barberry, Multiflora rose, Blueberry and dense Microstegium. Two vines Grape and Va. Creeper are hindering some crowns from developing.

This small sawtimber stand with the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	23%
Pole	6-10.9"	63%
Small tree	2-5.9"	14 %

Currently the stand contains 472 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 182 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 58% of the trees are acceptable.

The acceptable sawtimber volume currently is 3,000 bd. ft. per acre; once the undesirables are removed the stand will increase in volume, as more crop tree space is available.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer from Bay.
- This site is in the Critical Area and the harvest plan should be completed.
- This site contains an Eagle Buffer follow APG Eagle restrictions.

From a timber management point of view this stand is in need of a commercial selective harvest. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 182 B.A. and should be reduced to a B.A. of 80 Sq.ft. The initial thinning will involve removing 102 sq.ft. of unacceptable sawtimber and pole timber, as well as 20 Sq.ft. per acre of acceptable pole timber. The trees can be utilized for pulpwood with the thinning producing approximately 25 cords per acre.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
11-9	Commercial TSI	16.11
	Prepare new Plan	

## **Edgewood Area: Forest Map 11, Stand 11-10, 29.15 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Sweetgum with associate species being; Southern red oak, Hickory, Red maple, Willow oak, Pin oak, and Cherry. The understory is comprised of Barberry, Viburnum, Blueberry and dense Microstegium. Due to overstocking /stress the Sweetgum trees have Bleeding Canker, (Botryosphaeria) with many trees structurally weak.

This sawtimber stand has the following diameter distribution:

Mature	26"+	2 %
Sawtimber	11-23.9"	70%
Pole	6-10.9"	25%
Small tree	2-5.9"	3 %

Currently the stand contains 176 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 158 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 53% of the trees are acceptable.

The acceptable sawtimber volume currently is 6,500 bd. ft. per acre; once the undesirables are removed the stand will increase in volume, as more crop tree space is available.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- This site is in the Critical Area and the harvest plan should be completed.
- Flag off 100 foot no cut buffer from Bay.

From a timber management point of view this stand is in need of a commercial selective harvest in. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 158 B.A. and should be reduced to a B.A. of 80 Sq.ft. The initial thinning will involve removing 78 sq.ft. of unacceptable sawtimber and pole timber. The trees can be utilized for pulpwood with the thinning producing approximately 25 cords per acre.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
11-10	Commercial TSI	29.15
	Prepare new Plan	

## **Edgewood Area: Forest Map 11, Stand 11-11, 34.99 Acres**



### **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Sweetgum, Poplar and Pin oak, with associate species being; Southern red oak, Hickory, Red maple, Willow oak, Pin oak, Sassafras, Locust, Persimmon, Black oak and Cherry. The understory is comprised of Barberry, Blueberry, Multiflora rose, Honeysuckle and dense Microstegium. Due to overstocking /stress the Sweetgum trees have Bleeding Canker, (Botryosphaeria) with many trees structurally weak.

This sawtimber stand has the following diameter distribution:

Mature	26"+	16 %
Sawtimber	11-23.9"	67%
Pole	6-10.9"	16%
Small tree	2-5.9"	1 %

Currently the stand contains 180 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 186 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 54% of the trees are acceptable.

The acceptable sawtimber volume currently is 7,500 bd. ft. per acre; once the undesirables are removed the stand will increase in volume, as more crop tree space is available.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- This site is in the Critical Area and the harvest plan should be completed.
- Flag off 100 foot no cut buffer from Bay.

From a timber management point of view this stand is in need of a commercial selective harvest in. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 186 B.A. and should be reduced to a B.A. of 80 Sq.ft. of acceptable growing stock. The initial thinning will involve removing 106 sq.ft. of unacceptable sawtimber/ pole timber and poor quality matures. The trees can be utilized for pulpwood with the thinning producing approximately 30 cords per acre. Oaks should be favored as crop trees.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
11-11	Commercial TSI	29
	Prepare new Plan	34.99

## **Edgewood Area: Forest Map 11, Stand 11-12, 18.31 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum and Tulip poplar with scattered mixed Oak species which include; Pin oak, Southern red oak, Willow oak and Chestnut oak. Associate species include Hickory, Cherry, Black gum, Locust and Red maple. The understory is comprised of Barberry, Poison ivy and Blueberry. The ground layer contains a dense cover of Microstegium which is hindering seed development. This stand borders the bay in the MD defined Critical Area along Dove's Cove. 30% of the plots had at least one Oak or Poplar seeding. Currently, shade (Canopy closure) is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	6%
Sawtimber	11-23.9"	67%
Pole	6-10.9"	23%
Small tree	2-5.9"	4%

Currently the stand contains 143 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 152 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 66% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 152 B.A. and should be reduced to a B.A. of 75 Sq.ft. which includes all acceptable trees. The initial thinning will involve removing 77 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 23 cords per acre.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
11-12	Single Tree Selection	18.31
	Control invasives	
	Monitor natural regeneration	

## **Edgewood Area: Forest Map 11, Stand 11-13, 24.28 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum and Tulip poplar with scattered mixed Oak species which include; White oak, Southern red oak, Willow oak and Black oak. Associate species include Hickory, Dogwood, Black gum, and Locust. There are scattered mature Tulip poplar and Willow oak throughout. The understory is comprised of Greenbrier, Blackberry, New York fern and dense Microstegium. The ground layer contains a dense cover of Microstegium which is hindering seed development. This stand borders the bay in the MD defined Critical Area along Dove's Cove. 60% of the plots had at least one Oak or Poplar seeding. Currently, shade (Canopy closure) is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	11%
Sawtimber	11-23.9"	77%
Pole	6-10.9"	8%
Small tree	2-5.9"	4%

Currently the stand contains 126 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 140 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 66% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 140 B.A. and should be reduced to a B.A. of 75 sq.ft. which is all acceptable trees. The initial thinning will involve removing 65 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
11-13	Single Tree Selection	24.28
	Control invasives	
	Monitor natural regeneration	

## **Edgewood Area: Forest Map 11, Stand 11-15, 54.20 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is surrounded by marsh land on 3 sides and contains forested wetlands. Dominated by Tulip poplar, and mixed Oak, Sweetgum and Hickory are also present in the Overstory. The understory consists of Blueberry and Bayberry. The 20 regeneration plots show advanced regeneration in only 15% of the plots; due to shade (canopy closure) 80%, and deer pressure. Invasive Barberry and Wisteria are present in the stand.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	15%
Sawtimber	11-23.9"	61%
Pole	6-10.9"	20%
Small tree	2-5.9"	4%

Currently the stand contains 143 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 120 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 95% plus stocking level. From a tree form and vigor stand point, 42% of the trees outside of the mature class are acceptable. The acceptable sawtimber is 7,000 bd. ft. per acre.

### **Recommendations**

- Logging roads should be maintained for access and fire control
- Flag off 100 ft buffer
- This site is in the Critical Area and a harvest plan should be completed
- TSI

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 120 B.A. and should be reduced to a B.A. of 70 sq.ft. which is all acceptable trees and matures. The initial thinning will involve removing 50 sq.ft. of unacceptable sawtimber, pole timber, and small trees.

\*Access to this site is difficult, a single narrow road with marsh on both sides\*

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
11-15	TSI Prepare new plan	54.2

## **Edgewood Area: Forest Map 11, Stand 11-16, 29.82 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Mixed Oak species which include; White oak, Southern red oak, Willow oak, Pin oak and Black oak. Associate species include Red maple, Ash, Black gum and Sweetgum. There is scattered mature Tulip poplar and Willow oak throughout. The understory is comprised of Blueberry, Blackhaw, Pawpaw, Holly, Barberry, Greenbrier, Blackberry and dense Microstegium. The ground layer contains a dense cover of Microstegium which is hindering seed development in some areas. This stand borders the bay in the MD defined Critical Area. 3% of the plots had at least one Oak or Poplar seeding. Currently, shade (Canopy closure) is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	9%
Sawtimber	11-23.9"	63%
Pole	6-10.9"	17%
Small tree	2-5.9"	11%

Currently the stand contains 132 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 122 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 48% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 122 B.A. and should be reduced to a B.A. of 60 sq.ft. which is all acceptable trees. The initial thinning will involve removing 62 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 18 cords per acre, along with low grade sawtimber.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
11-16	Single Tree Selection Control invasives Monitor natural regeneration	29.82

## **Edgewood Area: Forest Map 11, Stand 11-17, 50.4 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by Tulip poplar, Sweetgum and Red maple. Associate species include Holly, Hickory, Cherry, Walnut, Oaks and Black gum. The understory is comprised of Spicebush, Barberry, Multiflora rose, Greenbrier, Bittersweet, and Wisteria in some crowns. Regeneration was found in only 10% of plots. The current Canopy closure is 90 %.

This stand contains forested wetland systems.

This timber stand has the following diameter distribution:

Mature	26"+	35%
Saw timber	11-23.9"	55%
Pole	6-10.9"	9%
Small tree	2-5.9"	1%

Currently the stand contains 107 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 137 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 73% of the trees are acceptable, which includes 30 % matures. This stand has numerous blow downs. Since regeneration is poor and trees are mature, a shelter wood system harvest would benefit this stand.

Currently a thinning will reduce competition; the stand has a basal area of 137 B.A. and should be reduced to a B.A. of 60 sq.ft. which is all acceptable trees, involving 50 sq.ft. of high-quality saw timber and 10 sq.ft. of matures. The initial thinning will involve removing 77 sq.ft. of matures, unacceptable saw timber, pole timber and small trees. The trees can be utilized for saw timber,

### **Recommendations**

- Controlling invasive and alien plants
- Shelter wood leaving 60 BA
- Final Shelter wood once advance regeneration is adequate

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
11-17	Control Invasives	50.4	2020
	Shelterwood harvest		2035

## Edgewood Area: Forest Map 12, Stand 12-1, 40.03 Acres

### Overstory Summary Narrative

Data was collected in 2011; this stand is dominated by Southern red oak, White oak, Willow oak, Chestnut oak, Tulip poplar, Scarlet oak and Sweetgum. The understory is comprised of Holly (dense in patches), Winterberry, Mt. Laurel, Sassafras, Honeysuckle vine and Microstegium. Regeneration of oak was found in 77 percent of the plots. The regeneration is present but not abundant and is in need of more light since the canopy closure is 80-90 percent. In light gaps within the forest, regeneration was more abundant. Deer pressure is heavy.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	10%
Sawtimber	11-23.9"	66%
Pole	6-10.9"	17%
Small tree	2-5.9"	7 %

In 2011 the stand **contained 145 trees per acre** with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 120 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 95% plus stocking level. From a tree form and vigor stand point, **only 53% of the trees outside of the mature class are acceptable.**

### **Forest restoration work completed in July 2019.**

The entire site was scanned for ordinance. The understory was comprised of shrubs that shaded out the forest floor. The majority of the site was mowed to open up the lower canopy level. Currently an adequate seed source is present for regeneration of Oak, Hickory and Poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed midstory and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 145 sq. feet of Basal Area to 98 sq. feet average. Lower density exists in portions where mature trees have died. The trees per acres currently averages 92 trees. The acceptable **growing stock is 94 percent and prior to restoration was only 53 percent.**

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. High value wildlife trees were marked for retention.

This intermediate thinning improved stand vigor, stand quality and now concentrates growth on the improved species composition.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked of Eagle buffer, waited until buffer clear to work.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Treat invasive plants in a section opposite land fill entrance.
- Met with COR prior to start of project and at completion for approval.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Yr.</u>
12-1	Collect stand data	40.03	2039
	Prepare new Plan		



## **Edgewood Area: Forest Map 12, Stand 12-2, 24.06 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum, Tulip Poplar and Mixed Oak species which include; Chestnut oak, Southern red oak and Black oak. Associate species include Virginia pine, Red maple, Black gum and Hickory. The understory is comprised of Blueberry, Sassafras, Beech, Greenbrier and Mt. Laurel. This stand borders Canal Creek along the western boundary in the MD defined Critical Area. 66% of the plots had at least one Oak or Poplar seeding with an average of 3000 seedlings per acre; however, they are not distributed evenly throughout the stand. Currently, shade (Canopy closure) is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	12%
Sawtimber	11-23.9"	62%
Pole	6-10.9"	23%
Small tree	2-5.9"	3%

Currently the stand contains 107 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 85% stocking level. From a tree form and vigor stand point, 50% of the trees are acceptable. Since only 50% of the stand is acceptable, this stand should be thinned to increase regeneration.

### **Recommendations**

- This site is in the MD defined Critical Area
- This site is eagle sensitive
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 130 B.A. and should be reduced to a B.A. of 66 sq.ft. which is all acceptable trees. The initial thinning will involve removing 64 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre, along with low grade sawtimber.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
12-2	Single Tree Selection	24.06
	Control invasives	
	Monitor natural regeneration	

**Forest restoration was performed in 2016** from the data was collected in 2014.

Restoration/silvicultural work began in March of 2016. This stand is dominated by Sweetgum, Tulip Poplar and Mixed Oak species which include; Chestnut oak, Northern red oak, Pin oak, Southern red oak, White oak and Willow oak. Associate species include Walnut, Red maple, Beech and Hickory. The understory was comprised of Viburnums, Blueberry and Spicebush. This stand borders Canal Creek along the western boundary. The Oak trees were favored over all others when releasing crop trees and in large areas within the stand the understory was mowed before cutting to increase sunlight to forest floor.

Prior to restoration the stand contained an average B.A. of 130 sq.ft. per acre average. From a tree form and vigor stand point 65% of the trees were acceptable. The restoration removed the vast majority of unacceptable growing stock leaving the residual stand with a Basal area of 80 sq.ft. per acre, with majority of all trees on site having acceptable quality. Once the canopy was open sunlight on the forest floor became available to aid in seed germination and encourage the growth of advance regeneration. Existing oak and hickory were sheltered to ensure their long-term survival as the deer pressure in the stand is high. Due to the lack of acceptable stock a one-acre area is open within the stand for planting as needed.

STAND	ACTIVITY	ACRES	DATE
12-2	maintain shelters	24.06	2018
	Inspect for more advance regeneration		2018
	Collect data for stand stocking.		2036

## **Edgewood Area: Forest Map 12, Stand 12-3, 42.33 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is dominated by Sweetgum, Tulip Poplar and Mixed Oak species which include; Chestnut oak, Northern red oak, Pin oak, Southern red oak, White oak and Willow oak. Associate species include Walnut, Red maple and Beech. The understory is comprised of Viburnums, Blueberry, Holly, Beech, Pepperbush, Cherry and Spicebush. This stand borders Canal Creek along the western boundary in the MD defined Critical Area.

**Prior** to restoration work the stand contained 128 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand an 85% stocking level. From a tree form and vigor stand point 65% of the trees are acceptable therefore this stand should be thinned to increase regeneration.

**Following** restoration work the stand now contains 75 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 90 sq. ft. per acre average. From a tree form and vigor stand point 85% of the trees are acceptable.

Controlling invasive species and alien plants is imperative to natural regeneration success. Deer control should be increased in this area as well.

### **Forest restoration work completed in August 2019.**

The entire site was scanned for ordinance. The understory was comprised of shrubs that shaded out the forest floor. Invasive multiflora rose and dense vines were common throughout the stand. The majority of the site was mowed to open up the lower canopy level. Currently an adequate seed source is present for regeneration of Oak and Poplar. The potential here is excellent.

Mar-Len Environmental, Inc. (MLE) removed mid-story and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and Poplar to dominate the stand, as well as reduced overstocking.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. High value wildlife trees were marked for retention. Vines were cut and invasive plants were spot sprayed.

This restoration thinning improved both stand vigor and quality and now concentrates growth on the improved species composition.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked off Eagle buffer, waited until buffer clear to work.
- Cut trees and consolidated brush piles where possible to expose the forest floor.

- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Treat invasive plants.
- Met with COR prior to start of project and at completion for approval.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Yr.</u>
12-3	Collect stand data	42.33	2039
	Prepare new Plan		

## **Westwood Area: Forest Map 12, Stand 12-4, 24.81 Acres**

### **Overstory Summary Narrative**

Data collected in 2003 states this stand is dominated by Sweet gum and Red maple with associate species being; Sassafras, Black oak, Pin oak, Southern red oak, White oak, Black cherry, Yellow poplar and Green ash. No information was collected on the understory.

This large sawtimber stand has an average diameter of 12.3

Currently the stand contains 110.42 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 132 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 62.2% stocking level. From a tree form and vigor stand point, 45% of the trees are acceptable.

The sawtimber volume currently is 7,156 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest.
- Shelter wood harvest to reduce the basal area to 50-60 sq. feet per acre of good seed trees.
- Collect data 15 years later for regeneration to see if remaining sawtimber can be removed.
- A final harvest in a shelterwood series or the overstory removal of residuals which will release established regeneration from competition with the existing overstory.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
12-4	shelter wood harvest	24.18
	Collect data/prepare plan for harvest	
	Final harvest	

## Westwood Area: Forest Map 12, Stand 12-5, 57.19 Acres

### Overstory Summary Narrative

Data was collected originally in 2003 and updated data in 2017. This stand is dominated by Tulip poplar, Southern red oak, White oak and Sweetgum, mature Poplar and Oak are also common throughout. Associate species include; Black oak, Chestnut oak, Willow oak, Black cherry, Black gum, Beech, Hickory, Red maple and Holly. The understory contains native Blueberry, Serviceberry, Spicebush, Hercules club and Muscle wood. Invasive plants (although not abundant) consist of Multiflora rose, Japanese Honeysuckle, Barberry and Wineberry. The stand has nice quality trees in the overstory; however, no advance regeneration was found in any plots. In some gap's sweetgum sapling were noted.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	24%
Sawtimber	11-23.9"	54%
Pole	6-10.9"	15%
Small tree	2-5.9"	7%

Currently the stand contains 174 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 167sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110 % stocking level. From a tree form and vigor stand point, 56% of the trees are acceptable.

This site is high quality and high priority as in contains an Eagle nest and buffers the Bay along the southern boundary.

### **Recommendations**

- The forest lacks natural regeneration, favor Poplar and Oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest.
- Shelter wood harvest to reduce Basal area to 60 sq. feet per acre of good seed trees.
- Collect data 15 years later for regeneration to see if remaining sawtimber can be removed.
- A final harvest in a shelterwood series or the overstory removal of residuals which will release established regeneration from competition with the existing overstory.

If the above cannot be done commercially, a restoration thinning removing 36 sq. ft. of unacceptable and 22 sq. ft. of basal area in poor quality pole timber will provide canopy gaps to increase sunlight to forest floor and aid in regeneration. The areas of dense shrubs and small poor-quality trees can be mowed to aid in preparing the site for restoration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
12-5	shelter wood harvest or restoration thinning	57.19	2019-2022
	Collect data/prepare plan for harvest	57.19	2037
	Final harvest if regeneration is adequate		TBD

## **Edgewood Area: Forest Map 12, Stand 12-6, 20.11Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. This stand is dominated by Sweetgum, Tulip poplar and Red maples. Oaks include Southern red oak and Pin oak. Loblolly pine planted in the area has a present in the stands northern corner. The understory is sparse and consists of Holly and Highbush blueberry with invasive Autumn olive, Barberry, Privet and Multiflora rose. The regeneration plots showed no advanced regeneration due to shade (canopy closure) is 85%, deer pressure and plant competition.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	10%
Sawtimber	11-23.9"	68%
Pole	6-10.9"	12%
Small tree	2-5.9"	10%

Currently the stand contains 236 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 156 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand 100% plus stocking level. From a tree form and vigor stand point, 58% of the trees outside of the mature class are acceptable. Bleeding canker is present on some of the stressed Sweetgums.

### **Recommendations**

- Control invasive plant competition
- Thin stand to reduce stocking

From a timber management point of view this stand is in need of a thinning. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 156 B.A. and should be reduced to a B.A. of 80 sq. ft. which will be the acceptable sawtimber, poles and matures. The initial thinning will involve removing 76 sq. ft. of unacceptable sawtimber, pole timber, small trees and poor quality matures.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
12-6	TSI	20.11
	Prepare new plan 15 yrs. after TSI	

## **Edgewood Area: Forest Map 12, Stand 12-7, 15.57Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. This stand is dominated by mixed Oak. Oaks include Southern red oak, Pin oak, Black red oak, Chestnut oak, Chestnut oak and Willow oak. Associated species include: Loblolly pine, Beech, Red maple, Sweetgum, Cherry and Hickory. The understory consists of Blueberry, Wine berry, Green briar and Multiflora rose. Only 25% of the plots had regeneration due to shade (canopy closure) is 85%, understory invasive competition is also a factor along with deer pressure.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	11%
Sawtimber	11-23.9"	73%
Pole	6-10.9"	13%
Small tree	2-5.9"	3%

Currently the stand contains 155 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 127 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand 100% plus stocking level. From a tree form and vigor stand point 62% of the trees outside of the mature class are acceptable.

### **Recommendations**

- TSI / Restoration
- Control invasive in understory

From a timber management point of view this stand is in need of thinning. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 131 B.A. and should be reduced to a B.A. of 80 sq. ft. which is all acceptable trees and matures. The initial thinning will involve removing 47 sq. ft. of unacceptable sawtimber, pole timber, small trees, and poor quality matures. Once canopy gaps are created by TSI and poorly formed trees are removed, Oak and Poplar regeneration should have a better chance to become established, however deer management is needed. Oaks, Tulip poplar and Loblolly pine should be favored as crop trees.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
10-9	TSI Manage toward Old Growth Prepare new plan	110.49



## **Edgewood Area: Forest Map 13, Stand 13-3, 59.93Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This environmentally sensitive stand contains partial Eagle buffers and borders Canal Creek along the stands entire Eastern border. It is dominated by Tulip poplar, White oak, Chestnut oak, Southern red oak, Black oak, Willow oak, Beech, Hickory, and Red maple. The understory consists of Blueberry, Holly, Blackberry, Mountain laurel, Privet, Dogwood, and Bayberry. The 20 regeneration plots show no advanced regeneration in the plots; due to shade, canopy closure 85%, and heavy deer pressure.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	22%
Sawtimber	11-23.9"	47%
Pole	6-10.9"	23%
Small tree	2-5.9"	8%

Currently the stand contains 131 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 118 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 61% of the trees outside of the mature class are acceptable. The acceptable sawtimber and matures is 7,600 bd. ft. per acre.

This site slopes towards the Bay, has numerous drainage patterns, and is too sensitive for intense silvicultural activities. Managing for Old Growth is the ideal. This site is also home to White Turtlehead flowers; which serves as the primary regional host plant for the Baltimore checker spot butterfly (*Euphydryas phaeton*), Maryland's official state insect.

**Phase one, Delivery order #0015 Forest restoration work completed in February 2017.** The entire site was scanned for ordinance, however; only 46 acres of forest restoration was performed based on the delivery order. Thirteen acres is still available for future restoration activities.

The understory was comprised of dense Holly which shaded out the forest floor. The vast majority of Holly was removed with the exception of three Variable Retention areas with higher density, creating island for nesting birds.

Currently an adequate seed source is present for regeneration of oak and poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 118 sq. feet of Basal Area to 80 sq. feet average. Lower density exists in portions where mature trees have died.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. Large strangling vines were also cut from crop trees to reduce negative impacts to the heathy crowns. Removing vines reduces the seed source.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.

\*Deer control should be increased in this area.

**Phase two, Solar project mitigation: Project restored 2.19 acres**

**Phase three, Delivery order #0170. Complete June 2019. A total of 11.74 acres were restored completing all work within Stand 13-3 for 59.93 acres.**

The understory was comprised of dense Holly which shaded out the forest floor. The vast majority of Holly was removed with the exception of three Variable Retention areas with higher density, creating island for nesting birds.

Currently an adequate seed source is present for regeneration of oak and poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 118 sq. feet of Basal Area to 80 sq. feet average. Lower density exists in portions where mature trees have died.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. Large strangling vines were also cut from crop trees to reduce negative impacts to the healthy crowns. Removing vines reduces the seed source.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Cut vines and treated with herbicide.
- Scarified site to promote soil and seed contact.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
13-3	Inspect Regeneration	59 .93	2029
13-3	Collect data	59.93	2039

## **Edgewood Area: Forest Map 13, Stand 13-4, 5.37Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This small stand contains mixed Oak species with White oak being the most common. Associate species include; Tulip poplar, Beech, Hickory and Red maple. The understory consists of Blueberry, Serviceberry and Greenbrier. No regeneration plots showed advanced regeneration; due to shade, canopy closure 85%, and heavy deer pressure.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	20%
Sawtimber	11-23.9"	44%
Pole	6-10.9"	28%
Small tree	2-5.9"	8%

Currently the stand contains 133 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 84 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 75% stocking level. From a tree form and vigor stand point 62% of the trees are acceptable. The existing Oak population provides an excellent seed source.

### **Recommendations**

-To enhance regeneration, a restoration thinning removing 23 sq. ft. of unacceptable sawtimber and 17 sq. ft. of basal area in poor quality pole timber will provide canopy gaps to increase sunlight to forest floor and aid in regeneration. The areas of dense shrubs and small poor-quality trees 10 sq. ft. of B.A. can be mowed to aid in preparing the site for restoration.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
13-4	Restore	5.37	2025
13-4	Inspect regeneration /shelter	5.37	2028
13-4	Collect data	5.37	2043

## **Edgewood Area: Forest Map 13, Stand 13-5, 9.54 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This an important stand that borders a wetland /marsh along its eastern boundary; this stand also is an interface between building and the wetland. This small stand contains mixed Oak species, Sweetgum and Tulip poplar. Oaks on site include: Pin, Willow and Southern red oak. Associate species include; Beech, Hickory, Ash, Sycamore, Black gum, Cherry, Holly and Red maple. The understory consists of Blueberry, Serviceberry, Multiflora rose, Privet with Bittersweet and Ivy vines. There was no Oak or Poplar regeneration, plots showed advanced regeneration of Beech seedlings. Recent storms have caused mature trees to uproot.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	20%
Sawtimber	11-23.9"	46%
Pole	6-10.9"	21%
Small tree	2-5.9"	13%

Currently the stand contains 195 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 143 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100+% stocking level. From a tree form and vigor stand point only 45% of the trees are acceptable. The existing Oak population provides an excellent seed source.

### **Recommendations**

-To enhance regeneration, a restoration thinning removing 42 sq. ft. of unacceptable sawtimber and 18 sq. ft. of basal area in poor quality pole timber will provide canopy gaps to increase sunlight to forest floor and aid in regeneration. Small poor-quality trees 15 sq. ft. of B.A. can be mowed or cut to aid in preparing the site for restoration.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
13-5	Restore	9.54	2025
13-5	Inspect & shelter	9.54	2028
13-5	Collect data	9.54	2043

## **Edgewood Area: Forest Map 13, Stand 13-13, 23.48 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This is an important stand adjacent to CAPA field; it borders a wetland /marsh along its entire northern boundary. This small stand contains mixed Oak species, with Sweetgum and Tulip poplar. Oaks on site include: Pin, Black and Chestnut Oak. Associate species include: Beech, Hickory, Ash, Sycamore, Blackgum, Cherry, Holly, Sycamore, Loblolly Pine and Red maple. The understory consists of Blueberry, Serviceberry, Multiflora rose, Barberry with Bittersweet and Ivy vines. There was no Oak or Poplar regeneration found with the plots.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	34%
Sawtimber	11-23.9"	44%
Pole	6-10.9"	22%
Small tree	2-5.9"	5%

Currently the stand contains 165 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 143 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100+% stocking level. From a tree form and vigor stand point only 45% of the trees are acceptable. The existing Oak population provides an excellent seed source.

### **Recommendations**

**Stand Management Objectives:** Manage towards Old Growth: mark legacy / largest trees in stand in order to distinguish long term growing stock. Relocate the Basal Area to a larger mean diameter by felling the target unacceptable growing stock. Felled trees increase down logs for decomposition. The standing dead snags will greatly add to the wildlife enhancement of the stand. The reduction of canopy coupled with deer density reduction will aid in natural Oak and Poplar regeneration while creating canopy gaps conducive to old growth forest. Structural complexity enhancement is key to long term sustainability and benefits managing towards and for Old growth. The invasive shrubs should be 100% controlled. The stand buffers a first order stream and associated wetlands while providing recreation and aesthetic value to CAPA field.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
13-13	Manage Old Growth	23.48	2030
13-13	Inspect Regeneration shelter and invasives	23.48	2035
13-13	Collect data	23.48	2045

## **Wrights Creek Area: Forest Map 13, Stand 13-14, 54.43 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this mixed oak stand is dominated by White oak and Yellow poplar with associate species being; Black oak, Beech, Red maple, Southern red oak, Hickory, Pin oak, Black gum, Locust, Chestnut oak and Scarlet oak. Holly, Blueberry, Japanese honeysuckle and Greenbrier were found in the understory.

This large sawtimber stand has an average merchantable diameter of 19.7

Currently the stand contains 292.28 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 117.8 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 80% stocking level. From a tree form and vigor stand point, 66.7% of the trees are acceptable.

The acceptable sawtimber volume currently is 10,710.85 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

Dominated by mixed oak and poplar, mature trees are common throughout. This stand has some of the oldest trees within the study and should be set aside and managed as old growth forest.

Objectives:

- Create a multi-layered canopy by utilizing a single tree selection method. Favor mature trees.
  - Girdle selected trees with low vigor and leave as snags.
  - Allow dead and dying trees to remain standing and on the ground.
  - Accelerate growth in largest trees through crown release cuttings.
- To encourage regeneration in both shrubs and trees and create a multiple layer canopy invasive plants should be controlled prior to harvest. This will assure that increased sunlight does not accelerate invasive plant growth. An effort should also be made to control the deer population so that feeding does not hinder plant development.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
13-14	commercial TSI	54.43
	control invasives	
	examine stand for commercial harvest	

## **Edgewood Area: Forest Map 14, Stand 14-1, 35.24 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Mixed Oak species which include; Chestnut oak, Scarlet oak, Pin oak, Willow oak, White oak, Black oak with Sweetgum and Tulip Poplar. The understory is comprised of dense areas of Blueberry, Holly, Serviceberry, Sassafras and Blackgum. This stand borders King Creek in the MD defined Critical Area. 60% of the plots had at least one Oak or Poplar seeding, with all of the seedlings being less than 6 inches due to severe deer browsing. Currently, shade (Canopy closure) is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	4%
Sawtimber	11-23.9"	52%
Pole	6-10.9"	34%
Small tree	2-5.9"	10%

Currently the stand contains 202 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 145 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 42% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- This site is eagle sensitive
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 145 B.A. and should be reduced to a B.A. of 61 sq.ft. which is all acceptable trees. The initial thinning will involve removing 84 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 26 cords per acre, along with low grade sawtimber.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
14-1	Single Tree Selection	35.24
	Control invasives	
	Monitor natural regeneration	

## **Edgewood Area: Forest Map 14, Stand 14-5, 36.89 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Mixed Oak species which include; Southern Red oak, Chestnut oak, Scarlet oak, Willow oak, White oak and Black oak. Associate species are Red maple, Locust, Blackgum, Hickory and Pine. The understory is comprised of dense areas of Blueberry, Huckleberry, Mt. Laurel, Holly, Serviceberry, Sassafras and Blackgum. This stand borders the open water on three sides in the MD defined Critical Area. 70% of the plots with a total of 4,700 seedlings per acre all need to be released by a thinning. Currently, shade (Canopy closure) is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	12%
Sawtimber	11-23.9"	49%
Pole	6-10.9"	28%
Small tree	2-5.9"	11%

Currently the stand contains 146 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 137 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 48% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- This site is eagle sensitive
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 137 B.A. and should be reduced to a B.A. of 66 sq.ft. which is all acceptable trees. The initial thinning will involve removing 71 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 21 cords per acre, along with low grade sawtimber.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
14-5	Single Tree Selection	36.89
	Control invasives	
	Monitor natural regeneration	



**Forest restoration work was completed in 2016.** This stand is dominated by Mixed Oak species which include; Southern Red oak, Chestnut oak, Scarlet oak, Willow oak, White oak and Black oak. Associate species are Red maple, Locust, Blackgum, Hickory and Pine. The understory is comprised of dense areas of Blueberry, Huckleberry, Mt. Laurel, Holly, Serviceberry, Sassafras and Blackgum. This stand borders the open water on three sides in the MD defined Critical Area and is important to wildlife and water quality.

Currently an adequate seed source is present; regeneration of oak and poplar seedlings have now become established and have been sheltered to protect from deer browse.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and Poplar to dominate the stand, as well as reduced overstocking from 137 B.A. to 80-85 B.A. via favoring the highest quality trees. Trees with poor form and vigor were clearly marked to be girdled or cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil.

## **Edgewood Area: Forest Map 14, Stand 14-6, 91.05 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011; this stand is dominated by Chestnut oak, Southern red oak, White oak, Willow oak, Tulip poplar, Red maple, Black oak and Sweetgum. The understory is comprised of Holly, Serviceberry and Blueberry. Regeneration of oak was not found in any of the sub-plots. The acorn production on site is good, however; the canopy closure is 90 percent and the deer pressure is heavy. This stand is an important buffer to the bay and encouraging oak regeneration should be a priority.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	7%
Sawtimber	11-23.9"	58%
Pole	6-10.9"	27%
Small tree	2-5.9"	7 %

Currently the stand contains 131 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 105 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 85% plus stocking level. From a tree form and vigor stand point, only 42% of the trees outside of the mature class are acceptable. The acceptable sawtimber volume currently is 4,800 bd. ft. per acre, once the undesirables are removed the stand will increase in volume, as more crop tree space is available and regeneration will improve as more light is added to the forest floor.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- This site is in the Critical Area and the harvest plan should be completed.
- Flag off 100 foot no cut buffer.
- This site contains an Eagle Buffer follow APG Eagle restrictions.

The shelterwood system is recommended when oak regeneration potential is inadequate or uncertain. It involves two or more harvests several years apart in the same stand. The first harvest is a thinning and the final harvest is a group selection.

The first harvest removes some merchantable timber as well as undesirable species. It creates holes in the canopy that permit sunlight to reach oak seedlings and stimulate their growth and may encourage residual oaks to produce more acorns. Light levels can be regulated by the amount of thinning to favor acorn germination and oak seedling survival while suppressing competition from undesirable trees and shrubs. Make the first cut after a large acorn crop, if possible. Leave the best trees of any desirable species and all un-merchantable oaks capable of producing stump sprouts. Remove all other trees larger than 2 inches diameter, including seed producing trees of undesirable species. This cut should leave a park like stand with a 60 to 70 percent canopy having no major gaps. It is better to leave too many trees than too few, or you may encourage competition.

A good acorn crop within two years of understory removal usually will assure adequate reproduction. If a good acorn crop does not occur within three years, control understory competition a second time, preferably during a good acorn year.

Take the final cut when a forester determines that the advanced reproduction is adequate. This cut releases seedlings and yields more merchantable timber. If a final cut is not desired leave the mature overstory.

-When relying on acorns to reestablish oaks, harvest and disturb the soil after the acorns drop, but before the ground freezes. Soil disturbance helps to bury the acorns and uproot competing vegetation.

To encourage regeneration the first thinning will reduce competition and open the canopy. The stand has a basal area of 105 B.A. and should be reduced to a B.A. of 50 Sq.ft. The initial thinning will involve removing 55 sq.ft. of unacceptable saw timber, pole timber and small tree class. The undesirables can be utilized for pulpwood, some of the trees will produce low grade saw logs which can be separated at time of marking the thinning. The thinning will produce approximately **18** cords per acre. Following the commercial pulpwood sale, the alien and invasive plants should be controlled and deer population reduced to aid oak regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
14-6	Stage 1 shelterwood	91.05
	Control invasives	
	Prepare new Plan for possible harvest	

**In 2016 MLE performed work on this stand.** The initial start of the project called for stand 39-1, which is a 49-acre stand surrounded by water on 3 sides, located off Surveillance Road in Aberdeen. Mar-Len staff along with E.A. UXO techs started the surface visual sweep with Schonstedt assist to prepare site with a safety access trail. After two days onsite and 100 anomalies flagged with permission of DPW Mar-Len pulled off site and moved location to Edgewood stand 14-6.

Stand 14-6 is dominated by Chestnut oak, Southern red oak, White oak, Willow oak, Tulip poplar, Red maple, Black oak and Sweetgum. The understory is comprised of Holly (very dense in areas), Serviceberry and Blueberry. Regeneration of oak was not found in any of the plots prior to the restoration project. The acorn production on site is good, however; the canopy closure was at 90 percent and the deer pressure is heavy. This stand is an important buffer to the bay and encouraging oak regeneration should be a priority.

Mar-Len Environmental, Inc. (MLE) removed unacceptable growing stock; allowing sunlight to filter to the forest floor. Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Vines were cut, and shrubs; including a dense midstory of Holly to help restore the natural forest ecosystem.

Other activities include:

- Secured Range Work Request and organized Tower Support for 39-1.
- 2-day UXO scan
- Worked with DPW Environmental to move site locations.
- Prior to any work at 14-6 MLE and DPW had a meeting with the Facility Manager at the site.
- Perform UXO scan of the entire project area.
- Marked poor quality trees for removal.

- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Scarified site to promote soil and seed contact.

## Edgewood Area: Forest Map 14, Stand 14-7, 12.68 Acres

### Overstory Summary Narrative

Data was collected in 2014. This stand is dominated by Mixed Oak and Tulip Poplar, oak species include; Southern red oak, Chestnut oak, White oak and Black oak. The understory is comprised of dense areas of Blueberry, Sweetgum, Blackgum and Red maple saplings. 0% of the plots have regeneration due to heavy deer browsing activity and dense shade due to the canopy closure of 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	10%
Sawtimber	11-23.9"	61%
Pole	6-10.9"	20%
Small tree	2-5.9"	9%

Currently the stand contains 152 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 144 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 54% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 144 B.A. and should be reduced to a B.A. of 78 sq.ft. which is all acceptable trees. The initial thinning will involve removing 66 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre, along with low grade sawtimber.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
14-7	Single Tree Selection Control invasives Monitor natural regeneration	12.7

**Forest restoration work completed in June 2017.** The entire site was scanned for ordinance, restoration was then performed to reduce stand stocking, targeting poor quality growing stock. The future potential for Oak regeneration is good.

Mar-Len Environmental, Inc. (MLE) removed mid story, and unacceptable over story trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring

Oaks, to dominate the stand, as well as reduced overstocking from 144 sq. feet of Basal Area to 70-80 sq. feet average. Lower density exists in portions where mature trees have died.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. Removing vines reduces the seed source. Sparse populations of Barberry and Microstegium were treated.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Treated invasive.
- Oak seedlings will be sheltered in the fall.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
14-7	Inspect regen	12.68	2019
14-7	Collect data	12.68	2038

## **Edgewood Area: Forest Map 14, Stand 14-10, 6.26 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This small stand contains mixed Oak species with Poplar and sweetgum. Oaks include: Chestnut, Willow Oak, Southern red Oak, Black Oak, and Scarlet Oak. Associate species include: Hickory, Blackgum, Holly, Sassafras and Red maple. The understory consists of Blueberry and scattered Serviceberry. Nonnative plants include: Barberry, Tear thumb and Multiflora rose.

No regeneration plots showed advanced regeneration; due to shade, canopy closure of 80%, and heavy deer pressure. This stand provides an important Bay buffer. Oaks are declining with Chestnut oak showing the most stress. Vines are in some crowns and Black gum and Red maple are filling in canopy gaps.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	21%
Sawtimber	11-23.9"	64%
Pole	6-10.9"	10%
Small tree	2-5.9"	5%

Currently the stand contains 226 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 125 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 70% of the trees are acceptable. The existing Oak and Poplar population provides an excellent seed source.

### **Recommendations**

-To enhance regeneration, a restoration thinning removing 20 sq. ft. of unacceptable sawtimber, 10 in. of low-quality pole timber and 3 sq. ft. of basal area in the poor-quality small trees group is recommended. This will provide canopy gaps to increase sunlight to forest floor and aid in regeneration. The invasive plant community should be treated and vines hindering crown development should be cut.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
14-10	Restore	6.26	2026
14-10	Inspect Regeneration/shelter	6.26	2028
14-10	Collect data	6.26	2043

## **Edgewood Area: Forest Map 14, Stand 14-12, 5.51 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This small stand is dominated by Tulip poplar and Sweetgum with Willow oak, Southern red oak, Black oak, and Scarlet oak. Associate species include: Blackgum, Black cherry, Locust, Sycamore and Red maple. The understory consists of Blueberry and scattered Dogwood.

Nonnative plants include: Barberry, Paulownia, Bittersweet, Honeysuckle and Multiflora rose. There are thick Barberry patches as well. No regeneration plots showed advanced regeneration due to shade, canopy closure of 80% and heavy deer pressure.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	40%
Sawtimber	11-23.9"	51%
Pole	6-10.9"	0%
Small tree	2-5.9"	8%

Currently the stand contains 146 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 155 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point 55% of the trees are acceptable. The existing Oak and Poplar population provides an excellent seed source.

### **Recommendations**

-To enhance regeneration, a restoration thinning removing 50 sq. ft. of unacceptable sawtimber and 6 sq. ft. of basal area in the poor-quality small trees group will provide canopy gaps to increase sunlight to forest floor and aid in regeneration. The invasive plant community should also be treated.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
14-12	Restore	5.51	2026
14-12	Inspect Regeneration shelter	5.51	2028
14-12	Collect data	5.51	2043



## **Westwood Area: Forest Map 14, Stand 14-13, 30.71 Acres**

### **Overstory Summary Narrative**

Data collected in 2017. This stand is dominated by Tulip poplar, Sweetgum and mixed Oaks. Oaks include: Southern red oak, Pin oak, Chestnut oak and Willow oak. Associate species include: Black cherry, Blackgum, Locust, Hickory, Walnut, Sycamore, Red maple and Holly. The understory contains Blueberry, Hercules club and Greenbrier. Invasive plants consist of Multiflora rose, Barberry (dense in sections) and Paulownia. No advance regeneration was found in any plots. The entire eastern stand boundary buffers the Bay.

Currently the stand contains 85 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 121 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90 % stocking level. From a tree form and vigor stand point 48 % of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor Poplar and Oak as crop seed trees.
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest.
- Reduce Basal area to 60 sq. feet per acre of good seed trees. Grapevine in crown needs to be removed and Invasive plants.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
14-13	Restoration thinning /Invasive control	30.71	2020
14-13	Inspect site for regeneration	30.71	2022
14-13	Collect data, prepare new plan.	30.71	2035

## **Edgewood Area: Forest Map 14, Stand 14-16, 32.2 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum, Tulip poplar and Red maple. Associate species are Southern Red oak, Cherry, Walnut, Willow oak, Persimmon and Virginia pine. The understory is comprised of Blueberry, Barberry and Multiflora rose; vines are thick in areas and hindering tree crown growth. 11% of the plots have regeneration and the canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	7%
Sawtimber	11-23.9"	62%
Pole	6-10.9"	24%
Small tree	2-5.9"	7%

Currently the stand contains 160 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 156 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 43% of the trees are acceptable.

### **Recommendations**

- This site is in the MD defined Critical Area
- This stand is eagle sensitive
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 156 B.A. and should be reduced to a B.A. of 68 sq.ft. which is all acceptable trees. The initial thinning will involve removing 88 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 26 cords per acre, along with low grade sawtimber.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
14-16	Single Tree Selection	32.2
	Control invasives	
	Monitor natural regeneration	

## Edgewood Area: Forest Map 15, Stand 15-2, 13.06 Acres

### Overstory Summary Narrative

Data was collected in 2014. This stand is dominated by mixed Oak which includes: Southern red oak, Willow oak, Northern red oak, Scarlet oak and White oak. Associate species include Red maple, Virginia pine, Sweetgum and Black gum. The understory is comprised of Blueberry, Spicebush, Arrowwood, Mt. Laurel and Wine berry. 60% of the plots have regeneration for a total of 1800 seedlings per acre. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	1%
Sawtimber	11-23.9"	73%
Pole	6-10.9"	18%
Small tree	2-5.9"	8%

Currently the stand contains 176 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 129 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 57% of the trees are acceptable.

### **Recommendations**

-Enhance regeneration by a Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 129 B.A. and should be reduced to a B.A. of 74 sq.ft. which is all acceptable trees. The initial thinning will involve removing 55 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 16 cords per acre, along with low grade sawtimber.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-2	Single Tree Selection	13.06
	Control invasives/ cut vines	
	Monitor natural regeneration	

**In November 2016 MLE performed** forest restoration /enhancement mitigation on 13.5 acres, favoring oak species for long term management and wildlife. UXO techs and Mar-Len personnel worked together to preform avoidance and flag anomalies on 13.5 acres. We flagged high quality Oak regeneration to ensure protection during field activity, marked crop trees to leave during restoration, mowed the dense understory to remove the dense shade layer it creates, thinned/cut undesirable growing stock and sheltered regeneration to protect from deer browse

## **Edgewood Area: Forest Map 15, Stand 15-3, 6.99 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Oak, Tulip poplar and Hickory; associate species include Beech and Muscle wood. The understory is comprised of Multiflora rose, Bittersweet vine and Grapevine. 33% of the plots have regeneration. The current Canopy closure is 85%. There is a large wetland in the southwest portion of the stand and a stream channel in the center; making this sensitive stand difficult to manage.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	38%
Pole	6-10.9"	54%
Small tree	2-5.9"	8%

Currently the stand contains 265 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 162 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 62% of the trees are acceptable.

### **Recommendations**

-Due to wetlands and stream this small acreage stand is too sensitive to manage.

-Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-3	Control invasives/ cut vines	6.99

## **Edgewood Area: Forest Map 15, Stand 15-4, 24.38 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. One of the mature stands in Edgewood, this stand is dominated by mixed Oak which includes: Northern red oak, Willow oak, Pin oak, Scarlet oak and White oak; along with Sweetgum and Tulip poplar. Associate species include Red maple, Holly, Black cherry and Black gum in the midstory. The understory is comprised of Blueberry, Holly, Serviceberry, Viburnum and Sassafras. 33% of the plots have regeneration. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	20%
Sawtimber	11-23.9"	58%
Pole	6-10.9"	11%
Small tree	2-5.9"	11%

Currently the stand contains 171 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 156 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 62% of the trees are acceptable.

### **Recommendations**

- Manage toward Old Growth
- Possibly create a recreational trail for the adjacent large office building

From an Old Growth management point of view a thinning will increase the average diameter within the stand. Currently numerous 30+ diameter trees are scattered throughout. Removing the unacceptable sawtimber and unacceptable pole trees will account for 42 sq. ft. per acre of undesirable trees to be removed. The trees can be utilized for pulpwood with the thinning producing approximately 13 cords per acre, along with low grade sawtimber.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-4	Manage toward Old Growth	24.38
	Control invasives/ cut vines	
	Monitor natural regeneration	

## **Edgewood Area: Forest Map 15, Stand 15-5, 9.05 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum, Red maple and Tulip poplar; associate species include Willow oak, White oak, and Southern red oak. The understory is comprised of Blueberry, Black cherry, Holly, Viburnums and Sassafras. 33% of the plots have regeneration. The current Canopy closure is 90%. There are wetlands and a stream within this small stand making it sensitive difficult to manage.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	26%
Sawtimber	11-23.9"	57%
Pole	6-10.9"	14%
Small tree	2-5.9"	3%

Currently the stand contains 127 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 140 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 62% of the trees are acceptable.

### **Recommendations**

-Due to wetlands and stream this small acreage stand is too sensitive to manage; allow the stand to go through natural succession of old growth.

-Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-5	Natural Old Growth	9.05

## **Edgewood Area: Forest Map 15, Stand 15-7, 4.76 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Loblolly with occasional White pine and Black cherry. The understory is comprised of Sweetgum seedlings, Blueberry, with Hickory, Gum and Ash regeneration. None of the plots have regeneration. The current Canopy closure is 80%. This site is publically visible as it is next to both a cemetery and office complex.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	65%
Pole	6-10.9"	23%
Small tree	2-5.9"	12%

Currently the stand contains 340 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 215 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 81% of the trees are acceptable. Loblolly pine mature at 150-300 years; therefore, the stand can be left alone and go through a natural process. However, in order to have healthier, more productive trees the stand could be thinned.

### **Recommendations**

-Single Tree Selection – reduce BA to 90 sq. ft. of acceptable growing stock in the sawtimber class, cutting approximately 37 cords per acre.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-7	Single Tree Selection	4.76

## **Edgewood Area: Forest Map 15, Stand 15-8, 57.98 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by White oak, Pin oak, Southern red oak, Willow oak, Black oak and Sweetgum. Oaks dominate this site while the understory is comprised of Sweet pepperbush, Blueberry, Viburnums, sassafras, Greenbrier, Serviceberry and Swamp azalea. 66% of the plots have regeneration for a total of 1400 seedlings per acre. The current Canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	9%
Sawtimber	11-23.9"	60%
Pole	6-10.9"	20%
Small tree	2-5.9"	11%

Currently the stand contains 186 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 117 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 64% of the trees are acceptable.

### **Recommendations**

-Single Tree Selection

-From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 117 B.A. and should be reduced to a B.A. of 75 sq.ft. which is all acceptable trees. The initial thinning will involve removing 42 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 13 cords per acre, along with low grade sawtimber.

-Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-8	Single Tree Selection Control invasives Monitor natural regeneration	57.98

\*May have to shelter regeneration of deer browse continues

**In 2016 Mar-Len Environmental, Inc. (MLE)** removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and Hickory to dominate the stands, as well as reduced overstocking by favoring the highest quality trees. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil.



**The projects included the following activities:**

- Had UXO techs and Mar-Len personnel work together to perform avoidance and flag anomalies on 58 acres.
- Flagged high quality Oak regeneration
- Marked crop trees to leave during restoration
- Mowed the dense understory to remove dense shade layer it creates
- Thinned /cut undesirable growing stock to acceptable growing stock levels.
- Sheltered regeneration to protect from deer browse
- Completed forest restoration /enhancement mitigation on 58 acres, favoring oak species for long term management on 1-03-17

**Re-Inspect Stand in 2033 to update stand stocking and management recommendations.**

## Edgewood Area: Forest Map 15, Stand 15-9, 17.48 Acres

### Overstory Summary Narrative

Data was collected in 2014. This stand is important as it buffers the head waters to Canal Creek and is a good candidate for forest restoration and mitigation. This stand is dominated by Sweetgum, Tulip poplar, White oak, Willow oak, Southern red oak, and Red maple. The understory is comprised of Sweet pepperbush, Hawthorne, Blueberry, Viburnums, Holly, Beech, Cherry, Greenbrier, Serviceberry, Winterberry and Swamp Azalea. 71% of the plots have regeneration with areas of advanced regeneration thicker in some pockets. The current Canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	8%
Sawtimber	11-23.9"	72%
Pole	6-10.9"	17%
Small tree	2-5.9"	3%

Currently the stand contains 120 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 120 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 61% of the trees are acceptable.

### Recommendations

- Restoration/Mitigation
- Shelter regeneration on a 25x25 spacing
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 120 B.A. and should be reduced to a B.A. of 73 sq.ft. which is all acceptable trees. The initial thinning will involve removing 47 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 14 cords per acre, along with low grade sawtimber. The thinning can be done with a tree shear to reduce impacts.

Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-9	Single Tree Selection	17.48
	Control invasives	
	Mitigation as needed	

\*May have to shelter regeneration if deer browse continues

**Forest restoration work completed in 2016.** This 42.6-acre forest restoration site was a combination of two adjoining stands that are separated by Canal Creek Headwaters.

Stand 15-9 was inventoried in 2014. Stand 15-19 was inventoried in 2009.

These stands are dominated by Mixed Oak species which include; Southern Red oak, Chestnut oak, Scarlet oak, Willow oak, White oak and Black oak. Associate species are Red maple, Sweetgum and Tulip poplar. The understory is comprised of holly, Sweetgum, multiflora rose and blueberry.

Currently an adequate seed source is present; regeneration of oak and poplar seedlings have now become established and have been sheltered to protect from deer browse.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and Poplar to dominate the stand, as well as reduced overstocking from 117 B.A. in stand 15-9; and 137 B.A. in stand 15-19. The average residual B.A. of acceptable growing stock is currently 83.

Trees with poor form and vigor were clearly marked to be girdled or cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil.

## **Edgewood Area: Forest Map 15, Stand 15-10, 5.62 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum and Tulip poplar; Oaks include White oak, Willow oak and Chestnut oak. The understory is comprised of Viburnums, invasive Bittersweet, Multiflora rose and Microstegium. 0% of the plots have regeneration. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	1%
Sawtimber	11-23.9"	65%
Pole	6-10.9"	32%
Small tree	2-5.9"	2%

Currently the stand contains 220 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 148 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 65% of the trees are acceptable.

### **Recommendations**

-Single Tree Selection

-From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 148 B.A. and should be reduced to a B.A. of 75 sq.ft. which is all acceptable trees. The initial thinning will involve removing 73 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 22 cords per acre, along with low grade sawtimber.

-Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-10	Single Tree Selection	5.62
	Control invasives	

## **Edgewood Area: Forest Map 15, Stand 15-11, 4.07 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is dominated by Sweetgum, Tulip poplar; and Oaks including White oak, Northern red oak, and Pin oak with associate species being Red maple, Hickory, Cherry, Beech and Persimmon. The understory is comprised of Blueberry, Dogwood, with invasive Dogwood, Bittersweet and Tree of Heaven. 0% of the plots have regeneration. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	9%
Sawtimber	11-23.9"	73%
Pole	6-10.9"	12%
Small tree	2-5.9"	6%

Currently the stand contains 140 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 136 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 73% of the trees are acceptable.

### **Recommendations**

- Due to the wetlands within the stand this site is too sensitive for intense management
- Controlling invasives and alien plants is imperative to natural regeneration success.
- Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-11	Control invasives Cut vines in crown	4.07

## **Edgewood Area: Forest Map 15, Stand 15-12, 6.07 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This small stand could be managed with stand 15-10, which is 5.6 acres. The stand is dominated by Mixed oak and Sweetgum; Oaks include White oak, Willow oak, Northern red oak, Scarlet oak and Black oak. The understory is dominated by blueberry. 0% of the plots have regeneration. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	16%
Sawtimber	11-23.9"	51%
Pole	6-10.9"	24%
Small tree	2-5.9"	9%

Currently the stand contains 140 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 123 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 57% of the trees are acceptable.

### **Recommendations**

-Single Tree Selection

-From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 123 B.A. and should be reduced to a B.A. of 70 sq.ft. which is all acceptable trees. The initial thinning will involve removing 53 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 16 cords per acre, along with low grade sawtimber.

-Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-12	Single Tree Selection	6.07

## **Edgewood Area: Forest Map 15, Stand 15-14, 11.72 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand borders Canal Creek and is an important wooded buffer. This is a priority area as it could be used for mitigation/restoration. The stand is dominated by Sweetgum, Tulip Poplar and Red maple. Associate species include Black Cherry, Locust, Persimmon and Pin Oak. The understory is comprised of Multiflora rose, Barberry and vines consisting of Oriental bittersweet and Tear thumb. 0% of the plots have regeneration. The current Canopy closure is 80%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	68%
Pole	6-10.9"	12%
Small tree	2-5.9"	6%

Currently the stand contains 116 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 114 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, 33% of the trees are acceptable.

### **Recommendations**

- Restoration/Mitigation site, large openings in stand.
- Shelterwood

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 114 B.A. and should be reduced to a B.A. of 38 sq.ft. which is all acceptable trees. The initial thinning will involve removing 76 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 17 cords per acre, along with low grade sawtimber.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-14	Shelterwood	11.72
	Control invasives	
	Restoration/Mitigation	

## **Edgewood Area: Forest Map 15, Stand 15-15, 13.49 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is dominated by Sweetgum and Red maple. Associate species include Black Cherry, Virginia pine, Persimmon and Willow Oak. The understory is comprised of Sassafras, Holly and Blackberry. 0% of the plots have regeneration. The current Canopy closure is 90%. This area has been highly impacted by man; there are open gaps and wetlands scattered throughout.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	5%
Sawtimber	11-23.9"	72%
Pole	6-10.9"	17%
Small tree	2-5.9"	6%

Currently the stand contains 112 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 116 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, 41% of the trees are acceptable.

### **Recommendations**

-This site is too sensitive to manage.

-Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-15	allow to go through natural succession	13.49



## **Edgewood Area: Forest Map 15, Stand 15-16, 6.09 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand borders Canal Creek and is an important wooded buffer in the MD defined Critical Area. This is a priority area as it could be used for mitigation/restoration. The stand is dominated by mixed Oaks which include; White oak, Southern red oak, Willow oak, Pin oak and Northern red oak with scattered Sweetgum. The understory is comprised of Pepperbush, Blueberry, Beech and Greenbrier. 60% of the plots have regeneration. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	65%
Pole	6-10.9"	23%
Small tree	2-5.9"	12%

Currently the stand contains 150 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 50% of the trees are acceptable.

### **Recommendations**

- Restoration/Mitigation site, shelter existing regeneration with 25x25 ft spacing
- In MD defined Critical Area
- Thinning can be done with tree shear and girdling to reduce impacts
- Single tree selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 130 B.A. and should be reduced to a B.A. of 65 sq.ft. which is all acceptable trees. The initial thinning will involve removing 65 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre, along with low grade sawtimber.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-16	Single Tree Control invasives Restoration/Mitigation	6.09

## **Edgewood Area: Forest Map 15, Stand 15-17, 7.55 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is dominated by mixed Oaks which include; White oak, Southern red oak, Willow oak, Pin oak, Northern red oak and Post oak. This is the only location where Post oak exists that is known throughout GAPG. Associate species include Red maple, Blackgum, Black cherry and Virginia pine. The understory is comprised of Pepperbush, Blueberry, Holly, Serviceberry and Mt. Laurel. 0% of the plots have regeneration. The current Canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	64%
Pole	6-10.9"	20%
Small tree	2-5.9"	16%

Currently the stand contains 165 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 152 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 10% stocking level. From a tree form and vigor standpoint, 56% of the trees are acceptable.

### **Recommendations**

-Single tree selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 152 B.A. and should be reduced to a B.A. of 75 sq.ft. which is all acceptable trees. The initial thinning will involve removing 77 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 23 cords per acre, along with low grade sawtimber.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-17	Single Tree selection	7.55

## **Railroad Yard Area: Forest Map 15, Stand 15-19, 44.01 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this Mixed oak stand is dominated by White oak and Sweet gum with associate species being; Red maple, Yellow poplar, Scarlet oak, Willow oak, Black oak, Northern red oak, Black gum, Hickory, Virginia pine and Holly. Blueberry, Sweet pepper bush, Greenbrier, Holly, Serviceberry, Blackberry, Sweet gum, Black gum, and Multiflora rose, Honeysuckle, Hickory and Cedar were found in the understory.

This large sawtimber stand has an average merchantable diameter of 16.91

Currently the stand contains 215.35 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 137 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90.4% stocking level. From a tree form and vigor stand point, 69% of the trees are acceptable.

The acceptable sawtimber volume currently is 10,674.60 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

-Dominated by mixed oak, mature trees are common throughout. This stand has some of the oldest trees within the study and should be set aside and managed as old growth forest.

Objectives:

- Create a multi-layered canopy by utilizing a single tree selection method. Favor mature trees.
- Girdle selected trees with low vigor and leave as snags.
- Allow dead and dying trees to remain standing and on the ground.
- Accelerate growth in largest trees through crown release cuttings.

-To encourage regeneration in both shrubs and trees and create a multiple layer canopy invasive plants should be controlled prior to harvest. This will assure that increased sunlight does not accelerate invasive plant growth. An effort should also be made to control the deer population so that feeding does not hinder plant development.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-19	commercial TSI control invasives examine stand for commercial harvest	44.01

**Forest restoration work completed in 2016.** This 42.6-acre forest restoration site was a combination of two adjoining stands that are separated by Canal Creek Headwaters.

Stand 15-9 was inventoried in 2014. Stand 15-19 was inventoried in 2009.

These stands are dominated by Mixed Oak species which include; Southern Red oak, Chestnut oak, Scarlet oak, Willow oak, White oak and Black oak. Associate species are Red maple, Sweetgum and Tulip poplar. The understory is comprised of holly, Sweetgum, multiflora rose and blueberry.

Currently an adequate seed source is present; regeneration of oak and poplar seedlings have now become established and have been sheltered to protect from deer browse.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and Poplar to dominate the stand, as well as reduced overstocking from 117 B.A. in stand 15-9; and 137 B.A. in stand 15-19. The average residual B.A. of acceptable growing stock is currently 83.

Trees with poor form and vigor were clearly marked to be girdled or cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil.

## **Forest Map 15: Stand 15-20, 42.68 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow poplar with associate species being; White oak, Red maple, Black oak, Pin oak, Southern red oak, Sassafras, Black cherry, Hickory and Holly. Honeysuckle, Multiflora rose, Japanese honeysuckle, Barberry, Viburnum, Sweet gum, Greenbrier and Blueberry were found in the understory.

This large sawtimber stand has an average merchantable diameter of 22.77

Currently the stand contains 101 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 118 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 61.7% stocking level. From a tree form and vigor stand point 54% of the trees are acceptable. The acceptable sawtimber volume currently is 13,306.94 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations (2009)**

-54% of the trees within the stand are unacceptable. A shelterwood harvest is required reducing the basal area to 54 sq. ft. of AGS per acre. A two stage shelterwood cut is recommended; the first stage reducing the stocking by 50% and years later when adequate regeneration is established the remaining trees should be harvested.

-Invasive plants should be controlled prior to harvest.

-An effort should be made to control deer population.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-20	commercial TSI	42.68
	control invasives	
	examine stand for commercial harvest	

### **Forest restoration work completed in August 2017 by MLE**

The entire site was scanned for ordinance, restoration was then performed on 37 acres to reduce stand tree density targeting poor quality growing stock. The future potential for Oak and Poplar regeneration is good.

Mar-Len Environmental, Inc. (MLE) removed mid story, and unacceptable over story trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oak and Poplar to dominate the stand. This mature stand had almost no sunlight reaching the forest floor.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. In 2009 the stand had an overage of 101 trees per acre. Following the removal of undesirable trees the current trees per acre average in 58 trees, the ground was scarified where possible to allow seed drop to

come in direct contact with the soil. Removing vines reduces the seed source. A very dense population of Barberry and Microstegium were treated on three occasions.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep
- Performed UXO scan of the entire project area
- Cut trees and consolidated brush piles where possible to expose the forest floor
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact
- Treated invasive plants and trees
- Deer control should be increased in this area

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
15-20	Inspect regen	42	2019
15-20	Shelterwood cut	42	2029

## **Edgewood Area: Forest Map 15, Stand 15-21, 12.60 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand contains numerous wetlands and is too sensitive for equipment or management. Several large mature Oaks were noted; including a 46-inch diameter Southern red oak. The stand is dominated by mixed Oaks which include; White oak, Southern red oak, Chestnut oak and Pin oak. Associate species include Red maple, Blackgum, Hickory, Tulip poplar, Sweetgum and Sycamore. The understory is comprised of Viburnum, Blueberry, and Holly along with Wisteria vine and Greenbrier. 40% of the plots have regeneration. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	11%
Sawtimber	11-23.9"	57%
Pole	6-10.9"	25%
Small tree	2-5.9"	7%

Currently the stand contains 148 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 126 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 55% of the trees are acceptable.

### **Recommendations**

- Allow stand to go through natural succession
- Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
15-21	Allow to go through natural succession	12.60

## **Edgewood Area: Forest Map 16, Stand 16-1, 31.95 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand borders the bay along its entire northern boundary in the MD defined Critical Area. This is a priority area as it could be used for mitigation/restoration. The stand is dominated by mixed Oaks which include; White oak, Chestnut oak, Southern red oak, Black oak, Scarlet and Northern red oak. Associate species include Red maple, Blackgum, Holly and Tulip poplar. The understory is comprised of Blueberry and Serviceberry with dense areas of Red maple and Blackgum. 90% of the plots have regeneration at 6800 seedlings per acre all being browsed by deer. The current Canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	10%
Sawtimber	11-23.9"	48%
Pole	6-10.9"	30%
Small tree	2-5.9"	12%

Currently the stand contains 270 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 124 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 105% stocking level. From a tree form and vigor stand point, 52% of the trees are acceptable.

### **Recommendations**

- Restoration/Mitigation site; shelter existing regeneration with 25x25 ft spacing
- In MD defined Critical Area
- Thinning can be done with tree shear and girdling to reduce impacts
- Single tree selection

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 124 B.A. and should be reduced to a B.A. of 64 sq.ft. which is all acceptable trees. The initial thinning will involve removing 60 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 18 cords per acre, along with low grade sawtimber.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
16-1	Single Tree Control invasives Restoration/Mitigation	31.95



**Restoration/ silvicultural activities were performed to reduce stocking and completed in December 2015 under DO #76.** This stand borders the bay along its entire northern boundary in the Maryland defined “Critical Area”.

This is a priority area to keep Oak dominance. The stand is dominated by mixed Oaks which include; White oak, Chestnut oak, Southern red oak, Black oak, Scarlet and Northern red oak. Associate species include Red maple, Blackgum, Holly and Tulip poplar. The understory was comprised of Blueberry and Serviceberry with dense areas of Red maple and Blackgum. The Gum, Holly and Red maple were removed in most places within the stand, along with dominant and co-dominate trees of undesirable form and vigor.

Prior to thinning the stand had an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 124 sq.ft. per acre average. Currently the average B.A. (in mostly acceptable growing stock) is 80 sq. feet per acre with canopy gaps where the B.A. is low at 50 sq. ft. per acre average.

Since the canopy is now open, sunlight on the forest floor is available to aid in seed germination and encourage growth of advanced regeneration. Existing Oak and Hickory should be sheltered to ensure their long-term survival as the deer pressure in the stand is high.

## **Edgewood Area: Forest Map 16, Stand 16-2, 20.22 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand borders the bay along its entire southern boundary in the MD defined Critical Area and is highly sensitive. The stand is dominated by mixed Oaks which include; White oak, Chestnut oak, Southern red oak, Black oak along with Tulip poplar and Hickory. Associate species include Sweetgum and dense Holly in the midstory, shading out the understory. The understory is comprised of Blueberry. 16% of the plots have regeneration. The current Canopy closure is 80%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	52%
Pole	6-10.9"	30%
Small tree	2-5.9"	4%

Currently the stand contains 173 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 128 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 40% of the trees are acceptable.

### **Recommendations**

- In the MD defined Critical Area
- Thinning can be done with tree shear to remove the dense Holly
- Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
16-2	Remove Holly	20.22

## Edgewood Area: Forest Map 16, Stand 16-3, 11.44 Acres

### Overstory Summary Narrative

Data was collected in 2014. This stand borders the bay along its entire eastern boundary in the MD defined Critical Area and buffers a housing development to the west. The stand is dominated by mixed Oaks which include; White oak, Chestnut oak, Southern red oak and Scarlet oak. Associate species include Red maple, Blackgum, Sweetgum and Holly. The understory is comprised of Blueberry and sparse Serviceberry. 100% of the plots have regeneration for a total of 7000 seedlings per acre; however, they are being heavily deer browsed. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	56%
Pole	6-10.9"	25%
Small tree	2-5.9"	5%

In 2013 the stand contained 175 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 140 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 46% of the trees are acceptable.

Following restoration work in May of 2018 the stand contains **95%** acceptable growing stock.

Currently the stand contains **105** trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of **85** sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a **70%** plus stocking level. From a tree form and vigor stand point, **95%** of the trees are acceptable.

**Forest restoration work completed in May 2018.** The entire site was scanned for ordinance prior to restoration work.

The understory was comprised of areas of dense Holly which shaded out the forest floor. The vast majority of Holly was removed with the exception of one Variable Retention areas with higher density; creating island for nesting birds with Holly dominating the midstory.

Currently an adequate seed source is present for regeneration of Oak and Poplar. The potential is excellent. Seedling had existing but were being shaded out and browsed.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from **175** trees per acre to **105** trees per acre average. Target trees for removal were Red Maple and Sweetgum along with poor quality trees of any species.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked crop trees to remain.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Stacked/ condensed brush piles.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
16-3	Inspect regeneration	11.44	2019
	Shelter 18" plus tree on 30 x 30 ft. spacing.		
	Re- examine stand	11.44	2038

## **Edgewood Area: Forest Map 16, Stand 16-4, 13.54 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand has some very mature Oaks, the largest being a 62-inch White oak. The stand is dominated by mixed Oaks which include; White oak, Red oak, Pin oak, Black oak and Willow oak. Associate species include Hickory, Red maple, Tulip poplar, Sweetgum and Holly. The understory is comprised of Blueberry and Microstegium. 14% of the plots have regeneration. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	10%
Sawtimber	11-23.9"	68%
Pole	6-10.9"	16%
Small tree	2-5.9"	6%

Currently the stand contains 150 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 133 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 105% stocking level. From a tree form and vigor stand point, 49% of the trees are acceptable.

### **Recommendations**

#### **-Single Tree Selection**

From a timber management point of view this stand is in need of a commercial thinning. Currently a thinning will reduce competition; the stand has a basal area of 133 B.A. and should be reduced to a B.A. of 65 sq.ft. which is all acceptable trees. The initial thinning will involve removing 68 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre, along with low grade sawtimber.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
16-4	single tree thinning	13.54

## **Edgewood Area: Forest Map 16, Stand 16-6, 61.39 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This environmentally sensitive stand borders the Bay on its Northern boundary. It is dominated by White oak, Chestnut oak, Scarlet oak and Southern red oak, with pockets of dense Holly in the midstory. The understory consists of Blackgum, Dogwood, Cherry, Highbush blueberry, and Microstegium. The 19 regeneration plots show advanced regeneration in 21% of the plots; due to shade (canopy closure) 90%, and heavy deer pressure.

\*There is an excellent seed source and seed drop; however, the lack of sunlight and high presence of deer prevent seedling germination success.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	28%
Sawtimber	11-23.9"	45%
Pole	6-10.9"	24%
Small tree	2-5.9"	3%

Currently the stand contains 153 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 134 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 60% of the trees outside of the mature class are acceptable. The acceptable sawtimber and matures is 10,000 bd. ft. per acre.

### **Recommendations**

- Logging roads should be maintained for access and fire control
- Flag off 100 ft buffer
- This site is in the Critical Area and a harvest plan should be completed
- Forest Enhancement to promote regeneration
- Control the invasive Microstegium
- Use portion for future mitigation (5.13 acres)

The 25-acre forest enhancement will include the following goals:

- Remove midstory trees allowing sunlight to filter to forest floor.
- Selectively shelter highest quality regeneration to protect from intense deer browse allowing future forest of oak to become established
- Restore the natural distribution of native trees and shrubs.
- Reduce overstocking by releasing the highest quality trees.

Trees with poor form and vigor have been clearly marked to be girdled or cut to reduce environmental stress in the stand. This will improve the stands stocking level assuring that adequate water, nutrients and sunlight are available to the highest quality seed producers.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
16-6	Forest Enhancement Control invasive Inspect for regeneration Prepare new plan	61.39

## **Edgewood Area: Forest Map 16, Stand 16-7, 15.83 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This Eagle sensitive stand is in the MD defined Critical Area. The stand is dominated by mixed Oaks which include; White oak, Chestnut oak, Southern red oak, Scarlet oak and Willow oak. Associate species include Tulip poplar, Sweetgum, Hickory, Virginia pine and dense Holly. The understory is comprised of Blueberry and Holly ranging from 2-10 inches in diameter. 0% of the plots have regeneration. The current Canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	12%
Sawtimber	11-23.9"	59%
Pole	6-10.9"	21%
Small tree	2-5.9"	8%

Currently the stand contains 136 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 152 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 59% of the trees are acceptable.

### **Recommendations**

- Eagle sensitive/MD defined Critical Area
- Single Tree Selection

From a timber management point of view this stand is in need of a commercial thinning and removal of midstory Holly to allow sunlight to reach the forest floor to aid in regeneration. Currently a thinning will reduce competition; the stand has a basal area of 152 B.A. and should be reduced to a B.A. of 70 sq.ft. which is all acceptable trees. The initial thinning will involve removing 82 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 25 cords per acre, along with low grade sawtimber.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
16-7	Single tree thinning	15.83



## **Edgewood Area: Forest Map 16, Stand 16-8, 31.07 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This Eagle sensitive stand is in the MD defined Critical Area. The stand is dominated by mixed Oaks which include; White oak, Chestnut oak, Southern red oak, Black oak and Willow oak. Associate species include, Black gum, Sweetgum, Red maple and dense Holly. The understory is comprised of Holly, Black gum, Red maple and Sassafras. 50% of the plots have regeneration with an average of 2100 seedlings per acre, not evenly distributed. The current Canopy closure is 95%. Deer pressure on seedlings is heavy.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	28%
Sawtimber	11-23.9"	53%
Pole	6-10.9"	12%
Small tree	2-5.9"	7%

Currently the stand contains 172 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 64% of the trees are acceptable.

### **Recommendations**

- Eagle sensitive/MD defined Critical Area
- Manage toward Old Growth
- Thinning via shear or girdling trees
- Potential mitigation/restoration site

**Forest restoration work completed in February 2017.** The entire site was scanned for ordinance, however; only 18.00 acres of forest restoration was performed based on the delivery order. Thirteen acres is still available for future restoration activities.

The understory was comprised of dense Holly which shaded out the forest floor. The vast majority of Holly was removed with the exception of a few Variable Retention areas with higher density, creating island for nesting birds.

Currently an adequate seed source is present for regeneration of oak and poplar. The potential is excellent. Very little sunlight was reaching the forest floor to aid in Oak seedling success.

Mar-Len Environmental, Inc. (MLE) removed mid story, and unacceptable over story trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 130 sq. feet of Basal Area to 95 sq. feet average. Lower density exists in portions where mature trees have died.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. Large strangling vines were also cut from crop trees to reduce negative impacts to the healthy crowns.

The trees per acre were reduced from 172 TPA to 118 TPA, while canopy 95 percent to average 75 percent with areas as low as 50 percent.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Mark trees to cut
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Leave Variable Retention areas for nesting.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>YEAR</u>
16-8	Manage toward old growth	31.07	2017
16-8	Re-examine /Data collection	31.07	2037

**Edgewood Area: Forest Map 16, Stand 16-9, 9.58 Acres**

Stand 16-9 had no formal data collected in the past. **MLE Forest restoration work completed in October 2017.** This 18-acre forest restoration site was a combination of two adjoining stands Stand 16-9 and Stand 16-11. See report on page that follows.

<u>STAND</u>	<u>ACTIVITY</u>	<u>Date</u>
16-9	inspect for regeneration, shelter if need	2019

## **Edgewood Area: Forest Map 16, Stand 16-11, 16.10 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This Eagle sensitive stand is in the MD defined Critical Area, bordering the bay along its southern boundary. The stand is dominated by mixed Oaks which include; White oak, Chestnut oak, Southern red oak, Black oak, Scarlet oak and Pin oak. Associate species include Blackgum, Red maple, Sweetgum and Holly. The understory is comprised of Blueberry. 25% of the plots have regeneration. The current Canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	3%
Sawtimber	11-23.9"	62%
Pole	6-10.9"	24%
Small tree	2-5.9"	11%

Currently the stand contains 150 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 136 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 46% of the trees are acceptable.

### **Recommendations**

- Eagle sensitive/MD defined Critical Area
- Single Tree Selection

From a timber management point of view this stand is in need of a thinning and removal of midstory Holly to allow sunlight to reach the forest floor, aiding in regeneration. Currently a thinning will reduce competition as the stand has a basal area of 136 B.A. and should be reduced to a B.A. of 63 sq.ft. which is all acceptable trees. The initial thinning will involve removing 73 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 22 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
16-11	Single Tree Selection	16.10

**MLE Forest restoration work completed in October 2017.** This 18-acre forest restoration site was a combination of two adjoining stands Stand 16-11 and Stand 16-9.

These stands are dominated by Mixed Oak species which include; Southern Red oak, Chestnut oak, Scarlet oak, Willow oak, White oak and Black oak. Associate species are Red maple, Sweetgum and Tulip poplar. The understory is comprised of holly, Sweetgum, multiflora rose and blueberry.

Currently an adequate seed source is present; regeneration of oak seedlings possible since the acorns can contact bare soil and have adequate light.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and to dominate the stand, as well as reduced overstocking from 136 B.A. and an unacceptable growing stock previously of 46% of all trees, to an average residual B.A. of 80 and an acceptable growing stock of 90 percent.

Trees with poor form and vigor were clearly marked to be girdled or cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil.

**\*Re-examine this stand for stocking levels and prepare new plan in 2037**

## Supplemental Data: Forest Map 16, Stand 16-12, 31.43 Acres

### Overstory Summary Narrative

Data collected in 2009 states this stand is dominated by White oak, Southern red oak, Black oak, Yellow poplar and Sweet gum with associate species being; Black gum, Chestnut oak, Red maple and Virginia pine. Blueberry, Holly, Serviceberry, Sassafras, Sweet bay magnolia and Greenbrier were found in the understory. Invasive plants include Microstegium and Honeysuckle.

This is a large sawtimber stand d.b.h. ranges 12” – 24”.

Currently the stand contains 195 trees per acre, with a B.A. of 120 sq.ft. per acre average. This stand is currently overstocked with 85% canopy closure.

### **Recommendations**

-An effort should be made to control deer population.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
16-12	commercial TSI control invasives examine stand for commercial harvest	31.43

In 2009 the stand contained 195 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 120 sq. ft. per acre average. The number of trees correlated with the B.A. gave this stand a 100% stocking level. From a tree form and vigor stand point, numerous trees prior to restoration were considered unacceptable growing stock.

Following restoration work in August of 2018 the stand contains **90%** acceptable growing stock. Currently the stand contains an average B.A. of **80** sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a **65%** plus stocking level.

**Forest restoration work completed in August 2018.** The entire site was scanned for ordinance prior to restoration work.

The understory was comprised of areas of Honeysuckle and patches of stilt grass which shaded out the forest floor.

Currently an adequate seed source is present for regeneration of Oak and Poplar. The potential is excellent. Seedlings had existed but were being shaded out and browsed.

Mar-Len Environmental, Inc. (MLE) removed midstory and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from **195** trees per acre to **75** trees per acre average. Target trees for removal were Red Maple and Sweetgum along with poor quality trees of any species.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. High quality small trees were flag to be protected during cutting.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked crop trees to remain.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Stacked/ condensed brush piles.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
16-12	Inspect regeneration	31.44	2022
	Shelter 18" plus tree on 30 x 30 ft. spacing		
	Re Examine stand	11.44	2038

## **Edgewood Area: Forest Map 16, Stand 16-13, 17.2 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Chestnut oak and Black oak with associate species being: Red maple, Hickory, Virginia pine, Scarlet oak and Black gum along with very few Beech and Sweet gum. Dense Holly, Blueberry and Serviceberry were found in the understory. This is a large sawtimber stand D.B.H. ranges 12" – 24". In 2009 the stand contains 200 trees per acre and was overstocked with 80-90% canopy closure.

Following restoration work in April of 2018 the stand contains 95% acceptable growing stock.

Currently the stand contains 82 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 90 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 70% plus stocking level. From a tree form and vigor stand point, 95% of the trees are acceptable. The acceptable sawtimber and matures is 8,000 bd. ft. per acre.

This large sawtimber stand has the following diameter distribution:

Mature	24"+	39%
Sawtimber	11-23.9"	50%
Pole	6-10.9"	8%
Small tree	2-5.9"	3%

**Forest restoration work completed in April 2018.** The entire site was scanned for ordinance prior to restoration work.

The understory was comprised of dense Holly which shaded out the forest floor. The vast majority of Holly was removed with the exception of two Variable Retention areas with higher density; creating island for nesting birds with Holly dominating the midstory.

Currently an adequate seed source is present for regeneration of Oak and Poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 200 trees per acre to 82 trees per acre average. Target trees for removal were Red Maple and Sweetgum along with poor quality trees of any species.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil.

Other activities include:



- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked crop trees to remain.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Stacked/ condensed brush piles.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
16-13	Inspect regeneration	17.2	2019
	Re Examine stand	17.2	20

### **Edgewood Area: Forest Map 17, Stand 17-1, 21.62 Acres**

Data was collected in 2001. This stand is dominated by Tulip poplar, Sweetgum, Red oak, Willow oak and Chestnut oak. Associate species include; Holly, Red maple, Sassafras, Hickory and Black gum. The understory is comprised of Blueberry, Arrowwood, Greenbrier, invasive Barberry, Honeysuckle vine and Microstegium. Regeneration was found in 70 percent of the plots. The regeneration is present but not abundant and is in need of more light since the canopy closure is 80 percent. In light gaps within the forest, regeneration was more abundant. Deer pressure is heavy. This stand borders the bay and has a first order stream and wetland.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	7%
Sawtimber	11-23.9"	61%
Pole	6-10.9"	24%
Small tree	2-5.9"	8 %

Currently the stand contains 276 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 171 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point only 58% of the trees outside of the mature class are acceptable. The acceptable sawtimber volume currently is 8,500 bd. ft. per acre. Once the undesirables are removed the stand will increase in volume. Once more crop tree space is available regeneration will improve as light is added to the forest floor.

### **Recommendations**

-This stand is in need of a harvest. The thinning will reduce competition; the stand has a basal area of 171 B.A. and should be reduced to a B.A. of 80 sq. ft. The initial thinning will involve removing 91 sq. ft. of Basal area per acre, which includes all unacceptable growing stock 66 sq. ft (saw timber, pole timber, small tree class) as well 25 sq. ft. of acceptable stock. The primary product is pulpwood. Some of the trees will produce low grade saw logs which can be separated at time of marking the thinning. Following the commercial pulpwood sale, the alien and invasive plants should be controlled and deer population reduced to aid oak regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
17-1	TSI	21.62
	Control invasives	
	Prepare new Plan	

### **Forest restoration work completed in June 2020.**

Mar-Len Environmental, Inc. (MLE) removed mid story and unacceptable overstory trees allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and Poplar to dominate the stand, as well as reduced overstocking from 171 B.A. to 90 B.A. Tree density per acre was drastically reduced from 276 trees per acre to 100. Trees with poor form and vigor

were clearly marked and cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. Invasive plants such as Barberry and Microstegium were treated.

Primary objective for intermediate thinning

Improve stand vigor, growth and health by reducing stress from over stocking.

Improve overall stand quality by concentrating growth on most desirable trees of best quality.

Improve stand composition favoring oaks throughout the stand.

Create light gaps favoring both crown growth and native regeneration

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO scan.
- Performed UXO scan of the entire project area.
- Marked high quality trees to remain.
- Marked wetland and wildlife trees prior to working.
- Cut trees and vines and consolidated brush piles where possible to expose the forest floor.
- Scarified site to promote soil and seed contact.
- Treated invasive species.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>YEAR</u>
17-1	Collect data/prepare new plan	21.62	2040

## **Edgewood Area: Forest Map 17, Stand 17-2, 26.88 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is dominated by Sweetgum, Red maple and Pin oak. Associate species include Willow oak, Southern red oak, Hickory, Virginia pine, White oak, Tulip poplar and Loblolly. The understory is comprised of Blueberry with patches of Barberry. 33% of the plots have regeneration. The current Canopy closure is 85%. The high stocking is causing the bleeding canker in the Sweetgum dominating the stand.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	69%
Pole	6-10.9"	28%
Small tree	2-5.9"	3%

Currently the stand contains 178 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 170 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 63% of the trees are acceptable.

### **Recommendations**

-Single Tree Selection, favoring Oak as crop trees

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 170 B.A. and should be reduced to a B.A. of 75 sq.ft. which is all acceptable trees. The initial thinning will involve removing 95 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 28 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
17-2	single tree selection	26.88

**Restoration and selection thinning to reduce stocking was completed in 2016.** Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks to dominate the stands, as well as reduced overstocking by favoring the highest quality trees. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil.

## **Edgewood Area: Forest Map 17, Stand 17-3, 18.14 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is dominated by Loblolly pine which accounts for 74% of the sawtimber class in the stand. Associate species include Willow oak, Southern red oak, Sweetgum and Red maple. The understory is comprised of Blueberry with small areas of Beech and Barberry. 60% of the plots have Oak regeneration. The current Canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	55%
Pole	6-10.9"	37%
Small tree	2-5.9"	8%

Currently the stand contains 200 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 162 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 73% of the trees are acceptable.

The Loblolly's were planted in 1964; making them 50+ years old. Loblolly matures at 150-300 years. In order to produce healthy trees, the hardwoods should be removed; such as Red maple and Sweetgum, favoring the Loblolly and Oaks.

### **Recommendations**

-Single Tree Selection, favoring Loblolly and Oak as crop trees

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 162 B.A. and should be reduced to a B.A. of 80 Sq.ft. which is all acceptable trees. The initial thinning will involve removing 82 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 25 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
17-3	Single tree selection	18.14

### **Restoration and selection thinning to reduce stocking was completed in 2016.**

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and Loblolly to dominate the stands, as well as reduced overstocking by favoring the highest quality trees. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil.

## **Edgewood Area: Forest Map 17, Stand 17-4, 5.82 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is dominated by Sweetgum, Red maple and Tulip with associate species including Willow oak, Black oak, Pin oak, Virginia pine and Persimmon. The understory is comprised of native Blueberry and invasive Barberry, Bittersweet, Privet, Multiflora rose and Microstegium. Vines are hindering crown development in some trees. 0% of the plots have regeneration. The current Canopy closure is 85%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	66%
Pole	6-10.9"	23%
Small tree	2-5.9"	12%

Currently the stand contains 195 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 148 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 59% of the trees are acceptable.

### **Recommendations**

- Single Tree Selection
- Invasive plant control

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 148 B.A. and should be reduced to a B.A. of 80 sq.ft. which is all acceptable trees. The initial thinning will involve removing 68 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
17-4	Single Tree Selection Invasive plant control	5.82

## **Edgewood Area: Forest Map 17, Stand 17-5, 8.83 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is dominated by mixed Oak and Poplar; associate species include Loblolly, Hickory, Sweetgum and Red maple. The understory is comprised of native Blueberry and invasive Barberry. At the time of the inventory 100% of the plots have regeneration. The 2014 Canopy closure was 90%.

This sawtimber stand has the following diameter distribution:

Mature	26"+	1%
Sawtimber	11-23.9"	61%
Pole	6-10.9"	31%
Small tree	2-5.9"	7%

Currently (2014) the stand contained 204 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 160 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 68% of the trees are acceptable.

The focus on the forest stand enhancement is to remove the unacceptable growing stock, allowing high quality trees to remain in the residual stand with less competition and adequate growing /crown space.

**Forest restoration work completed in June 2020.** The entire site was scanned for ordinance prior to enhancement work. The stand contains 8.87 acres, the contract calls for 13.5 acres of silviculture. The additional acres were gained in the adjacent Stand 17-1 which has 7.12 acres over what is needed to fulfill Enhancement work on a separate contract for that stand.

The pre enhancement stand data showed a very high Basal area of 160 sq. ft. per acre with very high stocking levels. Following the improvement work the Stand now contains a Basal area average of 82 sq. ft. per acre. The trees per acre was reduced to 70 trees per acre.

The understory was comprised of Barberry, Multiflora rose and dense areas of Blue berry which help shade out the forest floor. The majority of the invasive nonnative were mowed and treated with herbicide.

Currently an adequate seed source is present for regeneration of Oak and Poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native

trees, favoring Oaks, Hickory and Poplar to dominate the stand. Target trees for removal were Red Maple and Sweetgum along with poor quality trees of any species.

Trees with good form and vigor were clearly marked as future crop trees that will make up the residual stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. The tops were mowed and the trees stacked in groups for better mission and training access.

**Other activities include:**

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked crop trees to remain.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Stacked/ condensed brush piles.
- Herbicide treatment performed on invasive shrubs and grasses.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
17-5	Examine stand	8.87	2035



## **Lauderick Creek Area/Edgewood Area: Forest Map 17, Stand 17-6, 23.14 Acres**

### **Overstory Summary Narrative**

Data was collected in 2009 and restoration was completed in July 2018; this environmentally sensitive stand borders the Bay on three sides. Dominated by Sweetgum with associate species being: Southern red oak, Red maple, Yellow poplar, White oak, Chestnut oak, and Pin oak. Holly, Greenbrier and Blackberry were found in the understory with the Holly presenting very dense shading out the understory.

The stand contained 320 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 134 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, only 62% of the trees are acceptable.

### **Forest restoration work was completed in July 2018:**

The understory was comprised of dense Holly which shaded out the forest floor. The vast majority of Holly was removed with the exception of three Variable Retention areas with higher density; creating island for nesting birds.

Currently an adequate seed source is present for regeneration of Oak and Poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed mid- story, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 134 sq. ft. of Basal Area to 75 sq. ft. average. The trees per acre was reduced from 320 per acre 80 trees per acre average. Currently 90 percent of trees on site are acceptable. Poor quality Sweetgum and Red Maple were removed along with the Holly.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>YEAR</u>
17-6	Monitor regeneration	23.14	2020
17-6	Collect data and prepare plan	23.14	2035

## **Lauderick Creek Area: Forest Map 17 Stand 17-7, 52.78 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow Poplar with associate species being; Sweet gum, Red maple, Chestnut oak, Holly, Black oak, Black cherry, Northern red oak, Willow oak and Southern red oak. Blueberry, Greenbrier, Holly, Barberry and Japanese honeysuckle were found in the understory.

In 2009 the stand contains 208 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 142 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 75% stocking level. From a tree form and vigor stand point 78% of the trees are acceptable.

### **Recommendations 2009**

-TSI is required using single tree selection; reducing the basal area to 78 sq. ft. of AGS per acre.

### **Restoration**

**Forest restoration work completed in July 2020.** The entire site was scanned for ordinance prior to restoration work.

The understory was comprised of areas of dense Holly which shaded out the forest floor. The vast majority of Holly was removed with the exception of a few Variable Retention areas with higher density; creating island for nesting birds with Holly dominating the mid story.

Currently an adequate seed source is present for regeneration of Oak and Poplar. The potential is excellent. Seedlings that existed were being shaded out and browsed.

Mar-Len Environmental, Inc. (MLE) removed mid story and unacceptable overstory trees; allowing sunlight to filter to the forest floor. The forest floor on the west side of Belardi Road was treated with an herbicide to reduce the dense stilt grass layer. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from **208** trees per acre to **90** trees per acre average. Target trees for removal were Red Maple and Sweetgum along with poor quality trees of any species. The stand has a Basal area of 80 sq. ft. with 95 % of all trees acceptable growing stock.

Trees with good form and vigor were clearly marked as future crop trees that will make up the residual stand. High value wildlife trees dead or alive were marked to remain. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. The tops were mowed and the trees stacked in groups for better mission and training access.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked crop trees to remain.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Stacked/ condensed brush piles.
- Herbicide to treat stilt grass.

\*Deer control should be increased in this area.

Primary objective for intermediate thinning

Improve stand vigor, growth and health by reducing stress from over stocking.

Improve overall stand quality by concentrating growth on most desirable trees of best quality.

Improve stand composition favoring oaks throughout the stand.

Create light gaps favoring both crown growth and native regeneration

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
17-7	collect stand data	52.78	2035

## **Edgewood Area: Forest Map 17, Stand 17-8, 80 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum and Chestnut oak with associate species being; Southern red oak, Red maple, Scarlet oak, Willow oak and Black oak. Blueberry, Greenbrier, Holly, Barberry, Sweet gum and Japanese honeysuckle were found in the understory.

In 2009 the stand contained 235 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 120 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, 60% of the trees are acceptable. **Note:** The Basal area at the time of restoration was 145 B.A. per acre.

### **Forest restoration work completed in April 2019.**

The entire site was scanned for ordinance. The understory was comprised of shrubs that shaded out the forest floor. The majority of the site was mowed to open up the lower canopy level. Currently an adequate seed source is present for regeneration of Oak, Hickory and Poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed midstory and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 145 sq. feet of Basal Area to 80 sq. feet average. Lower density exists in portions where mature trees have died. The trees per acres currently averages 98 trees. The acceptable growing stock is 85 to 90 percent.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. High value wildlife trees were marked for retention.

This intermediate thinning improved stand vigor, stand quality and now concentrates growth on the improved species composition.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.

\*Deer control should be increased in this area.

17-8

Collect data

2039

Follow silvicultural recommendations associated with new data collected.

## **Lauderick Creek Area: Forest Map 17, Stand 17-9, 60.02 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Southern red oak, Red maple, Yellow poplar, Black cherry, Northern red oak, Chestnut oak, Scarlet Oak, Virginia pine, Pin oak and White oak. Blueberry, Greenbrier, Barberry and Japanese honeysuckle were found in the understory.

This large sawtimber stand has an average merchantable diameter of 16.77

Currently the stand contains 137.81 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 79.4% stocking level. From a tree form and vigor stand point, 76.7% of the trees are acceptable.

The acceptable sawtimber volume currently is 10,410.06 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- TSI is required using single tree selection; reducing the basal area to 80 sq. ft. of AGS per acre.
- Invasive plants should be controlled prior to harvest.
- An effort should be made to control deer population.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
17-9	commercial TSI	60.02
	control invasives	
	examine stand for commercial harvest	

## **Lauderick Creek Area: Forest Map 17, Stand 17-10/17-11, 5.83 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Virginia pine with associate species being; Sweet gum, Black oak, Black gum, Red maple and Southern red oak. Blackberry, Holly, Blueberry, Honeysuckle and Greenbrier were found in the understory.

This small sawtimber stand has an average merchantable diameter of 14.48

Currently the stand contains 160.72 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 105 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 64.1% stocking level. From a tree form and vigor stand point, 52.5% of the trees are acceptable.

The acceptable sawtimber volume currently is 1,911.73 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

-Currently this stand is dominated by Virginia pine and is going through natural succession. It should be left undisturbed to provide winter habitat for birds and other wildlife during harsh conditions.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
17-10/11	commercial TSI	5.83
	control invasives	
	examine stand for commercial harvest	

\*These stands are not contiguous (see map)

## Westwood Area: Forest Map 18, Stand 18-1, 49.68 Acres

### Overstory Summary Narrative

Data collected originally in 2003 and updated in 2017. This stand is dominated by Sweetgum with associate species being; Pin oak, Southern red oak, Red maple, Loblolly pine, White oak, Tulip poplar, Beech and Willow oak. The understory contains native Blueberry which is dense and Blackhaw. Invasive plants although not abundant consist of Multiflora rose, Japanese honeysuckle, Stilt grass and Wineberry. No advance regeneration was found in any plots. The sweetgum is showing signs of (Phytophthora) bleeding canker. This stand borders / buffers a first order stream and associated wetland along its south eastern boundary.

Currently the stand contains 176 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 168 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 % stocking level. From a tree form and vigor stand point, 52% of the trees are acceptable.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	20%
Sawtimber	11-23.9"	46%
Pole	6-10.9"	21%
Small tree	2-5.9"	13%

### **Recommendations**

- The forest lacks natural regeneration, favor Poplar and Oak as crop seed trees
- A commercial TSI or restoration project to reduce basal area to 85 sq. feet per acre of good seed tree with good form and vigor is needed.
- Treat invasive shrubs and forbs.
- Grind up tops and stack logs through out to keep mission access use open.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
18-1	TSI or Restoration project	49.68	2020
	Inspect for regeneration/ Shelter	49.68	2023
	Collect data prepare new plan	49.68	2035

## **Westwood Area: Forest Map 18, Stand 18-2, 22.67 Acres**

### **Overstory Summary Narrative**

Data collected originally in 2003 and updated in 2017. This stand is dominated by Sweetgum and six Oak species: Pin oak, Southern red oak, Chestnut oak, White oak and Post oak which is not very common at APG. Associate species includes Red maple, Loblolly pine, Virginia pine, and Tulip poplar, Holly, Blackgum and Cherry. The understory contains native Blueberry, Grapevine and Green briar. Invasive plants consist of Multiflora rose, Japanese Honeysuckle, Stilt grass and Tear thumb. No advance regeneration was found in any plots. Beech and unwanted Sweetgum seedling were noted. This stand borders / buffers a first order stream and associated wetland along its eastern and south eastern boundary.

Currently the stand contains 170 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 161 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 % stocking level. From a tree form and vigor stand point, 47% of the trees are acceptable.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	20%
Sawtimber	11-23.9"	46%
Pole	6-10.9"	21%
Small tree	2-5.9"	13%

### **Recommendations**

- The forest lacks natural regeneration, favor Poplar and Oak as crop seed trees
- A commercial TSI or restoration project to reduce Basal area to 75 sq. ft. per acre of good seed trees with good form and vigor is needed.
- Treat invasive shrubs and forbs.
- Grind up tops and stack logs through out to keep mission access use open.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
18-2	TSI or Restoration project	22.67	2020
	Inspect for regeneration/ Shelter	22.67	2023
	Collect data prepare new plan	22.67	2035



## Edgewood Area: Forest Map 18, Stand 18-3, 46.4 Acres

### Overstory Summary Narrative

Data was collected in 2016. A very mature stand dominated by Southern red oak, Willow oak, White oak, and Pin oak. Associate species include, Sweetgum, Hickory, and Red maple. The understory is comprised of Blueberry, Pepperbush, Greenbrier and Honeysuckle vine. Only 45% of the plots had regeneration, outside of the plots scattered advanced Oaks averaging 5 foot tall are present. Sweetgum is starting to fill canopy gaps as dead Oaks occur. The current Canopy closure is 65% a reflection of mature tree mortality. This stand is the critical area and borders the bay for a few thousand feet and plays a major role in protecting water quality.

This timber stand has the following diameter distribution:

Mature	26"+	21%
Saw timber	11-23.9"	56%
Pole	6-10.9"	17%
Small tree	2-5.9"	1%

Currently the stand contains 149 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 126 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 stocking level. From a tree form and vigor stand point, 60% of the trees are acceptable, which includes the acceptable matures 26 inches in DBH or greater.

### **Recommendations**

- Manage toward old growth favoring healthy legacy trees and acceptable stock
- Restoration to promote regeneration, control dense understory protecting high quality natural regeneration
- Cut vines in crop trees and treat invasive.
- Eagle buffer guidelines apply

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 126 B.A. and should be reduced to a B.A. of 75 sq. ft. which is all acceptable trees. The initial thinning will involve removing 44 sq.ft. of unacceptable saw timber, pole timber and small trees (leaving poor quality matures trees as future den and snag trees. The trees can be utilized for pulpwood or sheared and left as part of the restoration process. This stand has good access and can be easily managed.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
18-3	Restoration/TSI	46.43	2017
	Collect data/prepare new plan		2032

## **Edgewood Area: Forest Map 18, Stand 18-4, 50.76 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is Eagle sensitive and within the MD defined Critical Area. It is dominated by Tulip poplar and Sweetgum with associate species of Southern red oak, Willow oak, Shingle oak and Red maple. This may be the only location of Shingle oak on post. The understory is comprised of native Blueberry, invasive Barberry and Honeysuckle vine. 0% of the plots have regeneration. The current Canopy closure is 85%. Mature Tulip poplar, Willow oak and Southern red oak are scattered throughout the stand.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	8%
Sawtimber	11-23.9"	69%
Pole	6-10.9"	16%
Small tree	2-5.9"	7%

Currently the stand contains 144 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 182 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 66% of the trees are acceptable.

### **Recommendations**

- Eagle sensitive/MD defined Critical Area
- Single Tree Selection

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 182 B.A. and should be reduced to a B.A. of 80 sq.ft. which is all acceptable trees. The initial thinning will involve removing 102 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 31 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
18-4	Single Tree Selection Invasive plant control	50.76

## Edgewood Area: Forest Map 18, Stand 18-5, 47.4 Acres

### Overstory Summary Narrative

Data was collected in 2016. The stand is mature with nice specimens of the dominant trees. Dominated by Tulip poplar and mixed Oaks, which include, Willow, Southern red and White oaks. Associate species include, Gum, Beech, Holly (dense in areas) and Red maple. The understory is comprised of Blueberry, Barberry, Holly and Viburnum. Fifty percent of the plots have regeneration but due to extensive deer browse the seedlings are very small. The current Canopy closure is 75-80 %, open gaps are present where mature trees have died. The majority of mature trees are current in good conditions. Good stand for **restoration** to enhance and encourage regeneration in this mature stand.

This large saw timber stand has the following diameter distribution:

Mature	26"+	34%
Saw timber	11-23.9"	39 %
Pole	6-10.9"	21%
Small tree	2-5.9"	6%

Currently the stand contains 186 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 188 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 58% of the trees are acceptable with the majority being mature.

### **Recommendations**

- Manage toward old growth favoring healthy legacy trees and acceptable stock
- Restoration** to promote regeneration, control dense understory protecting high quality natural regeneration
- Treat invasive.
- Single Tree Selection, favoring high quality crop trees

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 146 B.A. and should be reduced to a B.A. of 70 sq. ft. which is all acceptable trees. The initial thinning will involve removing 68 sq.ft. of unacceptable saw timber, pole timber and small trees. The trees can be utilized for pulpwood or sheared and left as part of the restoration process.

\*Deer control should be increased in this area as well.

STAND	ACTIVITY	ACRES	DATE
18-5	TSI	47.4	2018
	Collect data/prepare new plan		2033

## **Edgewood Area: Forest Map 18, Stand 18-6, 38 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by Sweetgum and Tulip poplar. Associate species include Persimmon, Red maple Black cherry, Locust, Va. pine, Pin oak and Loblolly pine. The understory is comprised of Blueberry, Holly, Barberry, Wine berry and Microstegium. Ninety percent of the regeneration plots had no seedlings. The current Canopy closure is 85 %. The high stocking is causing stress on the Sweetgum dominating the stand. This stand is the critical area and borders the Bay along the entire eastern boundary and plays a major role in protecting water quality.

This timber stand has the following diameter distribution:

Mature	26"+	18%
Saw timber	11-23.9"	66%
Pole	6-10.9"	16%
Small tree	2-5.9"	0%

Currently the stand contains 144 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 163 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 51% of the trees are acceptable with high quality matures or 39% without mature stock.

### **Recommendations**

- This site is in the MD defined Critical Area
- Manage for Old Growth
- Restoration to enhance regeneration.
- Cut vines in crop trees
- Control invasives

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursuing Old Growth in this mature stand by designating legacy trees, increasing growth to the larger trees, creating standing dead, create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes; favoring all species and create down woody debris often found in Old growth forest.

Researchers have found that there is no one specific condition to aim for as a condition of old growth, instead it's found more valuable to increase the number of characteristics associated with these types of forest communities. Structural objectives and silvicultural techniques used to achieve structural enhancement may include:

Multiple Canopy: Single tree selection using a target diameter, release advance regeneration, encourage new regeneration associated with natural forest type.

-Single Tree Selection, favoring high quality Tulip poplar crop trees and Oaks.

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 163 B.A. and should be reduced to a B.A. of 90 sq.ft. which is all acceptable trees. The initial thinning will involve 73 sq.ft. of unacceptable, matures, saw timber and pole timber. This stand has good access and can be easily managed.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>YEAR</u>
18- 6	TSI and enhancement	38	2020
	Collect data/prepare new plan		2035

#### **Forest restoration work completed in June 2017.**

Mar-Len Environmental, Inc. (MLE) removed mid story, and unacceptable over story trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks and Poplar to dominate the stand, as well as reduced overstocking from 163 B.A. to 90 B.A. Tree density per acre was drastically reduced. Trees with poor form and vigor were clearly marked and cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. Invasive plants such as Barberry and Microstegium were treated.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO scan.
- Performed UXO scan of the entire project area.
- Marked poor quality trees for removal.
- Cut trees and vines and consolidated brush piles where possible to expose the forest floor.
- Scarified site to promote soil and seed contact.
- Treated invasive species.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>YEAR</u>
18- 6	Collect data/prepare new plan	12 +	2035

## **Westwood Area: Forest Map 18, Stand18-7, 89.35 Acres**

### **Overstory Summary Narrative**

Data collected in 2017. This stand borders/buffers a first order stream, a large marsh and the Bay for thousands of feet. Dominated by Sweetgum, Red maple and Tulip poplar; Oaks had a strong presence in 60 percent of the plots. Oaks present include; Pin oak, Southern Red Oak and Willow Oak. Associate species include: Loblolly, Sassafras, Sycamore, Locust, Beech, Holly, and Virginia pine. The understory contains native Blueberry, Grapevine and Greenbrier. Invasive plants consist of Multiflora rose, Japanese Honeysuckle, Stilt grass and Barberry. No advance regeneration was found in any plots. Beech and unwanted sweetgum seedling were noted as well as crowns being hindered by vines. Both Sweetgum and Oaks are showing stress from canker; bleeding canker in the Sweetgum and Hypoxylon canker in Oaks.

This sawtimber stand has the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	56%
Pole	6-10.9"	25%
Small tree	2-5.9"	5%

Currently the stand contains 159 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 125 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 % stocking level. From a tree form and vigor stand point, only 40 % of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor Poplar and Oak as crop seed trees.
- A commercial TSI or restoration project to reduce basal area to 60 sq. feet per acre of good seed trees with good form and vigor is needed.
- Treat invasive shrubs and forbs.
- Grind up tops and stack logs through out to keep mission access use open.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
18-7	TSI or Restoration project	89.35	2022
	Inspect for regeneration/ Shelter	89.35	2024
	Collect data prepare new plan	89.35	2037

## **Edgewood Area: Forest Map 18, Stand 18-8, 75 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by Tulip poplar and Sweetgum with high quality oaks such as Willow, Chestnut, Southern red and White oaks within the stand. Associate species include, Beech Locust, Hickory. The understory is comprised of Barberry, Multiflora rose, Holly and Viburnum. None of the plots have regeneration, Microstegium is dense. The Canopy closure was 85 %. The stand was also grossly over stocked with a BA of 174.

This large saw timber stand has the following diameter distribution:

Mature	26"+	6%
Saw timber	11-23.9"	78%
Pole	6-10.9"	15%
Small tree	2-5.9"	1%

The stand contains 232 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 174 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 115% stocking level. From a tree form and vigor stand point, 60% of the trees are acceptable.

### **Recommendations**

- Single Tree Selection, favoring high quality crop trees of Poplar and Oak.
- Cut vines in crop trees
- Treat invasive
- Shelter regeneration after thinning.

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 174 B.A. and should be reduced to a B.A. of 80 sq. ft. which is all acceptable trees. The initial thinning will involve removing 94 sq. ft. of unacceptable, matures, saw timber, pole timber, small trees as well as some acceptable quality trees. The trees could be utilized for saw logs and pulpwood.

Deer control should be increased in this area as well.

### **Forest restoration work completed in June 2019.**

The entire site was scanned for ordinance. The understory was comprised of shrubs that shaded out the forest floor. The majority of the site was mowed to open up the lower canopy level. Currently an adequate seed source is present for regeneration of Oak, Hickory and Poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed mid-story and unacceptable overstory trees in allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 174 sq. feet of Basal Area to 80 sq. feet average. Lower density exists in portions of the stand with the lowest Basal Area being 50 sq. ft. per acre. The trees per acres currently averages 80 trees from the 232 in 2016. The

acceptable growing stock is now 90 percent. Stand stocking is high where forested wetlands prohibited access.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. High value wildlife trees were marked for retention with a W.

This intermediate thinning improved stand vigor, stand quality and now concentrates growth on the improved species composition. Sweetgum is still a major component but Oaks and Poplar now make up a greater percentage of high-quality trees.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked crop trees.
- Mark high value wildlife trees.
- Flagged all wetland prior to thinning.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.

\*Deer control should be increased in this area.

18-8

Collect data

2039

Follow silvicultural recommendations associated with new data collected.



## **Lauderick Creek Area: Forest Map 18, Stand 18-9, 58.45 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow poplar with associate species being; Red maple, Sweetgum, Cottonwood, White oak, Black oak, Chestnut oak and Southern red oak. Blueberry, Blackberry, Holly, Greenbrier, Barberry, Sweet gum and Japanese honeysuckle were found in the understory.

This small sawtimber stand has an average merchantable diameter of 13.9

Currently the stand contains 362 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 120 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 74.2% stocking level. From a tree form and vigor stand point, 35% of the trees are acceptable.

### **Forest restoration work completed in April 2019.**

The entire site was scanned for ordinance. The understory was comprised of Holly, dense blueberry shrubs and small sweetgum trees that shaded out the forest floor. The majority of the site was mowed to open up the lower canopy level. Currently an adequate seed source is present for regeneration of Oak, Hickory and Poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed midstory and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand, as well as reduced overstocking from 120 sq. feet of Basal Area in 2009 to 75-80 B.A. sq. feet average. Lower density exists in sections of forest with the lowest BA of 40 recorded. The trees per acres currently averages 60-80 trees. The acceptable growing stock is 80 percent plus. Prior to restoration only 35 percent of all trees on site were acceptable.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. High value wildlife trees were marked for retention.

This intermediate thinning improved stand vigor, stand quality and now concentrates growth on the improved species composition.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Clearly marked wildlife trees with high potential.
- Marked all acceptable growing stock.
- Flagged wetland and stream buffers prior to working.

## **Recommendations**

Follow silvicultural recommendations associated with new data collected, control deer to allow regeneration to establish.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
18-9	TSI in remaining	11 .0	2020-22
18-9	Collect data follow new plan recommendations	58.45	2040

## **Edgewood Area: Forest Map 18, Stand 18-10, 54.6 Acres**

### **Overstory Summary Narrative**

Data was collected in 2016. The stand is dominated by Tulip poplar, mixed Oaks and Sweetgum. Oaks include, Southern red, Willow, Pin and Chestnut oaks. The understory is comprised of Blueberry, Barberry, Holly, Multiflora rose, Wine berry and Microstegium. Only one plot had a seedling, the remaining plots had no regeneration. The current Canopy closure is 80 %. The high stocking is causing stress on the Sweetgum dominating the stand. This stand is the critical area and borders the Bay on three sides and plays a major role in protecting water quality.

This timber stand has the following diameter distribution:

Mature	26"+	16 %
Saw timber	11-23.9"	68%
Pole	6-10.9"	15%
Small tree	2-5.9"	1%

Currently the stand contains 187 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 178 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 115 stocking level. From a tree form and vigor stand point, 59% of the trees are acceptable.

### **Recommendations**

- Single Tree Selection, favoring high quality Oak crop trees and Tulip poplar
- Cut vines in crop trees
- Treat invasive dense in areas

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 178 B.A. and should be reduced to a B.A. of 80 sq. ft. which is all acceptable trees. The initial thinning will involve removing 98 sq.ft. of unacceptable saw timber, pole timber and small trees. As well as some acceptable timber. The trees can be utilized for saw logs and pulpwood. This stand has good access and can be easily managed.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
18-10	Single Tree Selection	54.6	2020
	Prepare new plan		2035

## **Aberdeen Area: Forest Map 21, Stand 21-17, 124.19 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This environmentally sensitive stand borders the Bay on three sides, and is part of an Eagle Buffer. This highly disturbed area, historically used as a residence and farm, is diverse in species composition. Species include White oak, Chestnut oak, Sweetgum, Southern red oak, Pin oak, Red maple, Sycamore, Black walnut, Catalpa, Cottonwood, Locust, and Tulip poplar. The understory consists of Dogwood, Bayberry, Horse chestnut, Cherry, Highbush blueberry, Blackgum, Winterberry, Barberry, Tree of Heaven, Oriental bittersweet, and Microstegium. The 25 regeneration plots show no advanced regeneration in the plots; due to deer pressure and heavy invasives.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	37%
Sawtimber	11-23.9"	40%
Pole	6-10.9"	17%
Small tree	2-5.9"	6%

Currently the stand contains 65 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 78 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 55% plus stocking level. From a tree form and vigor stand point, almost no trees are acceptable.

### **Recommendations**

- Flag off 100 ft buffer
- This site is in the Critical Area and a harvest plan should be completed
- Forest restoration to promote regeneration
- Control the invasives

This stand is in need of restoration as it is under stocked and the majority of the trees are in poor condition. The goal should be to establish 100 trees per acre, planting Oak and Poplar as the dominate species. This can be accomplished after each planting location is cleared in a 6 ft. diameter and treated with herbicides.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
21-17	Forest restoration/planting	124.19
	Prepare new plan	61.4

This site can be used for mitigation and planted as acreage is needed.

## **Edgewood Area: Forest Map 26, Stand 26-3, 95.94 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. The stand is within the MD defined Critical Area. It is dominated by Tulip poplar with associate species of Beech, Hickory, White oak, Swamp chestnut oak, Pin oak and Red maple. The understory is comprised of native Blueberry, Holly, Sassafras and Bayberry with Wisteria vine and Greenbrier. 23% of the plots have regeneration. The current Canopy closure is 90%. Mature Tulip poplar and Oaks are scattered throughout. Invasive plants include Barberry, Multiflora rose, Microstegium, Bittersweet, Honeysuckle, autumn olive and Privet.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	26%
Sawtimber	11-23.9"	65%
Pole	6-10.9"	8%
Small tree	2-5.9"	1%

Currently the stand contains 100 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 119 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 56% of the trees are acceptable.

### **Recommendations**

- MD defined Critical Area
- Manage for Old Growth
- Control invasives

A large portion of the AGS (33%) is in mature trees, making this stand a good candidate to manage toward Old Growth. There are only 100 trees per acre, many of them are undesirable and/or dying matures which is a component of Old Growth. This stand can be left alone in its current state.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-3	Leave stand in current state Control invasives to encourage regeneration	95.94

## **Aberdeen Area: Forest Map 26, Stand 26-6, 44.48 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by Sweetgum, Red maple, Pin oak, Sycamore, Tulip poplar, Beech, Southern red oak, White oak, and Scarlet oak, with Sweetgum and Red maple being the most prevalent. The understory consists of Blueberry, Holly, Sweetgum, Greenbrier, and Black haw. The 10 regeneration plots show no advanced regeneration in the plots; due to deer pressure, heavy invasives, and canopy closure of 75%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	61%
Pole	6-10.9"	16%
Small tree	2-5.9"	0%

Currently the stand contains 91 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 120 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand an 85% plus stocking level. From a tree form and vigor stand point, 20% of the trees are acceptable, not including matures. This stand is stocked well below C-level, however due to the Eagle habitat, wetlands and proximately to the Romney Creek. This stand is too sensitive for intense management, and should be left alone to go through natural succession.

### **Recommendations**

- This site is in the Critical Area
- Eagle Buffer
- Leave stand in its natural state

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-6	Prepare new plan	44.48

## **Aberdeen Area: Forest Map 26, Stand 26-7, 47.44 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is important as it buffers Romney Creek and houses the C Tower Eagle Nest and part of the Romney Roost. The stand is dominated by Sweetgum, Red maple, and Tulip poplar, with associated species of Black cherry, Sycamore, Ash, Silver maple, willow oak, and Southern red oak. The understory consists of Highbush blueberry, Holly, with downed wood, heavy vines and trees. The 15 regeneration plots show no advanced regeneration in the plots; due to deer pressure and heavy invasives. The majority of the trees are in poor condition, the mortality is high and the stand is in need of restoration.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	32%
Sawtimber	11-23.9"	61%
Pole	6-10.9"	6%
Small tree	2-5.9"	1%

Currently the stand contains 63 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 122 sq. ft. per acre average.

### **Recommendations**

- This site is in the Critical Area
- Eagle Buffer & Nest/Roost
- Restoration to encourage Poplar regeneration

The majority of the stand has large gaps with numerous downed and dead trees. Remove the dense invasive plant layer to encourage seed contact with soil. If regeneration from seed is not successful this area should be planted with Oak and Poplar as the dominate species. It is a great mitigation site for Aberdeen Proving Grounds.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-7	Forest Restoration *	31.0
	Inspect Restoration work	31.0
	Prepare new plan	47.44

\*Restoration is scheduled for June 2014, UXO has completed approximately 31 + acres.

## **Aberdeen Area: Forest Map 26, Stand 26-9, 84.77 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is important as it buffers Romney Creek and is part of the C Tower Eagle buffer and the Romney Roost. The stand is dominated by Sweetgum, Red maple, and Tulip poplar, with associated species of Black cherry, Sycamore, Ash, Silver maple, Willow oak, and Southern red oak. The understory consists of Highbush blueberry, Holly, and Blackhaw, with downed wood, heavy vines and trees. The 20 regeneration plots show no advanced regeneration in the plots; due to deer pressure and heavy invasives. The majority of the trees are in poor condition, the mortality is high and the stand is in need of restoration. The majority of the stand has large gaps with numerous downed and dead trees. The vast majority of the trees, 75% are in poor health and vigor and should be removed to aid in natural regeneration.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	35%
Sawtimber	11-23.9"	47%
Pole	6-10.9"	12%
Small tree	2-5.9"	6%

Currently the stand contains 152 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 85 sq.ft. per acre average with only 21 sq.ft. Being acceptable stock

### **Recommendations**

- This site is in the Critical Area
- Eagle Buffer & Roost
- Shelterwood cut removing all unacceptable stock, control invasives before harvest
- Restoration and enhancement (plant and shelter if harvest does provide adequate regeneration)
- Use as a future mitigation site

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-9	Shelterwood harvest Invasive plant removal Inspect regeneration Prepare new plan	84.77



**In November of 2014 MLE, Inc. restored the Forest Community in and around the Romney Creek Roost and Eagle Nest; a total of 40.0 acres.** The site was under stocked with the majority of trees being unacceptable and damaged. The invasive plant community in the understory was dense with multiflora rose, barberry and microstegium. Poplar dominates the overstory and is an excellent seed source. The goals were completed: girdle undesirable trees, cut vines, scarify the ground layer and treat with herbicide.

**Activities:**

- Performed first UXO scan of site under DO#50
- GPS site, map attached.
- Prepared Digging Permit and site-specific work order to scarify the ground to a depth of 3”.
- Used Fecon Forestry mower to scarify the ground and to remove dense layer of microstegium and shrubs.
- Treated bare ground with a pre-emergent to suppress spring grass seed germination.

**NOTE:** The project benefited both Eagle Habitat and water quality as the majority of the trees are planted in close proximity to the bay.

## **Aberdeen Area: Forest Map 26, Stand 26-11, 28.24 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Tulip Poplar. Associate species include; Sweetgum, Black cherry, Beech, Red oak, Walnut, Hickory, and White oak. The understory is comprised of Holly, Wine berry, Barberry, and Microstegium. No regeneration noted in the large canopy gaps after blow down. Highly invasive and alien understory is hindering regeneration along with the intense deer browse. None of the plots had regeneration. This stand is an important buffer to the Bay and is deteriorating.

This mature stand has the following diameter distribution breakdown:

Mature	26"+	54 %
Sawtimber	11-23.9"	37%
Pole	6-10.9"	7%
Small tree	2-5.9"	2 %

\*Majority of Mature trees are unacceptable

Currently the stand contains 78 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 169 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, the majority of the trees are unacceptable.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer.
- This site is in the Critical Area and the harvest plan should be completed.
- This site contains an Eagle Buffer follow APG Eagle restrictions.

This stand is in need of a regeneration cut to open up the canopy and allow regeneration to establish. Yellow-poplar is a prolific seeder, and large crops are produced almost annually. A combination of a single tree selection and small less than ½ group selections will aid in regeneration. The Stand is marked in the same manner as with single-tree selection cut, the only difference being that small openings are created in the stand. Single-tree selection cutting occurs between the openings. In these areas the majority of trees are unacceptable and should be removed leaving only acceptable high-quality growing stock. The residual basal area in the single tree selection portions of the stand should be 65 sq.ft. per acre.

Controlling invasive and alien plants directly after the harvest is imperative to natural regeneration success. Deer control should be increased in this area as well. High quality regeneration should be sheltered if the deer population cannot be controlled.

STAND	ACTIVITY	ACRES
26-11	Single tree/small group harvest Control invasives Prepare new Plan	28.24

## **Edgewood Area: Forest Map 26, Stand 26-12, 10.41 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is within the MD defined Critical Area. It is dominated by Sweetgum, Tulip poplar and Red maple. Associated species are Cherry, Black gum and Sycamore. The understory is comprised of Viburnum, Barberry, Blackberry, Blueberry, Holly and Beech. Wisteria vine is hindering crown development. 0% of the plots have regeneration. The current Canopy closure is 90%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	5%
Sawtimber	11-23.9"	82%
Pole	6-10.9"	13%
Small tree	2-5.9"	0%

Currently the stand contains 115 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 180 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 44% of the trees are acceptable.

### **Recommendations**

- MD defined Critical Area
- Single Tree Selection
- Invasive plant control

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 180 B.A. and should be reduced to a B.A. of 80 sq.ft. which is all acceptable trees. The initial thinning will involve removing 100 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 30 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-12	Single Tree Selection Invasive plant control	10.41

## **Edgewood Area: Forest Map 26, Stand 26-14, 73.19 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is Eagle sensitive within the MD defined Critical Area. It is dominated by Sweetgum, Tulip poplar and Red maple. Associated species are Pin oak, Willow oak, Southern red oak, Walnut and Sycamore. The understory is comprised of Multiflora rose, Barberry, Winterberry, Blueberry and Holly with Wisteria, Bittersweet and Honeysuckle vines. 7% of the plots have regeneration. The current Canopy closure is 70%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	28%
Sawtimber	11-23.9"	57%
Pole	6-10.9"	14%
Small tree	2-5.9"	1%

Currently the stand contains 54 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 114sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 80% stocking level. From a tree form and vigor stand point, 40% of the trees are acceptable.

### **Recommendations**

- Eagle sensitive/MD defined Critical Area
- Old Growth
- Invasive plant control
- Restoration/Mitigation site/potential planting locations
- Shear or girdle undesirables to reduce site impact

A large portion of the AGS (43%) is in mature trees, making this stand a good candidate to manage towards Old Growth. There are only 54 trees per acre, many of them are undesirable and/or dying matures which is a component of Old Growth. This stand can be utilized for restoration, large openings can be planted and microstegium should be controlled to aid in seed germination.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-14	Restoration/Mitigation Invasive plant control	73.19

## **Aberdeen Area: Forest Map 26, Stand 26-18, 55.17Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. The stand is dominated by Willow oak, Southern red oak, Beech, White oak, Black gum, Sweetgum, Tulip poplar, Northern red oak, and Swamp chestnut oak. The understory consists of Blueberry, Greenbrier, with patches of dense Holly. The 20 regeneration plots show only Beech and Sweetgum regeneration, no advanced Oak regeneration shows in the plots.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	33%
Sawtimber	11-23.9"	67%
Pole	6-10.9"	15%
Small tree	2-5.9"	0%

Currently the stand contains 114 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 116 sq. ft per acre average. The number of trees correlated with the B.A. gives this stand a 90% plus stocking level. From a tree form and vigor stand point, 38% of the trees outside of the mature class are acceptable. This stand has numerous drainage patterns/wetlands and hydric soils. It is too sensitive for intense management.

### **Recommendations**

- This site is in the Critical Area
- Eagle Buffer
- Leave in natural state

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-18	Prepare plan	55.17

## **Aberdeen Area: Forest Map 26, Stand 26-1/2, 39.2 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This entire stand is part of the Chilbury Eagle Nest & Buffer and borders the Bay to the Northwest. Dominate species include Tulip poplar, Red maple, Sweetgum, Sycamore and Willow oak. The understory consists of Multiflora rose, Barberry, Honeysuckle vine, and Microstegium. The 10 regeneration plots show no advanced regeneration in the plots; due to deer pressure and heavy invasives.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	34%
Sawtimber	11-23.9"	54%
Pole	6-10.9"	6%
Small tree	2-5.9"	6%

Currently the stand contains 52 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 103 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 75% plus stocking level. From a tree form and vigor stand point, 39% of the trees are acceptable, not including matures.

### **Recommendations**

- Flag off 100 ft buffer
- This site is in the Critical Area
- Forest restoration
- Control the invasives
- Eagle Buffer

In April, 2013, Forest restoration at Chilbury was completed in part of the buffer itself; for a total of 9 acres. The site was under stocked with the majority of the trees being unacceptable and damaged. The invasive plant community in the understory was dense with multiflora rose and microstegium. The goal was to create an invasive free location, approximately 6 foot in diameter for each tree, and plant an oak and poplar dominated community in the understory.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-1/2	Forest restoration/planting	30.2
	Prepare new plan	39.2

## **Aberdeen Area: Forest Map 26, Stand 26-19, 26.34 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by Sweetgum and Tulip poplar and scattered Red maple. The dominating Sweetgum has canker due to stress. The understory consists of Blueberry, dense areas of Barberry, Wine berry, Blackhaw, and Microstegium. The 10 regeneration plots show no advanced regeneration in the plots; due to deer pressure, heavy invasives, and canopy closure of 80%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	15%
Sawtimber	11-23.9"	69%
Pole	6-10.9"	16%
Small tree	2-5.9"	0%

Currently the stand contains 112 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 128 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% plus stocking level. From a tree form and vigor stand point, 45% of the trees are acceptable, not including matures. Sawtimber and matures account for 8,500 bd. ft. per acre.

### **Recommendations**

- Flag off 100 ft buffer
- This site is in the Critical Area
- Control the invasives
- TSI
- Logging access roads should be maintained for management access and fire control.
- Restoration /mitigation site

From a timber management point of view this stand is in need of a commercial thinning. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 128 B.A. and should be reduced to a B.A. of 70 Sq.ft. which is all acceptable trees. The initial thinning will involve removing 58 sq.ft. of unacceptable mature, sawtimber, and pole timber. The trees can be utilized for pulpwood with the thinning producing approximately 18 cords per acre.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-19	Control Invasives	23.65
	TSI	23.65
	Prepare new plan	26.4

In 2013, a small 2.75-acre portion along the bay was planted for Eagle habitat restoration and a 0.25 acre adjoining section was planted to satisfy mitigation for Poole's Island.

## **Aberdeen Area: Forest Map 26, Stand 26-20, 42.24 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Yellow poplar, Sweet gum, Willow oak, Pin oak, Sycamore, Black cherry, Black oak and Beech with associate species being; Sassafras, Black gum, Red maple and Holly. No information was collected on the understory.

This stand has the following diameter distribution breakdown:

Mature	26"+	32%
Sawtimber	11-25.9"	55%
Pole	6-10.9	11%
Small tree	2-5.9"	2%

Currently the stand contains 100 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 124 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 43% of the trees are acceptable.

The acceptable sawtimber volume currently is 10,360 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- This site contains an Eagle Buffer follow APG Eagle restrictions.
- This stand provides FID habitat.
- TSI to remove undesirables and reduce stocking.

As per the 2001 data, this stand has 100% stocking with 43% of the trees being acceptable. The basal area should be reduced to 60 sq.ft. per acre. This will favor crop trees, as well as provide sunlight for regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
26-20	commercial TSI collect data/prepare plan	42.24

## **Edgewood Area: Forest Map 27, Stand 27-3, 65.36 Acres**



### **Overstory Summary Narrative**

Data was collected in 2014. The stand is Eagle sensitive within the MD defined Critical Area. It is dominated by mixed Oak, Sweetgum, Tulip poplar and Red maple. Associated species are River birch, Blackgum, Beech, Persimmon and Sycamore. The understory is comprised of Blueberry, Bayberry, Holly, Viburnum, Serviceberry and Sassafras. The understory is sparse in general. 20% of the plots have regeneration; however, an excellent Oak seed source is present. The current Canopy closure is 95%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	11%
Sawtimber	11-23.9"	60%
Pole	6-10.9"	17%
Small tree	2-5.9"	12%

Currently the stand contains 106 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 95 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, 72% of the trees are acceptable.

### **Recommendations**

- Eagle sensitive/MD defined Critical Area
- Single Tree Selection

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 95 B.A. and should be reduced to a B.A. of 65 sq.ft. which is all acceptable trees. The initial thinning will involve removing 30 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 9 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
27-3	Single Tree Selection	65.36

## **Aberdeen Area: Forest Map 29, Stand 29-1, 56.40 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. 16.7 acres of restoration has occurred within this stand, including 9 acres along the shoreline; near the Cannery planting. This essential Eagle buffer and major Roost area is dominated by Sycamore, Tulip Poplar and Red maple, with associate species of Cherry, Locust, Ash, and Walnut. The understory is heavily invasive with Microstegium, Multiflora rose, Wine berry, Honeysuckle, Climbing bittersweet, Mile a Minute weed, and Barberry. The 19 regeneration plots show no advanced regeneration, due to invasives and excessive deer browsing.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	38%
Sawtimber	11-23.9"	54%
Pole	6-10.9"	6%
Small tree	2-5.9"	2%

Currently the stand contains 44 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 65 sq. ft per acre average. The number of trees correlated with the B.A. gives this stand a 40% plus stocking level. From a tree form and vigor stand point, 30% of the trees outside of the mature class are acceptable. This stand is in need of Restoration on the remaining 39.7 acres of the site.

### **Recommendations**

- This site is in the Critical Area
- Eagle Buffer & Roost
- Restoration

Restoration involved creating access throughout the stand for maintenance. Removing vines from crowns in acceptable trees, creating a 6 ft diameter cleared planting location, and planting Oak and Poplar dominating species with tree shelters.

This is an excellent mitigation site for the Aberdeen area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-1	Restoration	39.7
	Prepare new plan	56.40

## **Aberdeen Area: Forest Map 29, Stand 29-2, 25.45 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by Sweetgum, Red maple, and Silver maple, with associate species of Tulip poplar and Sycamore, with occasional Willow oak and Southern red oak. The understory is heavily invasive with Microstegium, Multiflora rose, Japanese honeysuckle, climbing bittersweet, and Barberry. The 10 regeneration plots show no advanced regeneration, due to invasives.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	18%
Sawtimber	11-23.9"	68%
Pole	6-10.9"	12%
Small tree	2-5.9"	2%

Currently the stand contains 74 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 97 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 70% plus stocking level. From a tree form and vigor stand point, 35% of the trees outside of the mature class are acceptable.

### **Recommendations**

- This site is in the Critical Area & Eagle Roost/Buffer
- Forest Enhancement

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-2	Forest Enhancement Prepare plan	254.5

**In February of 2014 restoration work was complete;** removing an invasive shrub layer, extensive vine cutting and girdling unacceptable growing stock that was marked. In spring of 2014 invasives that re sprout will be treated with herbicide.

## **Aberdeen Area: Forest Map 29, Stand 29-3, 17.53 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is dominated by Sweetgum and Red maple, with associate species of Willow oak, Hickory, Walnut and Ash. The understory is heavily invasive with Microstegium, Multiflora rose, Japanese honeysuckle, climbing bittersweet, and Barberry. The 10 regeneration plots show no advanced regeneration, due to invasives.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	5%
Sawtimber	11-23.9"	78%
Pole	6-10.9"	12%
Small tree	2-5.9"	5%

Currently the stand contains 114 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 133 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 27% of the trees outside of the mature class are acceptable.

### **Recommendations**

- This site is in the Critical Area & Eagle Roost
- Forest Enhancement

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-3	Forest Enhancement	8.5
	Prepare plan	17.53

**In February of 2014 restoration work was complete;** removing an invasive shrub layer, extensive vine cutting and girdling unacceptable growing stock that was marked. In spring of 2014 invasives that re sprout will be treated with herbicide.

8.5 acres was removed from the restoration site due to extensive ordinance found in January 2014 survey.

## **Aberdeen Area: Forest Map 29, Stand 29-4, 75.05 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand is an important buffer to Romney Creek; it has an existing pond in the center and a large wetland swamp in its Northern portion. One area along the Northwest side of the stand is in very poor quality, almost impassible. This stand is dominated by Sweetgum and Tulip poplar with associated species being, Red maple and Willow oak. The understory is heavily invasive with Barberry, and also contains Microstegium, Multiflora rose, and Japanese honeysuckle. The 20 regeneration plots showed one plot (5%) with advanced regeneration, due to invasives.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	30%
Sawtimber	11-23.9"	60%
Pole	6-10.9"	9%
Small tree	2-5.9"	1%

Currently the stand contains 93 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 107 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 21% of the trees outside of the mature class are acceptable.

### **Recommendations**

- This site is in the Critical Area
- Eagle Roost
- Too sensitive for management, leave in its natural state

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-4	Prepare a new plan	75.05

## **Phillips Army Airfield Area: Forest Map 29, Stand 29-5, 195.35 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by American beech and Sweet gum with associate species being; Red maple, White oak, Black gum, Willow oak, Southern red oak, Yellow poplar, Black oak, Pin oak, Walnut and Sycamore. Greenbrier, Sweet pepperbush, Blueberry, Honeysuckle, Wine berry, Barberry, Holly and Japanese honeysuckle were found in the understory.

This large sawtimber stand has an average merchantable diameter of 18.41

Currently the stand contains 104.37 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 89.5 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 60.6% stocking level. From a tree form and vigor stand point, 39.0% of the trees are acceptable.

The acceptable sawtimber volume currently is 7,192.51 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

-This stand provides FID habitat and should maintain a basal area of 90 ft<sup>2</sup>/ac average with at least 70 percent canopy closure at all times.

-This site contains an Eagle Buffer follow APG Eagle restrictions.

-This stand has 2.3% cover in the ground layer. Ground vegetation is comprised of vegetation from 0 - 3 ft. in height. This includes grasses, sedges, ferns, club mosses, seedlings and wild flowers.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-5	commercial TSI control invasives examine stand for commercial harvest	195.35

## **Phillips Army Airfield Area: Forest Map 29, Stand 29-6, 10.22 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow poplar with associate species being; Red maple, Sweet gum, Sycamore, Black gum and Walnut. Blueberry, Multiflora rose, Barberry, Greenbrier, Honeysuckle and Holly were found in the understory.

This large sawtimber stand has an average merchantable diameter of 18.24

Currently the stand contains 93.44 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 110 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 52.5% stocking level. From a tree form and vigor stand point, 60% of the trees are acceptable.

The acceptable sawtimber volume currently is 9,571.75 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

-This stand provides FID habitat and should maintain a basal area of 90 ft<sup>2</sup>/ac average with at least 70 percent canopy closure at all times.

-This site contains an Eagle Buffer follow APG Eagle restrictions.

Fire has damaged many of the trees in this stand. A TSI can help remove the unacceptable stock (45%), and leave an under stocked poplar forest with 50 sq. ft. of growing stock. The invasive plant community is high and the site needs to be restored to allow the poplar and other native species to regenerate. If invasive plants cannot be controlled, planting a native understory would help with future stocking.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-6	commercial TSI	10.22
	control invasives	
	examine stand for commercial harvest	

## **Forest Map 29, Stand 29-7, 10.10 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Red maple, Black locust and Sweet gum with associate species being; Black cherry, Ash and Black walnut. Grapevine, Greenbrier and Blueberry were found in the understory. Invasive plants include Microstegium, Barberry and Grapevine.

This is a mature sawtimber stand d.b.h. ranges 12" – 24".

This stand is under stocked with 60% canopy closure.

### **Recommendations**

- This stand provides FID habitat and should maintain a basal area of 90 ft<sup>2</sup>/ac average with at least 70 percent canopy closure at all times.
- This site contains an Eagle Buffer follow APG Eagle restrictions.
- Fragmented with large openings and some vine intrusion into canopy.
- Good restoration site.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-7	commercial TSI	10.10
	control invasives	
	examine stand for commercial harvest	



## **Aberdeen Area: Forest Map 29, Stand 29-8, 43.9 Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. Buffering the Romney Creek, this stand is dominated by Poplar, Sweetgum and Red maple. Associate species include Sycamore, Pin oak, Willow oak and Walnut in the overstory. The mid and understory are comprised of Blueberry, Beech, Dogwood, Holly and Sassafras. This stand is very important for water quality. The regeneration plot survey found advanced regeneration in none of the plots, however: large grass openings adjacent to the Romney and could be planted. Currently shade (Canopy closure) is 80% and deer pressure is heavy.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	22%
Sawtimber	11-23.9"	63%
Pole	6-10.9"	13%
Small tree	2-5.9"	2%

Currently the stand contains 134 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 145 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 66% of the trees are acceptable.

### **Recommendations**

- Survey planting acreage availability
- Control beech and Vines in crowns
- Remove unacceptable growing stock
- Manage toward old growth

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursue Old Growth in this mature stand by designating legacy trees, increasing growth to the larger trees, creating standing dead and canopy gaps to aid in natural regeneration, establishing a diversity of trees sizes; favoring all species and create down woody debris often found in Old growth forest.

Researchers have found that there is no one specific condition to aim for as a condition of old growth, instead it's found more valuable to increase the number of characteristics associated with these types of forest communities. Structural objectives and silvicultural techniques used to achieve structural enhancement may include:

Multiple Canopy: Single tree selection using a target diameter, release advance regeneration, encourage new regeneration associated with natural forest type.

Create snags and down woody debris: Girdle trees (if approval is given) of various sizes that are unacceptable, felling and leaving trees of healthiest trees with large diameters.

Accelerate growth in legacy trees: Full or partial crown release. A total of 62 square feet of unacceptable growth is spread out among sawtimber, pole and small trees size classes.

Controlling invasive and alien plants is imperative to natural regeneration success. Deer control should be increase in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-8	Single Tree Selection TSI. Basal spray young Beech and Gum. Manage for Old Growth	43.9

## **Aberdeen Area: Forest Map 29, Stand 29-9, 243.1 Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. This stand is dominated by Yellow poplar, White oak, Willow oak, Swamp white oak, Black gum, Pin oak, and American beech. Associate species include, Red maple, Sweetgum, Hickory and Pine. The understory contains Highbush blueberry, Clethra and Laurel. Invasive understory plants include; Barberry, Wine berry and areas of Microstegium. Unique features in this large stand with excellent forest interior habitat for birds, include: Large areas of forested wetlands and large mature Poplar and Oaks in the 40-inch range.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	37%
Sawtimber	11-25.9"	43%
Pole	6-10.9	12%
Small tree	2-5.9"	8%

Currently the stand contains 171 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) 132 of sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90-stocking level. From a tree form and vigor stand point, 55 % of the trees are acceptable. Forested wetlands account for 70 acres of this stand, data was collected in the forested wetlands except large open body waters.

Silvicultural recommendations of most concern, is to start eliminating the Beech, seedlings, saplings, small tree and pole class. Areas exist where large openings have occurred naturally and Beech has occupied these areas in what is called a Beech desert where nothing else can compete. The present and occupation of Beech in the Last 20 year was aggressive.

### **Recommendations**

- GPS blocks within the stand of 20 acres that need treatment.
- Prepare treatment block maps.
- Apply a post emergent treatment on seeding, Basal application to treat sapling and small size class trees.
- The pole and larger trees should be cut and each stump treated to prevent sprouting.
- Invasive plants within treatment blocks should be addressed at the same time.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-9	GPS / Map treatment blocks	20-acre units
	Reduce Beech impact on stand	
	Request re exam 2040	243.09

## **Aberdeen Area: Forest Map 29, Stand 29-10 41.7 Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. The stand is dominated by Sweetgum and Red maple. Sweetgum, the dominate species shows signs of bleeding canker. Associate species include; Pin oak, Cherry, Persimmon, White oak and Tulip poplar. The understory is comprised of Barberry, Multiflora rose, Holly, Blueberry and Viburnum. None of the plots have regeneration and Microstegium is dense in areas. The current Canopy closure is 78 %. The stand is grossly over stocked with a BA of 187 and borders a small stream along the southern boundary.

This large saw timber stand has the following diameter distribution:

Mature	26"+	0%
Saw timber	11-23.9"	67%
Pole	6-10.9"	23%
Small tree	2-5.9"	10%

Currently the stand contains 270 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 187 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 +% stocking level. From a tree form and vigor stand point, 47% of the trees are acceptable.

### **Recommendations**

- Single Tree Selection, favoring high quality crop trees of Poplar and Oak.
- Cut vines in crop trees
- Treat invasive
- Restoration

From a timber management point of view this stand is in need of a thinning to reduce competition. The stand has a basal area of 187 B.A. and should be reduced to a B.A. of 90 sq. ft. which is all acceptable trees. The initial thinning will involve removing 97 sq. ft. of unacceptable matures, saw timber, pole timber and small trees as well as some acceptable quality trees.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-10	TSI /restoration	41.7
	Collect data/prepare new plan	

## **Aberdeen Area: Forest Map 29, Stand 29-11, 31.12 Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. The stand is dominated by Tulip poplar, Sweetgum and Red maples. Associate species are Willow oak, Pin oak, Swamp white oak, Swamp White and Swamp Chestnut oaks, Ash, Black gum and Sycamore. The understory is comprised of Beech, Holly, Barberry, Multiflora rose, Holly and Viburnum. None of the plots have regeneration. The current Canopy closure is 75 %.

This large saw timber stand has the following diameter distribution:

Mature	26"+	27%
Saw timber	11-23.9"	53%
Pole	6-10.9"	12%
Small tree	2-5.9"	10%

Currently the stand contains 118 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 115 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand an 80 % stocking level. From a tree form and vigor stand point, only 45% of the trees are acceptable. The stand does not have enough acceptable growing stock to perform a thinning, coupled with the sites hydrology this stand is not a good candidate for restoration.

### **Recommendations**

- Allow stand to go through nature succession.
- Deer control should be increased
- Monitor for stand health.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
29-11	Collect data/prepare new plan	31.12	2035

## **Aberdeen Area: Forest Map 29, Stand 29-12, 34.29 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. Restoration has occurred in this stand, within a 2.75-acre area. Seventy-five trees on 1/4<sup>th</sup> of an acre, along the shoreline were planted for Poole's Island mitigation. The remaining 2.5 acres was planted to restore the Eagle habitat where a portion of the stand was in decline.

The stand is dominated by Tulip poplar, with associated species of Sycamore, Red maple, Walnut, and Sweetgum. Numerous Tulip poplars are in the 30-inch dbh range. The understory consists of Microstegium, Multiflora rose, Wine berry, and Barberry. The 10 regeneration plots show no advanced regeneration, due to shade, invasives and excessive deer browsing.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	48%
Sawtimber	11-23.9"	36%
Pole	6-10.9"	15%
Small tree	2-5.9"	0%

Currently the stand contains 76 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 99 sq. ft per acre average. The number of trees correlated with the B.A. gives this stand a 75% plus stocking level. From a tree form and vigor stand point, 27% of the trees outside of the mature class are acceptable. This stand has a large drainage pattern that runs through the middle of the stand and feeds a Marsh before entering the bay.

### **Recommendations**

- This site is in the Critical Area and needs a Harvest Plan
- Eagle Buffer
- Shelterwood cut

This stand is in need of a regeneration cut to open up the canopy and remove undesirable trees which will allow regeneration to be established. Yellow-poplar is a prolific seeder, and large crops are produced almost annually. The shelterwood system is recommended when regeneration potential is inadequate or uncertain. It involves two or more harvests several years apart in the same stand. The first harvest is a thinning and the final harvest is a group selection.

The first harvest removes some merchantable timber as well as undesirable species. It creates holes in the canopy that permit sunlight to reach oak seedlings and stimulate their growth and may encourage residual oaks to produce more acorns. Light levels can be regulated by the amount of thinning to favor acorn germination and oak seedling survival while suppressing competition from undesirable trees and shrubs. Make the first cut after a large acorn crop, if possible. Leave the best trees of any desirable species and all un-merchantable oaks capable of producing stump sprouts. Remove all other trees larger than 2 inches diameter, including seed producing trees of undesirable species. This cut should leave a park like stand with a 40 to 50 percent.

The stand has a basal area of 99 B.A. and should be reduced to a B.A. of 40 Sq.ft. The initial thinning will involve removing 59 sq.ft. of unacceptable trees. Following the shelterwood sale the alien and invasive plants should be controlled and deer population reduced to aid in Poplar regeneration.

Inspect the Harvest in ten years for regeneration, to see if regeneration is viable. If Poplar regeneration is adequate, proceed with removing the remaining canopy.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
29-12	Shelterwood Harvest Follow up for 2 <sup>nd</sup> harvest Prepare new plan	34.29

## **Aberdeen Area: Forest Map 30, Stand 30-1, 91.29 Acres**

### **Overstory Summary Narrative**

Data was collected in 2012. This stand contains FIDS Habitat and is part of a large forested wetland system. The stand is dominated by mixed Oak, which include Swamp chestnut oak, Pin oak, White oak, Northern red oak, Willow with associated species being, Tulip poplar, Beech and Blackgum. The understory is dense with Holly, Sweet pepperbush, Greenbrier, and Highbush blueberry. The 20 regeneration plots showed one plot (5%) with advanced regeneration. This stand has very heavy deer browsing.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	49%
Pole	6-10.9"	24%
Small tree	2-5.9"	11%

Currently the stand contains 150 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 98 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 85% plus stocking level. From a tree form and vigor stand point, 48% of the trees including the mature class are acceptable. This area has a lot of deadwood from past Gypsy Moth damage.

### **Recommendations**

- This site is in the Critical Area
- FIDS Habitat
- Too sensitive for management, leave in its natural state

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-1	Prepare new plan	91.29



**Aberdeen Area: Forest Map 30, Stand 30-8, 20.96 acres**

**Previously was part a larger stand**

**Overstory Summary Narrative**

Data was collected in 2019. The stand is dominated by Sweetgum and Red maple. Associate over story trees include; Sycamore, Walnut, Willow oak, and Sothern red oak. The understory is comprised of Barberry, Multiflora, Blueberry and Viburnum. None of the plots have regeneration. The current Canopy closure is 77%. The stand is stocked with a BA of 122. This stand borders a forested wetland to the south.

This large saw timber stand has the following diameter distribution:

Mature	26"+	10%
Saw timber	11-23.9"	70%
Pole	6-10.9"	19%
Small tree	2-5.9"	1%

Currently the stand contains 96 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 122 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90 +% stocking level. From a tree form and vigor stand point, 42% of the trees are acceptable.

**Recommendations**

- Single Tree Selection, favoring high quality crop trees of Poplar and Oak.
- Cut vines in crop trees
- Treat invasive
- Enhancement
- Due to the over quality this Stand should be low on the enhancement schedule.

From a management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 122 B.A. and should be reduced to a B.A. of 60 sq. ft. which is all acceptable trees. The initial thinning will involve removing unacceptable, saw timber and pole timber.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-8	Enhancement	20.96
	Collect data/prepare new plan	

## **Edgewood Area: Forest Map 30, Stand 30-14, 46.45 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is within the MD defined Critical Area. It is dominated by Sweetgum and Red maple, with associated species being Pin oak, Willow oak, Tulip poplar, Southern red oak and Sycamore. The understory is comprised of Greenbrier, Barberry, Blueberry, Holly, Wisteria and Grapevine. The Barberry is extremely dense, almost impassible in some areas. 0% of the plots have regeneration. The current Canopy closure is 80%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	19%
Sawtimber	11-23.9"	62%
Pole	6-10.9"	16%
Small tree	2-5.9"	3%

Currently the stand contains 102 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 124s sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 38% of the trees are acceptable.

### **Recommendations**

- MD defined Critical Area
- Single Tree Selection
- Control invasives

From a timber management point of view this stand is in need of a thinning. Currently a thinning will reduce competition; the stand has a basal area of 124 B.A. and should be reduced to a B.A. of 70 sq.ft. which is all acceptable trees. The initial thinning will involve removing 54 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 16 cords per acre.

Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-14	Single Tree Selection Control invasives	46.45

## **Forest Map 30-15, 28.39 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum, White oak and Red maple with associate species being; Beech, Willow oak, Swamp white oak and Pin oak. Blueberry, Black willow and Greenbrier were found in the understory.

This is a large sawtimber stand d.b.h. ranges 12" – 24".

This stand is fully stocked with 70% canopy closure. Mature tree die off.

### **Recommendations**

-This stand provides FID habitat and should maintain a basal area of 90 ft<sup>2</sup>/ac average with at least 70 percent canopy closure at all times.

-Large forested wetland, standing water throughout.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-15	commercial TSI control invasives examine stand for commercial harvest	28.39

## **Edgewood Area: Forest Map 30, Stand 30-16, 37.74 Acres**

### **Overstory Summary Narrative**

Data was collected in 2014. This stand is within the MD defined Critical Area and has a large potential planting location along the North side where the stream is present. The stand is dominated by Tulip poplar, Beech and mixed Oak; oaks include Swamp chestnut oak, Swamp white, Black oak, White oak, Northern red oak, Scarlet oak and Willow oak. The understory is very sparse comprising of native Blueberry and Greenbrier. 40% of the plots have regeneration. The current Canopy closure is 70%.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	45%
Sawtimber	11-23.9"	40%
Pole	6-10.9"	8%
Small tree	2-5.9"	7%

Currently the stand contains 100 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 60% of the trees are acceptable.

### **Recommendations**

- MD defined Critical Area
- Manage for Old Growth
- Control invasives
- Restoration/Mitigation potential

A large portion of the AGS (60%) is in mature trees, making this stand a good candidate to manage toward Old Growth. There are only 100 trees per acre, many of them are undesirable and/or dying matures which is a component of Old Growth. This stand can be restored, removing the undesirable saw and pole timber as well as the undesirable small trees such as Beech and Gum and sheltering existing regeneration on a 25x25 spacing and monitoring future regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-16	Manage toward old growth Restoration/Mitigation	37.74

**In 2016 MLE performed restoration work on this forest enhancement site is in the Critical Area.**

This stand borders Romney Creek tidal waters. This stand had little to no advanced regeneration. The stand is dominated by Tulip poplar, Beech and mixed Oak; oaks include Swamp chestnut oak, Swamp white, Black oak, White oak, Northern red oak, Scarlet oak and Willow oak. The understory is very sparse comprising of native Blueberry and Greenbrier.

Mar-Len Environmental, Inc. (MLE) removed unacceptable growing stock; allowing sun light to filter to the forest floor. Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Vines were cut, shrubs and Beech regeneration treated to help restore the natural forest ecosystem.

Other activities include:

- Secured Range Work Request and organized Tower Support.
- UXO scan of entire site prior to any restoration work.
- Marked poor quality trees for removal.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Scarified site to promote soil and seed contact.
- Prepared and submitted Excavation permit for approval from APG Safety to allow permission to stake and shelter regeneration.
- UXO team scanned each shelter location and were on site for intrusive activity.
- Treated with herbicide to prevent Beech from becoming dominant in the understory.
- Prepared and submitted herbicide report for Mr. Stanley Futch.

## **Aberdeen Area: Forest Map 30, Stand 30-17, 6.74 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by White oak, Yellow poplar and American beech with associate species being; Sweet gum and Southern red oak. No information was collected on the understory.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	51.8%
Sawtimber	11-25.9"	33.7%
Pole	6-10.9	4.5%
Small tree	2-5.9"	0%

Currently the stand contains 41.29 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 90 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 51.7% stocking level. From a tree form and vigor stand point, 61.8% of the trees are acceptable.

The acceptable sawtimber volume currently is 12,701.46 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

-This stand provides FID habitat and should maintain a basal area of 90 ft<sup>2</sup>/ac average with at least 70 percent canopy closure at all times.

-Control heavy deer pressure.

-No activity needed; allow the natural succession and continue to provide a buffer for Romney Creek.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-17	collect data/prepare plan	6.74

## **Aberdeen Area: Forest Map 30, Stand 30-18, 18.68 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Sweet gum, Pin oak, Yellow poplar, White oak and Red maple with associate species being; Black cherry, American beech, Black gum, Blueberry and Holly. No information was collected on the understory.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	17%
Sawtimber	11-25.9"	63%
Pole	6-10.9	18%
Small tree	2-5.9"	2%

Currently the stand contains 112 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 107 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 85% stocking level. From a tree form and vigor stand point, 28% of the trees are acceptable.

The acceptable sawtimber volume currently is 8,000 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- This stand provides FID habitat and should maintain a basal area of 90 ft<sup>2</sup>/ac average with at least 70 percent canopy closure at all times.
- Romney Creek travels through the center of this stand. It is too sensitive for any kind of management.
- Inspect for forest health and possible restoration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-18	collect data/prepare plan	18.68

## **Aberdeen Area: Forest Map 30, Stand 30-19, 49.8 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Yellow poplar, Sweet gum, American beech, White oak and Red maple with associate species being; Black oak, Northern red oak, Willow oak, Pin oak and Black gum. No information was collected on the understory.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	38.5%
Sawtimber	11-25.9"	53%
Pole	6-10.9	3.8%
Small tree	2-5.9"	0%

Currently the stand contains 51.61 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 95.4 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 54.3% stocking level. From a tree form and vigor stand point, 61.5% of the trees are acceptable.

The acceptable sawtimber volume currently is 11,948 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- No access, no active management.
- Inspect forest health in 15 years.
- This stand provides FID habitat and should maintain a basal area of 90 ft<sup>2</sup>/ac average with at least 70 percent canopy closure at all times.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-19	collect data/prepare plan	49.63



## **Aberdeen Area: Forest Map 30, Stand 30-20, 76.67 acres**

### **Overstory Summary Narrative**

Data was collected in 2019. This stand is dominated by mature Tulip poplar, Beech and mixed Oak species including Willow oak, Southern red oak, Pin oak and White oak. Associate species include Sweetgum and Red maple. The understory is comprised of Barberry, Blueberry and Holly. The largest tree measured was a 59-inch Willow oak. This stand borders the Romney and is very important for water quality. The regeneration plot survey found advanced regeneration in 0% of the plots. Currently, shade (Canopy closure) is 90%. This stand is impressive due to all of the matures trees.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	35%
Sawtimber	11-23.9"	47%
Pole	6-10.9"	14%
Small tree	2-5.9"	4%

Currently the stand contains 162 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 141 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point 55% of the trees are acceptable.

### **Recommendations**

- Old Growth
- Leave in natural state
- Control beaver dams flooding areas.
- Inspect for forest health

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursue Old Growth in this mature stand by designating legacy trees, increasing growth to the larger trees, creating standing dead and create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes; favoring all species and create down woody debris often found in Old growth forest.

Access to stand with equipment is difficult and the stand is unique in its maturity. Due to this we recommend to let the stand go through natural succession.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-20	Monitor stand health Manage for Old Growth	76.67 ac

**Aberdeen Area: Forest Map 30-22, 16.99****Previously part of Stand 30-8****Overstory Summary Narrative**

Data was collected in 2019. This stand was flood from Beaver and currently has a low stocking and high mortality due to flooding. The stand is dominated by Red maples, Sweetgum with Pin oak and Persimmons present. The understory is comprised of Highbush blueberry, Willow, Greenbrier, Swamp azalea and Clethra. No of the plots have regeneration. The current Canopy closure is 17 %.

This large saw timber stand has the following diameter distribution:

Mature	26"+	%
Saw timber	11-23.9"	64%
Pole	6-10.9"	36%
Small tree	2-5.9"	0%

Currently the stand contains 230 trees per acre with 157 per acre dead or 70 percent of a trees per acre dead or dying. The B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 28 sq. ft. per acre average. The number of trees correlated with the B.A. gives the stand an understocked level.

**Recommendations**

-Allow stand to go through nature succession.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
30-22	Collect data/prepare new plan	16.99	2040

**Aberdeen Area: Forest Map 30, Stand 30-23, 20.96 acres**  
**Previously was part a larger stand 30-8**

**Overstory Summary Narrative**

Data was collected in 2019. The stand is dominated by Tulip poplar, Sweetgum and Red maple. The Canopy closure is 70% and the stand is fully stocked. This stand borders a forested wetland to the north. Due to fire that impacted the entire stand the vast majority of the trees are under stress and of poor quality, reducing the stands overall quality.

This large saw timber stand has the following diameter distribution:

Mature	26"+	12%
Saw timber	11-23.9"	61%
Pole	6-10.9"	21%
Small tree	2-5.9"	6%

Currently the stand contains 156 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 155 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 +% stocking level. From a tree form and vigor stand point only 39% of the trees are acceptable.

**Recommendations**

-Due to the poor-quality trees and its location, the stand should be left alone to go through natural succession.

-Deer control should be increased in this area as regeneration has little competition and native tree species will occupy stand.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-23	Collect data/prepare new plan	20.96

**Aberdeen Area: Forest Map 30-24, 20.68 acres**  
**Previously part of Stand 30-8**

**Overstory Summary Narrative**

Data collected in 2019 shows the stand contains numerous mature and large sawtimber class trees, dominated by Tulip poplar and Oaks. Oaks include: Willow, Black, Pin, White and Southern Red. The understory is comprised of Highbush blueberry, Greenbriar, Bayberry and Black haw. The stand contains numerous man-made drainage ditches and wetlands.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	43%
Sawtimber	11-25.9"	38%
Pole	6-10.9	15%
Small tree	2-5.9"	4%

Currently the stand contains 120 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 136 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 95% stocking level. From a tree form and vigor stand point 60% of the trees are acceptable. The plots had no Oak or Poplar regeneration, a thinning will aid in regeneration.

**Recommendations**

- Enhancement cut, favoring high quality crop trees of Poplar and Oak.
- Cut vines in crop trees
- Treat invasive

From a management point of view this stand is in need of a thinning. Currently a thinning will reduce competition. The stand has a basal area of 136 B.A. and should be reduced to a B.A. of 80 sq. ft. which is all acceptable trees. The initial thinning will involve removing 56 sq. ft. of unacceptable, matures, saw timber, pole timber and small tree class trees.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
30-24	Enhancement	20.68
	collect data/prepare plan 2040	20.26

## **Westwood Area: Forest Map 33, Stand 33- 18, 64.98 Acres**

### **Overstory Summary Narrative**

Data collected in 2017. This stand has a first order stream and a large marsh; dominated by Willow oak, and Sweetgum, Oaks had a strong presence in 80 percent of the plots. Oaks present include: Pin oak and Southern Red Oak. Associate species include: Persimmon, Sycamore, Locust, Beech, Holly and Black cherry. The understory contains native Blueberry and Viburnums. Invasive plants consist of Multiflora rose, Japanese honeysuckle, Stilt grass, Bittersweet and Barberry which comprises 70 percent of the understory. No advance regeneration was found in any plots. Beech seedlings were noted as they do well in the 90 percent canopy closure.

This sawtimber stand has the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	61%
Pole	6-10.9"	16%
Small tree	2-5.9"	8%

Currently the stand contains 146 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 125 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 % stocking level. From a tree form and vigor stand point only 48 % of the trees are acceptable.

### **Recommendations**

- Restoration project to reduce basal area to 60 sq. ft. per acre of good seed trees with good form and vigor is needed. Favor Poplar and Oak as crop seed trees
- Treat invasive shrubs and forbs which are dense.
- Grind up tops and stack logs through out to keep mission access use open.

Note: Due to the stream and marsh only 39 acres can be managed.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
33-18	TSI or Restoration project	39	2023
	Inspect for regeneration/ Shelter	39	2025
	Collect data prepare new plan	39	2038

## **Aberdeen Area: Forest Map 33, Stand 33-22, 107.14 Acres**

### **Overstory Summary Narrative**

Data was collected in 2019. This stand is dominated by mature mixed Oak species, Poplar, Sweetgum and Beech. Oak species include Willow oak, Southern red oak, Pin oak and White oak. Associate species include Sweetgum and Red maple. The understory is comprised of Blueberry, Beech and Holly. The largest tree measured was a 48-inch Willow oak with numerous Oaks ranging from 130 to 220 years old. This stand borders the bay and is very important for water quality. The regeneration plot survey found advanced regeneration in 10% of the plots however, no Oak or Poplar were present. Currently, shade (Canopy closure) is 90% and deer pressure is heavy.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	26%
Sawtimber	11-23.9"	41%
Pole	6-10.9"	16%
Small tree	2-5.9"	17%

Currently the stand contains 218 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 145 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% plus stocking level. From a tree form and vigor stand point, 46% of the trees are acceptable.

### **Recommendations**

- Manage for Old Growth
- Control beech and Sweetgum saplings/small tree.
- Forested wetland throughout.

Old Growth forest have well developed structures, legacy or large trees, multiple aged trees and abundant down wood and numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursuing Old Growth in this mature stand by designating legacy trees, increasing growth to the larger trees, creating standing dead, creating canopy gaps to aid in natural regeneration, establish a diversity of trees sizes; favoring all species and create down woody debris often found in Old growth forest.

Researchers have found that there is no one specific condition to aim for as a condition of old growth; instead it's found more valuable to increase the number of characteristics associated with these types of forest communities. Structural objectives and silvicultural techniques used to achieve structural enhancement may include:

Multiple Canopy: Single tree selection using a target diameter, release advance regeneration, encourage new regeneration associated with natural forest type.

Create snags and down woody debris: Girdle trees (if approval is given) of various sizes that are unacceptable, felling and leaving trees of healthiest trees with large diameters.

Accelerate growth in legacy trees: Full or partial crown release. A total of 79 square feet of unacceptable growth is spread out among all size classes.

Controlling invasive and alien plants is imperative to natural regeneration success. Deer control should be increased in this area as well. **Due to large forested wetland and a sparse tree and shrub wetland area in the south east area of the stand areas of potential and accessible to silviculture should be GPS location for accurate acreage.**

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
33-22	Single Tree Selection Basal spray young Beech and Gum. Manage for Old Growth	107.14

## **Aberdeen Area: Forest Map 33, Stand 33-25, 39.49 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Swamp white oak, White oak, American beech, Sweet gum and Red maple with associate species being; Holly, Black gum, Spice bush and Locust. Blueberry and Brambles were found in the understory.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	20%
Sawtimber	11-25.9"	52%
Pole	6-10.9	20%
Small tree	2-5.9"	8%

Currently the stand contains 126 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 87 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 75% stocking level. From a tree form and vigor stand point, 56% of the trees are acceptable.

The acceptable sawtimber volume currently is 8,800 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- Due to past high mortality in White oaks from past Gypsy Moth damage, inspections are needed.
- This stand provides FID habitat and should maintain a basal area of 90 ft/ac average with at least 70 percent canopy closure at all times.
- This stand was not overstocked in 2001.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
33-25	collect data/prepare plan	39.49



## **Westwood Area: Forest Map 34, Stand 34-15, 81.61 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This stand buffers Romney Creek along its north western boundary for thousands of feet and is dominated by Sweetgum, Red maple and Tulip poplar. Oaks present include; Pin oak, Southern Red Oak and Willow oak. Associate species include: Sassafras, Sycamore, Persimmon, Beech, Holly and Blackgum. The understory contains native Blueberry, Grapevine, Viburnum, Winterberry and Holly. Invasive plants consist of Multiflora rose, Japanese honeysuckle, Stilt grass, Greenbrier and Barberry. No advance regeneration was found in any plots. Beech seedlings were noted as well as crowns hinder by vines. Sweetgums showing stress from bleeding canker.

This sawtimber stand has the following diameter distribution:

Mature	26"+	15%
Sawtimber	11-23.9"	70%
Pole	6-10.9"	10%
Small tree	2-5.9"	5%

Currently the stand contains 131 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 144 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100 % stocking level. From a tree form and vigor stand point, only 46 % of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees.
- Restoration project to reduce basal area to 70 sq. ft. per acre of good seed trees with good form and vigor is needed.
- Treat invasive shrubs and forbs.
- Grind up tops and stack logs through out to keep mission access use open.
- Potential planting site along Romney outside of flood plain.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
34-15	Restoration project	81.61	2025
	Inspect for regeneration/ Shelter	81.61	2027
	Collect data prepare new plan	81.61	2040

\*Site has good access.

## **Aberdeen Area: Forest Map 34, Stand 34-17, 140.45 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Sweet gum, Red maple, Willow oak, Pin oak and Black locust with associate species being; Northern red oak, Southern red oak, White oak, Black cherry, Black gum, Yellow poplar and Ash. No information was collected on the understory.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	23.9%
Sawtimber	11-25.9"	52.2%
Pole	6-10.9	25.7%
Small tree	2-5.9"	0%

Currently the stand contains 120.26 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 101.7 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 63.8% stocking level. From a tree form and vigor stand point, 44.8% of the trees are acceptable.

The acceptable sawtimber volume currently is 6,801 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- This stand provides FID habitat and should maintain a basal area of 90 ft/ac average with at least 70 percent canopy closure at all times.
- Avoid cutting in forested wetlands which are scattered throughout.
- A shelterwood cut is needed to encourage regeneration. This should be done in 20-acre patches, leaving residual basal areas of 40-50 ft<sup>2</sup>/ac. of acceptable growing stock.
- Cut in three, 20-acre patches for a total of 60 acres per cycle. These do not have to be adjacent.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
34-17	shelterwood harvest	60
	shelterwood harvest	60
	collect data/prepare plan	140.45

## **Forest Map 35, Stand 35-15, 45.88 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Yellow poplar, Paulownia, Persimmon and Cherry. Blueberry and Holly were found in the understory. Invasive plants include Microstegium, Multiflora rose, autumn olive and Honeysuckle.

This is a pole timber stand d.b.h. ranges 6" – 11.9".

This stand is adequately stocked with 90% canopy closure.

360 Trees per acre.

### **Recommendations**

- Grapevine hindering canopy and dense grass hindering potential regeneration.
- Recommend area for potential reclamation in the form of mowing and replanting.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
35-15	commercial TSI	45.88
	control invasives	
	examine stand for commercial harvest	

## **Forest Map 35, Stand 35-16, 48.28 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Yellow poplar, Locust, Cherry and a few large Walnut with associate species being; Cherry, Walnut and Locust. Multiflora rose was found in the understory. Invasive plants include Microstegium, Multiflora rose and Ailanthus.

This is a mature sawtimber stand d.b.h average 24”.

This stand is fully stocked with 80-90% canopy closure except in wetland.

### **Recommendations**

- This site contains an Eagle Buffer follow APG Eagle restrictions.
- Deer pressure.
- 100' of successional Sweet gum along the road and large open wetland in eastern portion of the stand.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
35-16	commercial TSI	48.28
	control invasives	
	examine stand for commercial harvest	

## **Edgewood Area: Forest Map 37 Stand 37-8, 58.98 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. An important stand that borders the Romney along its entire southern Boundary. This stand is predominately Sweetgum with Tulip poplar and Red maple. Mature Southern red oak and Willow oak are scattered throughout as well as Pin oak. The understory consists of Blueberry, Winterberry, Bayberry, Multiflora rose, Autumn Olive and Barberry. There was no Oak or Poplar regeneration. The Sweetgum is showing signs of canker due to stress and breaking apart.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	6%
Sawtimber	11-23.9"	68%
Pole	6-10.9"	23%
Small tree	2-5.9"	3%

\*Mature Poplar along Romney in a portion of the stand.

Currently the stand contains 142 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 136 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100+ stocking level. From a tree form and vigor stand point only 50% of the trees are acceptable. The existing Oak and Poplar population provides an excellent seed source once sunlight can reach forest floor to aid in germination.

### **Recommendations**

-To enhance regeneration a restoration thinning removing 33 sq. ft. of unacceptable sawtimber and 30 sq. ft. of basal area in poor quality pole timber will provide canopy gaps to increase sunlight to forest floor and aid in regeneration. Small poor-quality trees can be mowed or cut to aid in preparing the site for restoration.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
37-8	Restore/thin	58.98	2025
37-8	Inspect regeneration/ shelter	58.98	2028
37-8	Collect data	58.98	2043

## **Aberdeen Area: Forest Map 37, Stand 37-12, 110.67 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Yellow poplar, Red maple, Sweet gum, Pin oak, Ash, White oak and Black cherry with associate species being; Dogwood, Holly and Hickory. Multiflora rose, Serviceberry, Greenbrier and autumn olive were found in the understory.

This sawtimber has the following diameter distribution breakdown:

Mature	26"+	14%
Sawtimber	11-25.9"	53%
Pole	6-10.9	30%
Small tree	2-5.9"	3%

Currently the stand contains 188 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 113 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, 32% of the trees are acceptable.

The acceptable sawtimber volume currently is 8,000 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- Sustain health of the riparian forest and flood plain.
- No silvicultural recommendations.
- Collect new data.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
37-12	collect data/prepare plan	110.67

## **Aberdeen Area: Forest Map 38, Stand 38-5, 72.70 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Sweetgum with associate species being Red maple, Willow oak, Pin oak, and Tulip poplar. The understory is comprised of, Winterberry, Barberry, Blueberry, Honeysuckle and Microstegium. Due to overstocking/stress the Sweetgum trees have Bleeding Canker, (*Botryosphaeria*) with many trees structurally weak.

This sawtimber stand has the following diameter distribution:

Mature	26"+	3 %
Sawtimber	11-23.9"	60%
Pole	6-10.9"	27%
Small tree	2-5.9"	11 %

Currently the stand contains 225 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 134 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 53% of the trees are acceptable.

The acceptable sawtimber volume currently is 6,800 bd. ft. per acre; once the undesirables are removed the stand will increase in volume, as more crop tree space is available.

### **Recommendations**

-Logging access roads should be maintained for management access and fire control.

From a timber management point of view this stand is in need of a commercial thinning. Currently a (TSI) thinning will reduce competition; the stand has a basal area of 134 B.A. and should be reduced to a B.A. of 70 Sq.ft. which is all acceptable trees. The initial thinning will involve removing 64 sq.ft. of unacceptable sawtimber, pole timber and small trees. The trees can be utilized for pulpwood with the thinning producing approximately 20 cords per acre.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
38-5	Commercial TSI	72.70
	Prepare new Plan	

## **Forest Map 38, Stand 38-17, 31.60 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Pin oak, Red maple, Locust, Cherry, Catalpa and Sycamore. Blueberry, Greenbrier and American holly were found in the understory. Invasive plants include Microstegium and Honeysuckle vine.

This is a small sawtimber stand d.b.h. ranges 6" – 24".

This stand is adequately stocked with 60% canopy closure.

### **Recommendations**

- Fragmented
- Deer pressure

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
38-17	commercial TSI control invasives examine stand for commercial harvest	31.60



## **Aberdeen Area: Forest Map 38 Stand 38-18, 42.26 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. An important stand that borders the Romney along a portion of its southern boundary. Harvested approximately 10 years ago the mature stand still contains mostly unacceptable stock and a dense understory of stilt grass. This stand is predominately Tulip poplar with mature Oaks and Sweetgum. The understory consists of Blueberry and Blackberry. Nonnative plants include; Bayberry, Multiflora rose and Barberry. There was no Oak or Poplar regeneration. The stand has a large opening that can be planted for mitigation/ restoration. An 8 acres section starting within the 100-foot Bay buffer was laid out.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	40%
Sawtimber	11-23.9"	53%
Pole	6-10.9"	6%
Small tree	2-5.9"	1%

Currently the stand contains only 66 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 70+ stocking level. From a tree form and vigor stand point only 37% of the trees are acceptable. The existing Oak and Poplar population provides an excellent seed source. The entire stand needs invasive plant control to expose soil, which is currently covered in stilt grass.

### **Recommendations**

-Treat the entire 8 acre proposed planting area and plant Oak and Polar on a 15 x 15-foot spacing once invasives are controlled to ensure success. Three-gallon potted trees would provide enough immediate height; shelter with 5-foot shelters.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
38-18	Remove invasive and plant	8	2019
38-18	Treat remaining stand acres	34	2021
38-18	Collect data	42.26	2035

## **Phillips Army Airfield Area: Forest Map 38, Stand 38-19, 74.58 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Red maple, Willow oak, Pin oak, Black cherry, Black gum, Yellow poplar, Sassafras and Southern red oak. Japanese honeysuckle, Blueberry, Sweet gum, Barberry, Multiflora rose, Black gum, Greenbrier, Beech, Wine berry and Holly were found in the understory.

This large sawtimber stand has an average merchantable diameter of 16.80

Currently the stand contains 166.39 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 150 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 87.8% stocking level. From a tree form and vigor stand point, 90.7% of the trees are acceptable.

The acceptable sawtimber volume currently is 12,296.90 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- Harvested in 2009.
- Invasive plants should be controlled prior to harvest.
- An effort should be made to control deer population.
- This site contains an Eagle Buffer follow APG Eagle restrictions.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
38-19	commercial TSI	74.58
	control invasives	
	examine stand for commercial harvest	

## **Phillips Army Airfield Area: Forest Map 38, Stand 38-20, 12.49 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Red maple, Willow oak and Pin oak. Blueberry, Multiflora rose, Japanese honeysuckle, Barberry and Greenbrier were found in the understory.

This large sawtimber stand has an average merchantable diameter of 15.24

Currently the stand contains 360.59 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 146.7 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 97% stocking level. From a tree form and vigor stand point, 83.3% of the trees are acceptable.

The acceptable sawtimber volume currently is 9,240.54 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- TSI is required using single tree selection; reducing the basal area to 80 sq. ft. of AGS per acre.
- Invasive plants should be controlled prior to harvest.
- An effort should be made to control deer population.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
38-20	commercial TSI	12.49
	control invasives	
	examine stand for commercial harvest	

## **Phillips Army Airfield Area: Forest Map 38, Stand 38-21, 31.47 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Red maple, Black cherry, Southern red oak, Yellow poplar and Pin oak. Blueberry, Honeysuckle, Multiflora rose, Barberry and Wine raspberry were found in the understory.

This large sawtimber stand has an average merchantable diameter of 16.69

Currently the stand contains 76.3 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 101.3 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 55.3% stocking level. From a tree form and vigor stand point, 67.5% of the trees are acceptable.

The acceptable sawtimber volume currently is 10,229.22 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- Invasive plants should be controlled prior to harvest.
- An effort should be made to control deer population.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
38-21	commercial TSI	31.47
	control invasives	
	examine stand for commercial harvest	

## **Phillips Army Airfield Area: Forest Map 38, Stand 38-22, 38.86 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Red maple, Willow oak, Pin oak, White oak, Southern red oak and Ash. Barberry, Blueberry, Honeysuckle, Greenbrier, Sweet gum, Multiflora rose and Japanese honeysuckle were found in the understory.

This large sawtimber stand has an average merchantable diameter of 17.14

Currently the stand contains 145.38 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 121.1 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 76.3% stocking level. From a tree form and vigor stand point, 82.2% of the trees are acceptable.

The acceptable sawtimber volume currently is 10,805.79 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- This stand was harvested between 2007 and 2009. Unacceptable growing stock still remains consisting of 39 sq. ft. per acre. TSI is required.
- Invasive plants should be controlled prior to harvest.
- An effort should be made to control deer population.
- The southern portion of this site contains an Eagle Buffer follow APG Eagle restrictions.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
38-22	commercial TSI	38.86
	control invasives	
	examine stand for commercial harvest	

## **Aberdeen Area: Forest Map 38, Stand 38-23, 73.81 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Sweetgum with associated species being; Pin oak, Southern red oak, White oak, Willow oak and Red maple. The understory is comprised of Holly, Blueberry, Multiflora rose, and areas of dense young Beech saplings. Regeneration was found in 36 percent of the plots. Deer pressure is heavy. Due to overstocking /stress the Sweetgum trees have Bleeding Canker (*Botryosphaeria*) with many trees structurally weak.

This small sawtimber stand has the following diameter distribution:

Mature	26"+	4%
Sawtimber	11-23.9"	70%
Pole	6-10.9"	22%
Small tree	2-5.9"	4 %

Currently the stand contains 176 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 139 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 95% plus stocking level. From a tree form and vigor stand point, only 57% of the trees outside of the mature class are acceptable. The acceptable sawtimber volume currently is 8,000 bd. ft. per acre; once the undesirables are removed the stand will increase in volume, more crop tree space will be available and regeneration will improve as more light is added to the forest floor.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- This site contains an Eagle Buffer follow APG Eagle restrictions.

This stand is in need of a commercial harvest. The thinning will reduce competition. The stand has a basal area of 139 sq. ft. and should be reduced to a B.A. of 80 sq.ft. The initial thinning will involve removing 55 sq.ft. of unacceptable (saw timber, pole timber, small tree class). The undesirables can be utilized for pulpwood. The thinning will produce approximately **18** cords per acre. Following the commercial pulpwood sale, the alien and invasive plants should be controlled and deer population reduced to aid regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
38-23	Commercial TSI	73.81
	Control invasives	
	Prepare new Plan	

## **Aberdeen Area: Forest Map 39, Stand 39-3, 21.55 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011; this stand is dominated by Tulip Poplar. Associate species include; Sweetgum, Beech, Southern red oak, Walnut, Hickory, and White oak. The understory is comprised of Blueberry, Wine berry, Multiflora rose, Barberry, and Microstegium. Regeneration was noted in 37 percent of the plots, but is being hindered by thousands of pawpaw seedlings/saplings. This stand is an important buffer to the Bay and is deteriorating.

This mature stand has the following diameter distribution breakdown:

*Mature	26"+	54 %
Sawtimber	11-23.9"	38%
Pole	6-10.9"	7%
Small tree	2-5.9"	1 %

\*Majority of Mature trees are unacceptable.

Currently the stand contains 110 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 148 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, the majority of the trees are unacceptable.

### **Recommendations**

- Logging access roads should be maintained for management access and fire control.
- Flag off 100 foot no cut buffer.
- This site is in the Critical Area and the harvest plan should be completed.
- This site contains an Eagle Roost follow APG Eagle restrictions.

This stand is in need of a regeneration cut to open up the canopy and allow regeneration to establish. Yellow-poplar is a prolific seeder, and large crops are produced almost annually. A combination of a single tree selection and small less than ½ group selections will aid in regeneration. The Stand is marked in the same manner as with single-tree selection cut, the only difference being that small openings are created in the stand. Single-tree selection cutting occurs between the openings. In these areas the majority of trees are unacceptable and should be removed leaving only acceptable high-quality growing stock. The residual basal area in the single tree selection portions of the stand should be 60 sq.ft. per acre.

Controlling the pawpaw and invasive plants directly after the harvest is imperative to natural regeneration success. Deer control should be increased in this area as well. High quality regeneration should be sheltered if the deer population cannot be controlled.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
39-3	Single tree/small group harvest	21.55
	Control invasives	
	Prepare new Plan	

## **Phillips Army Airfield Area: Forest Map 40, Stand 40-6, 15.68 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Red maple with associate species being; Black cherry, Yellow poplar, Black gum, White oak and Sweet gum. Multiflora rose, autumn olive, Wine berry, Blueberry, Honeysuckle and Greenbrier were found in the understory.

This large sawtimber stand has an average merchantable diameter of 19.05

Currently the stand contains 74.63 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 95 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 44.5% stocking level. From a tree form and vigor stand point, 30% of the trees are acceptable.

The acceptable sawtimber volume currently is 6,045.86 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

This large sawtimber stand contains 15.6 acres with a very low relative density of 44%. It has a canopy closure of only 67%. This stand contains highly invasive species and should be cleared and planted with native species to create a healthy forest.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
40-6	commercial TSI	15.68
	control invasives	
	examine stand for commercial harvest	



## **Phillips Army Airfield Area: Forest Map 40, Stand 40-7, 31.34 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Black cherry with associate species being; Sweet gum, Dogwood, Persimmon, Walnut and Paulownia. Autumn olive, Honeysuckle, Grapevine, Multiflora rose and Wine berry were found in the understory.

This small sawtimber stand has an average diameter of 7.44

Currently the stand contains 158.92 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 65 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 41% stocking level. From a tree form and vigor stand point, 16.7% of the trees are acceptable.

The acceptable sawtimber volume currently is 1,713.16 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- This stand is highly invasive with 74% of the trees being unacceptable.
- This stand should be cleared and planted for mitigation.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
40-7	commercial TSI	31.34
	control invasives	
	examine stand for commercial harvest	

## **Phillips Army Airfield Area: Forest Map 40, Stand 40-8, 43.59 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Red maple, Willow oak, Persimmon, Southern red oak, Black cherry, Yellow poplar, Sycamore, Osage orange and Norway maple. Autumn olive, Multiflora rose, Privet, Barberry, Poison ivy, Sweet gum, Honeysuckle and Grapevine were found in the understory.

This large sawtimber stand has an average merchantable diameter of 17.32

Currently the stand contains 145.06 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 116 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 67% stocking level. From a tree form and vigor stand point, 26.3% of the trees are acceptable.

The acceptable sawtimber volume currently is 7,830.29 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

This site is being considered for forest restoration to satisfy mitigation requirements for the test track at GAPG. The goal is to restore the forests ecological integrity by reducing the environmental stress influenced by exotic invasive plants and to restore the natural distribution of native trees and shrubs. A Timber Stand Improvement (TSI) to reduce overstocking will release the canopy of the highest quality trees.

-An effort should be made to control deer population.

-Prior to site activities; stream buffers and drainage swales should be marked clearly.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
40-8	commercial TSI	43.59
	control invasives	
	examine stand for commercial harvest	

## **Aberdeen Area: Forest Map 40, Stand 40-9, 19.23 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Yellow poplar, Red maple, Sweet gum and Pin oak with associate species being; Black cherry, Sassafras, Black locust, Dogwood and Paulownia. No information was collected on the understory.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	14%
Sawtimber	11-25.9"	59%
Pole	6-10.9	23%
Small tree	2-5.9"	4%

Currently the stand contains 146 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 119 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 95% stocking level. From a tree form and vigor stand point, 28% of the trees are acceptable.

The acceptable sawtimber volume currently is 11,000 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- No silvicultural recommendations due to lack of data collected in 2001.
- Collect data and prepare a management plan.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
40-9	collect data/prepare plan	19.23

## **Aberdeen Area: Forest Map 40, Stand 40-10, 29.69 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Sweet gum, Red maple and Black locust with associate species being; Scarlet oak, Sassafras, Sycamore and Osage orange. Dense autumn olive, Grapevine and Honeysuckle were found in the understory.

This pole timber stand has the following diameter distribution breakdown:

Mature	26"+	0%
Sawtimber	11-25.9"	11%
Pole	6-10.9	72%
Small tree	2-5.9"	17%

Currently the stand contains 292 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 100 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, 50% of the trees are acceptable.

The acceptable sawtimber volume currently is 1,400 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

-Maintain the current condition to provide a screen for test track.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
40-10	collect data/prepare plan	29.69

## **Phillips Army Airfield Area: Forest Map 40, Stand 40-11, 13.05 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Persimmon and Dogwood. Autumn olive, Grapevine, Multiflora rose and Honeysuckle were found in the understory.

This pole stand has an average diameter of 7.40

Currently the stand contains 117.15 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 40 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 29.0% stocking level. From a tree form and vigor stand point, 14% of the trees are acceptable.

The acceptable sawtimber volume currently is 584.71 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

-This pole size Sweet gum stand contains 13 acres with a very low relative density of 29%. It has a canopy closure of only 35%. This stand is dominated by invasive species and should be cleared and planted with native species to create a healthy forest.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
40-11	commercial TSI	13.05
	control invasives	
	examine stand for commercial harvest	

## **Aberdeen Area: Forest Map 41, Stand 41-1, 18.8 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011; this stand was dominated by mixed Oak and Sweetgum. Oaks include Southern red oak, White oak, Willow oak, Swamp white oak and Pin oak. Associate species include Red maple, Beech Black gum and Hickory. The understory was comprised of Holly, Blueberry, Persimmon and Pawpaw with invasive Barberry, Microstegium and Multiflora rose. Regeneration of Oak was found in 12 percent of the plots. The canopy closure was 90 percent and the deer pressure is heavy.

This small sawtimber stand had the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	43%
Pole	6-10.9"	21%
Small tree	2-5.9"	22 %

The stand had contained 191 trees per acre with an average, following restoration the stand has an average of **90 trees** per acres. B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) was 114 sq. ft. per acre average. The residual Basal Area is now **75 sq. ft.** per acre. The number of trees correlated with the B.A. gives this stand a 100% stocking level, prior to thinning. Current stocking level is 60 percent +. From a tree form and vigor stand point, only 57% of the trees outside of the mature class were acceptable. The site now contains 80 percent acceptable growing stock.

**Forest restoration work completed in July 2018.** The entire site was scanned for ordinance prior to restoration work on the 18.8 acres. The remaining 2.44 acres of restoration was moved off site in Map 16.

The understory was comprised of Holly which shaded out the forest floor. The majority of the Holly and invasive shrubs were removed.

Currently an adequate seed source is present for regeneration of Oak and Poplar. The potential is excellent.

Mar-Len Environmental, Inc. (MLE) removed midstory, and unacceptable overstory trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, Hickory and Poplar to dominate the stand. Target trees for removal were Red Maple and Sweetgum along with poor quality trees of any species. Sweetgum were showing signs of Canker.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil

### **Other activities include:**

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked crop trees to remain.

- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.
- Scarified site to promote soil and seed contact.
- Stacked/ condensed brush piles.

\*Deer control should be increased in this area.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>DATE</u>
41-1	Inspect regeneration	18.80	2021
	Re Examine stand	17.2	2036

## **Aberdeen Area: Forest Map 41, Stand 41-2, 24.11 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011; this stand is dominated by Sweetgum and Willow oak. Associate species include Red maple, Beech, Persimmon, Black gum and Ash. The understory is comprised of Holly, Blueberry, Pawpaw, and Beech with invasive Honeysuckle, Microstegium and Multiflora rose. Regeneration of oak was found in 33 percent of the plots. The canopy closure is 85 percent and the deer pressure is heavy.

This small sawtimber stand has the following diameter distribution:

Mature	26"+	2%
Sawtimber	11-23.9"	45%
Pole	6-10.9"	35%
Small tree	2-5.9"	18 %

Currently the stand contains 236 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 122 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, only 55% of the trees outside of the mature class are acceptable. The acceptable sawtimber volume currently is 6,500 bd. ft. per acre; once the undesirables are removed the stand will increase in volume, as more crop tree space is available and regeneration will improve as more light is added to the forest floor.

### **Recommendations**

-This stand has man-made drainage patterns, wetlands and should be managed when the site is dry or frozen to prevent rutting.

From a timber management point of view this stand is in need of a commercial selective harvest. The thinning will reduce competition; the stand has a basal area of 114 B.A. and should be reduced to a B.A. of 70 Sq.ft. The initial thinning will involve removing 52 sq.ft. of unacceptable saw timber, pole timber and small size class trees. The undesirables can be utilized for pulpwood. The thinning will produce approximately **12-15** cords per acre. Following the commercial pulpwood sale, the alien and invasive plants should be controlled and deer population reduced to aid oak regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
41-2	Commercial TSI	24.1
	Control invasives	
	Prepare new Plan	



## **Aberdeen Area: Forest Map 41, Stand 41-13, 45.85 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, this stand is dominated by Southern red oak, White oak, Swamp chestnut oak 43", Tulip poplar, Willow oak and Sweetgum with associate species being; Red oak, Pin oak, Beech, Black gum and Red maple. This stand has trees over 200 years old. The understory is comprised of Blueberry, Arrow wood, Sweet pepperbush and Pawpaw. Regeneration was found in only 23 percent of the plots, factors hindering regeneration include the intense deer browse and dense canopy closure of 90 percent.

This mature stand has the following diameter distribution breakdown:

Mature	26"+	28%
Sawtimber	11-23.9"	51%
Pole	6-10.9"	15%
Small tree	2-5.9"	6 %

Currently the stand contains 146 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 115 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90% stocking level. From a tree form and vigor stand point, only 39% of the trees outside of the mature class are acceptable.

### **Recommendations**

**Manage towards Old Growth:** Actively pursue Old Growth in this mature stand by; designating legacy trees, increase growth in the larger trees, create standing dead, create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes, favor all species and create down woody debris often found in Old growth forests. Beech and Pawpaw in the understory should be controlled when they dominate in localized areas.

Structural objectives and silvicultural techniques used to achieve structural enhancement may include;

**Multiple Canopy:** Single tree selection using a target diameter, release advanced regeneration, encourage new regeneration associated with natural forest types.

**Create snags and down woody debris:** Girdle trees of various sizes that are unacceptable, felling and leaving trees of healthiest trees with large diameters.

**Accelerate growth in legacy trees:** Full or partial crown release.

Once canopy gaps are created by girdling poorly formed trees, shelter 200 existing high-quality seedlings per acre (with a 6-foot shelter) so the regeneration can become established without deer pressure. Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
41-13	Active manage for Old Growth	45.85
	Shelter existing seedlings	
	Control invasives	
	Prepare new Plan	

## **Phillips Army Airfield Area: Forest Map 41, Stand 41-22, 68.38 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum, Red maple and Willow oak with associate species being; Pin oak, Ash and White oak. Beech, Blueberry, Honeysuckle, Multiflora rose, Barberry and Greenbrier were found in the understory.

This small sawtimber stand has an average diameter of 4.32

Currently the stand contains 271.28 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 82 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 55.5% stocking level. From a tree form and vigor stand point, 56% of the trees are acceptable.

The acceptable sawtimber volume currently is 7,530.05 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- Harvested in 2008.
- Invasive plants should be controlled prior to harvest.
- An effort should be made to control deer population.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
41-22	commercial TSI	68.38
	control invasives	
	examine stand for commercial harvest	

## **Phillips Army Airfield Area: Forest Map 41, Stand 41-23, 27.82 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Red maple, Willow oak and Pin oak. Blueberry, Multiflora rose, Japanese honeysuckle, Barberry, Greenbrier, Persimmon, Grape vine, Beech and Bayberry were found in the understory.

This small sawtimber stand has an average merchantable diameter of 15.62

Currently the stand contains 454.36 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 123.3 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 78.5% stocking level. From a tree form and vigor stand point, 76.7% of the trees are acceptable.

The acceptable sawtimber volume currently is 8,886.42 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

### **Recommendations**

- TSI is required using single tree selection; reducing the basal area to 80 sq. ft. of AGS per acre.
- Invasive plants should be controlled prior to harvest.
- An effort should be made to control deer population.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
41-23	commercial TSI	27.82
	control invasives	
	examine stand for commercial harvest	

## **Aberdeen Area: Forest Map 42, Stand 42-5, 37.54 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, storm damage in the form of uprooted trees occurred in this stand in 2011. Dominated by Tulip poplar and mixed oak. Oaks include; Southern red oak, White oak, Northern red oak, Chestnut oak and Black oak, with Sweetgum and Red maple also present in the overstory. The understory is comprised of dense Pawpaw (approximately 2,500 per acre), Holly, Mt. Laurel, Blueberry, Witch hazel and Beech. Regeneration was not found in any plots; the lack of a sustainable forest is due to a dense canopy and shrubs layer as well as deer pressure which is intense. This stand plays a critical role in water quality.

This mature stand has the following diameter distribution:

Mature	26"+	43%
Sawtimber	11-23.9"	46%
Pole	6-10.9"	7%
Small tree	2-5.9"	4%

Currently the stand contains 78 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 112 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 75% plus stocking level.

### **Recommendations**

-This site contains an Eagle Buffer follow APG Eagle restrictions.

To aid in regeneration this environmentally sensitive stand should have the understory removed to control the dense shade layer of Pawpaw; this will allow sunlight in where the downed and dead trees exist. Shelter advanced oak and poplar regeneration to protect from the heavy deer population.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
42-5	Control understory	37.54
	Control invasives	
	Prepare new Plan	

## **Aberdeen Area: Forest Map 43, Stand 43-4, 27.74 Acres**

### **Overstory Summary Narrative**

Data collected in 2001 states this stand is dominated by Yellow poplar, Sweet gum, Red oak, Willow oak and Black cherry with associate species being; Dogwood, Hickory, Red maple, Scarlet oak, Muscle wood, Ash and Spice bush. No information was collected on the understory.

This large sawtimber has the following diameter distribution breakdown:

Mature	26"+	31%
Sawtimber	11-25.9"	42%
Pole	6-10.9	24%
Small tree	2-5.9"	3%

Currently the stand contains 114 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 130 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 100% stocking level. From a tree form and vigor stand point, 62% of the trees are acceptable.

The acceptable sawtimber volume currently is 13,000 bd. ft. per acre; once the undesirables are removed the stand will increase in volume as more crop space becomes available.

In 2011 restoration activities occurred on 10 acres within this stand. Trees were girdled and invasive plants were mechanically removed and treated with chemical. Advanced regeneration was sheltered with protection using a 25' by 25' spacing.

### **Recommendations**

- Continue to treat understory to control invasives.
- Maintain tree shelters.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
43-4	control invasives/maintain shelters	10
	collect data/prepare plan	27.74

## **Aberdeen Area: Forest Map 44, Stand 44-2, 7.49 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011. Major storm damaged occurred in this stand in 2011, a large number of Poplar are uprooted and or have severe crown damage. Dominated by Tulip poplar, associate species include; Locust, Beech, Red maple, Hickory and Willow oak. The understory is comprised of Holly, Winterberry, Pawpaw and Black cherry with invasive Honeysuckle vine, Wine berry, Tear thumb and Microstegium. No regeneration was noted in any plot.

This sawtimber stand has the following diameter distribution:

Mature	26"+	0%
Sawtimber	11-23.9"	82%
Pole	6-10.9"	9%
Small tree	2-5.9"	9 %

Currently the stand contains 80 trees per acre (this is low, due to storm damage) with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 80 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 50% stocking level. From a tree form and vigor stand point, only 50% of the trees are acceptable.

### **Recommendations**

The stand needs a salvage harvest to aid in natural regeneration. Along with removing all downed trees the unacceptable sawtimber 26 sq. ft. per acre and the unacceptable pole timber 6 sq.ft. per acre should be removed, leaving only high-quality seed trees. Once all trees have been removed the shrub layer should be removed or sprayed and the ground prepared to accept the seed.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
44-2	Salvage Harvest	7.49
	Control invasives	
	Prepare new Plan	

## **Aberdeen Area: Forest Stand 44-3, 24.90 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011. The stand is dominated by mixed oak and Tulip poplar. Oaks include; Southern red oak, White oak, Northern red oak, Scarlet oak, Chestnut oak and Black oak. Associate species include; Beech, Sweetgum, Hickory, Sassafras and Black gum. The understory is comprised of Pawpaw, Holly, Blackberry, Spicebush, Black haw and Beech with invasive, Honeysuckle, Wine berry, Tree of Heaven and Multiflora rose. Regeneration was found in 50% of the plots, however; their overall composition per acre is low. The lack of adequate regeneration is due to a dense canopy and shrub layer as well as deer pressure which is intense. This stand plays a critical role in water quality; it occupies steep slopes and has a large drainage pattern that carries storm flow from the intensely developed adjacent land.

This mature stand has the following diameter distribution:

Mature	26"+	45%
Sawtimber	11-23.9"	40%
Pole	6-10.9"	12%
Small tree	2-5.9"	3%

NOTE: 40" diameter trees are common

Currently the stand contains 120 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 119 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 85% plus stocking level.

### **Recommendations**

-Sustaining this stand is crucial to the bay's health, however; access due to steep slopes makes management difficult. Where regeneration is becoming established shrubs and other low-quality plants/trees that are impeding growth should be removed. Where dead and dying trees occur the understory should be cleared to encourage regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
44-3	Control understory near regeneration Prepare new Plan	24.90



## **Aberdeen Area: Forest Map 44, Stand 44-5, 10.24 Acres**

### **Overstory Summary Narrative**

Data was collected in 2011, within the two plantations. The younger plantation occupies the northern half of the site and is approximately 10 years old. Dominated now by Ash and Pin oak the planting is only 50 percent stocked since no maintenance was performed. A dense grass base, Multiflora rose and Calvary pear dominate the ground and shrub layer. Deer pressure is intense.

### **Recommendations**

Specific recommendations include, strip spraying all trees rows to remove dense grass, mow the entire site and replant 150 (1-3-gallon oaks per acre) for a total of 750 trees to adequately stock the plantation.

The second plantation is approximately 20 years old and is dominated by Trident maple that was planted. Associate species that are well established are White oak, Pin oak and Willow oak. The plantation is functional and productive.

### **Long Term Harwood plantation Maintenance:**

All plantations at Aberdeen Proving Ground should be managed beyond the two-year maintenance and survival period.

Below are popular silvicultural methods used to maintain tree plantations:

### **Integrated Vegetation and Pest management**

Integrated Vegetation Management should include mowing to control most of the weed growth. Post and pre-emergent herbicides should be used selectively around the tree seedlings and samplings. After planting care is very important; trees should be inspected regularly for invasion from insects and/or animals. For most insects Malathion and Pyrethrum can be used for control. For deer, rabbits, ground hogs, voles and mice, Repellex or a similar type product is most effective.

Weed control is needed after the trees have been established. A pre -emergent should be re-applied in early spring (March) before leaf-out occurs. When applying a post emergent during the growing season, it is important to prevent tree/shrub leaf contact when spraying the base for weeds.

The main objective of managing pests and diseases in plantations is to keep them in a healthy, productive condition. IPM inspections help define the outbreak and the most ecologically available control method. Often chemicals do not need to be used; as beneficial insects (such as spiders and ladybugs) will control an unwanted population of insects on their own.

Insects and disease can be a secondary factor with the primary causes of the pest or disease, being stress from overstocking, over-maturity, poor site/species relationship. A sound IPM program for each plantation consists of prevention and suppression. Prevention consists of actions taken to make trees and forests less hospitable to the build-up of pests and diseases and/or preventing new introductions. Direct

suppression consists of biological, chemical or mechanical tactics designed to reduce pest and disease populations and subsequent losses. IPM systems consist of a combination of monitoring and action tools designed to reduce pest-induced losses.

Deer control falls within pest management activities. Deer shelters are the best mechanisms available until population density can be controlled. Shelters need to be maintained 3 to four times annually to make insure they are functional.

### **Corrective Pruning**

The purpose of pruning is to train trees to a single straight stem and develop more valuable, knot-free trunks. Pruning and thinning should be considered together. Do not prune a weak, poorly formed tree that will be removed at a thinning. High-density plantations have lower pruning costs than low-density plantations. The larger the initial tree spacing, the more artificial pruning will be required to produce a clear bole. However, a higher tree density requires a thinning earlier to reduce competition. The close spacing of trees in high-density plantations forces an upright growth habit and causes natural pruning of the lowest branches as a result of lack of light.

Pruning some branches increases the growth rate of the remaining branches as the same amounts of nutrients are available to a lesser amount of tree. This beneficial effect lasts for one year. By directing the tree's growth through pruning, one can improve the growth and form of the tree. In contrast, careless pruning can significantly reduce growth, introduce disease, and reduce timber value. Pruning to develop a single stem can begin when trees are 2 years old. Young trees 1 to 6 years old are most commonly pruned in late winter, as close to bud break as practical. The most common problems that require pruning are co dominant stems (upright branches that compete with the main leader of the tree), low limbs growing upward into the canopy, forks (vigorous lateral branches arising from the central leader with a narrow, less than 45° branch angle), dead branches, epicormic sprouts, and branches that cross over each other. Pruning should start at the top of each tree and proceed down to the trunk. This top-to-bottom approach is valuable because pruning cuts will be overgrown rapidly with the onset of active growth in the spring.

Regardless of tree age, it is important to remove any dead, broken, diseased, or dying branches. A key factor is to identify the main stem or leader, any branches that will compete with it, and decide how much of the competing stems should be removed. Any branch that originates in the bottom half of the tree that has grown into the top third of the canopy should be either removed or subordinated. No more than 25 to 30 percent of the foliage should be removed in any year, especially if a tree is mature. Side limbs should be pruned before they reach 1 inch in diameter. One and a half to 2-inch limbs may also be pruned safely if proper technique is used. Lower limbs larger than 2 inches may be cut back to a short stub and gradually removed over a 2 to 3-year period.

Pruning too many limbs can lead to bole sprouts (epicormic sprouts). Hardwood species differ widely in their tendency to grow epicormic sprouts. For example, white oak is very prone to epicormic sprouting. Epicormic sprouts should be removed as soon as possible because they will lead to the formation of knots.

Timber trees must have a harvestable butt log with a clear stem a minimum of 8 ½ feet in length. The goals should be to produce a clear stem 17 feet in length requiring pruning to a height of 18 to 20 feet.

## **Coppicing**

Badly malformed trees may be cut back close to the ground; a pruning technique known as coppicing. This low coppice should take place while trees are dormant. If there is plenty of light, the stump will typically produce several shoots. The larger the diameter of the coppiced stump, the more shoots will grow. A single shoot should be selected from the many stump sprouts after 1 or 2 years of growth, and the other competing branches and stems removed.

## **Thinning**

As a plantation matures, trees become crowded and competition among them causes growth rates to decline. Thinning is the selective process of removing trees to allow the maximum growth especially grown development in others. Thinning also provides the opportunity to selectively remove poorly formed trees and species of lower value. The need for thinning will arise faster and be more important for high-density plantation on good sites with high survival.

The goal of thinning is to maintain a steady growth rate; therefore, monitoring the growth rate of the trees is important.

Trees planted at high density usually require two pre-commercial thinning before harvest. In pure hardwood plantations, a first thinning is typically necessary when the trees are 8 to 15 years old; just before the crowns start to touch each other (crown closure). The second thinning occurs when trees are between 20 and 25 years of age.

**Note:** All plantations should be inspected twice a year at minimum to record site condition's and customize a silvicultural plan based on current stand conditions.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
44-5	Perform maintenance on younger plantation	5
	Re-establish plantation when mitigation is needed	
	Inspect twice a year	
	Prepare new Plan	10.24

## **Aberdeen Area: Forest Map 44, Stand 44-7, 27.34 Acres**

### **Overstory Summary Narrative**

This stand has been set aside to satisfy Forest Mitigation associated with Bay Side Development. Data was collected in 2011, this stand is dominated by Northern Red oak and Tulip poplar with associate species being; Sweetgum, Black cherry, Beech, Black gum and Ash. This stand has trees over 150 years old. The understory is comprised of an average 1,800 Sweet gum saplings per acre. Privet, Oriental bittersweet, Honeysuckle, English ivy, Catalpa and Multiflora rose are also present. Advanced Oak, Ash or Poplar regeneration was found in 90 percent of the plots but is competing with dense Sweet gum. Highly invasive and alien understory is hindering regeneration as well, along with the intense deer browse. This stand had storm damage that created openings and uprooted mature trees, leaving only invasive plants in the void.

This very mature stand has the following diameter distribution breakdown:

Mature	26"+	72%
Sawtimber	11-23.9"	25%
Pole	6-10.9"	3%
Small tree	2-5.9"	0 %

Currently the stand contains 66 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 107 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand an 80% stocking level. From a tree form and vigor stand most of the trees are acceptable.

### **Recommendations**

Manage towards Old Growth:

Old Growth forests have well developed structures; legacy or large trees, multiple aged trees and abundant down wood along with numerous standing dead snags. Old growth structure creation/restoration through active low-key management leaving all trees and biomass on site can be performed to enhance these characteristics. Actively pursue Old Growth in this mature stand by, designating legacy trees, increasing growth for the larger trees, create standing dead, create canopy gaps to aid in natural regeneration, establish a diversity of trees sizes, favor all species and create down woody debris often found in Old growth forest.

Researchers have found that there is no one specific condition to aim for as a condition of old growth, instead find it more valuable to increase the number of characteristics associated with these types of forest communities.

Create Multiple Canopy Layers: Release advanced regeneration and encourage new regeneration associated with natural forest type. To accomplish this goal, all Sweet gum in the understory should be removed and treated with an herbicide to prevent sprouting; this will release the existing natural forest type regeneration. Undesirable saw and pole timber 12 sq. ft per acre can be girdled, left standing for wildlife while creating additional growing space for regeneration and allowing sunlight to reach the forest floor.

Once canopy gaps are created by girdling poorly formed trees and the understory is free of Sweet gum and invasives, shelter 200 trees per acre (with a 6-foot shelter height) of Oak and Poplar to aid in regeneration of this stand. Controlling invasives and alien plants is imperative to natural regeneration success. Deer control should be increased in this area as well.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
44-7	Actively manage for Old Growth to encourage regeneration	27.34
	Control invasives	
	Prepare new Plan	

## **Forest Map 45, Stand 45-3, 43.14 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Poplar and Sweet gum with associate species being; Hickory, Red oak, White oak, Sycamore, Black cherry and Red maple. Paw paw were found in the understory. Invasive plants include Honeysuckle, Multiflora rose, Grapevine and Poison ivy.

This is a mature sawtimber stand d.b.h. ranges 12” – 24”.

This stand is adequately stocked with 85-90% canopy closure.

### **Recommendations**

- This site contains an Eagle Buffer follow APG Eagle restrictions.
- This stand has giant trees throughout. Multiple 38” Sweet gum and Poplar along with a 40” + White oak.
- This area has potential to be managed as an old growth forest.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
45-3	commercial TSI control invasives examine stand for commercial harvest	43.14

**Forest restoration work completed in July 2017.** The site was scanned for ordinance, forest restoration was performed based on the delivery order. Thirty-one acres is still available for future restoration activities.

The understory was comprised of dense Pawpaw, Brambles and Vines which shaded out the forest floor. Mar-Len Environmental, Inc. (MLE) removed mid story, and unacceptable over story trees; allowing sunlight to filter to the forest floor. MLE also restored the natural distribution of native trees, favoring Oaks, and Poplar to dominate the stand. Lower density exists in portions where mature trees have died and alien plants have filled the gaps.

Trees with poor form and vigor were clearly marked to be cut to reduce environmental stress in the stand, numerous trees were hollow, dying or diseased. Following the removal of undesirable species, the ground was scarified where possible to allow seed drop to come in direct contact with the soil. Large strangling vines were also cut from trees to reduce negative impacts to the healthy crowns. Removing vines reduces the seed source.

Other activities include:

- Secured Range Work Request and organized Tower Support for UXO sweep.
- Perform UXO scan of the entire project area.
- Marked poor quality trees for removal.
- Cut trees and consolidated brush piles where possible to expose the forest floor.
- Mowed tops and lops to reduce fuel load.

- Scarified site to promote soil and seed contact.
- Flagged 300 locations and UXO scanned for planting
- Treated site with herbicide to remove invasive plant competition.

## **Forest Map 46, Stand 46-17, 3.48 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum, Sycamore, Red maple and Yellow poplar with associate species being; Persimmon and Black cherry. Sweet gum regeneration and Holly were found in the understory. Invasive plants include Microstegium, Barberry, Switch grass and Ailanthus.

This stand is a mixture of sawtimber 12" – 23.9" and pole timber 6" – 11.9".

This stand is under stocked with 60% canopy closure.

### **Recommendations**

-This stand provides FID habitat and should maintain a basal area of 90 ft/ac average with at least 70 percent canopy closure at all times.

-This site contains an Eagle Buffer follow APG Eagle restrictions.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
46-17	commercial TSI	3.48
	control invasives	
	examine stand for commercial harvest	



## **Westwood Area: Forest Map 46, Stand 46-18, 7.35 Acres**

### **Overstory Summary Narrative**

Data collected in 2003 states this stand is dominated by Loblolly pine with associate species being; White oak, Sweet gum, Green ash and Red maple. No information was collected on the understory.

This small sawtimber stand has an average diameter of 10.7

Currently the stand contains 249.72 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 180 sq.ft. per acre average. The number of trees correlated with the B.A. gives this stand a 108.3% stocking level. From a tree form and vigor stand point, 75.0% of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration and is grossly overstocked
- Favor pines with a good crown ratio as well as any oaks in the stand
- Reduce basal area to 70- 80 sq. feet per acre of high-quality trees at each 10-year thinning.
- Allow this 48-year-old stand to mature to 80 years old before seed tree cut

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
46-18	TSI Collect data / plan for regeneration	7.35

## **Spesutie Island: Forest Map 46, Stand 46-19, 4.43 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Pin oak, Persimmon and Black gum. Blueberry and Sweet gum saplings were found in the understory. Invasive plants include Honeysuckle and dense Multiflora rose.

This is a sawtimber stand d.b.h. ranges 12” – 23.9”.

Currently the stand contains 150 trees per acre. This stand is adequately stocked with 95-100% canopy closure.

### **Recommendations**

- Favor high quality Sweetgum as crop trees
- Reduce Basal area to 80 sq. feet per acre, let grow for 15 years.
- Follow Eagle restrictions

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
46-19	commercial TSI control invasives examine stand for commercial harvest	4.43

## **Spesutie Island: Forest Map 46, Stand 46-20, 11.88 Acres**

### **Overstory Summary Narrative**

Data collected in 2009 states this stand is dominated by Sweet gum with associate species being; Pin oak and Persimmon. Blueberry, Holly, Multiflora rose, Honeysuckle, Greenbrier and some grass were found in the understory. Invasive plants include Honeysuckle, climbing bittersweet, Multiflora rose and Grapevine.

This is a pole timber stand d.b.h. ranges 6" – 16".

Currently the stand contains 300 trees per acre. This stand is currently overstocked with 100% canopy closure.

### **Recommendations**

- An effort should be made to control deer population.
- Remove invasive plants concentrating on heavy Multiflora rose.
- Harvest with stand SP-2, adjacent smaller stand.
- Reduce to 80 BA of high-quality crop trees, let grow 15 years.
- Follow Eagle restrictions

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>
46-20	commercial TSI control invasives examine stand for commercial harvest	11.88

## **Churchville: Forest Map 48, Stand 48-1, 15.54 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This stand is dominated by high quality mature Tulip poplar, mixed upland Oaks and Beech. Associate species include: Ash, Hornbeam, Blackgum and Dogwood. The understory contains native Paw paw, which tends to become dense if not controlled. Invasive plants although not abundant consist of Barberry and Wineberry. The stand has nice quality trees in the overstory; however, no advance regeneration was found in any plots

This large sawtimber stand has the following diameter distribution:

Mature	26"+	42%
Sawtimber	11-23.9"	49%
Pole	6-10.9"	8%
Small tree	2-5.9"	1%

Currently the stand contains 92 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 176 sq. ft per acre average. The number of trees correlated with the B.A. gives this stand a 110 % stocking level. From a tree form and vigor stand point 67% of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest using a two stage shelterwood harvest.
- Shelter wood harvest to reduce Basal area to 60 sq. feet per acre of good seed trees.
- Collect data 15 years later for regeneration to see if remaining sawtimber can be removed.
- A final harvest in a shelterwood series or the overstory removal of residuals which will release established regeneration from competition with the existing overstory.

A commercial saw log sale, removing 70 sq. ft. of mature trees and 38 sq. ft. of basal area in poor quality sawtimber (when merchantable timber is removed canopy gaps will increase sunlight to forest floor and aid in regeneration). The areas of dense shrubs and small poor-quality trees can be mowed to aid in preparing the site for restoration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
48-1	shelter wood harvest	15.54	2019
	collect data/prepare plan for harvest	15.54	2029
	(Final harvest if regeneration is adequate)		
	Prepare new plan	15.54	2035

## **Churchville: Forest Map 48, Stand 2 7.95 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This stand is dominated by high quality mature Tulip poplar, mixed upland Oaks and Beech. Associate species include: Ash, Hornbeam, Hickory, Sassafras, Blackgum and Dogwood. The understory contains native Black haw which tends become dense if not controlled. Invasive plants, although not abundant consist of Barberry, Autumn olive and Wineberry. The stand has nice quality trees in the overstory; however, no advance regeneration was found in any plots

This large sawtimber stand has the following diameter distribution:

Mature	26"+	43%
Sawtimber	11-23.9"	49%
Pole	6-10.9"	7%
Small tree	2-5.9"	1%

Currently the stand contains 166 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 110 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 90 % stocking level. From a tree form and vigor stand point, 49% of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest.
- Harvest with stand 48-1.
- A commercial saw log sale with low grade logs primary part of the 47 sq. ft. per acres of unacceptable sawtimber will be cut leaving the high quality matures and acceptable sawtimber for a total Basal Area remaining in crop trees of 54 sq. ft. Canopy gaps will increase sunlight to forest floor and aid in regeneration. The areas of dense shrubs and small poor-quality trees can be mowed to aid in preparing the site for restoration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
48-2	Selection harvest	7.95	2019
	Prepare new plan	7.95	2035

## **Churchville: Forest Map 48, Stand 48-3, 26.43 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This stand is dominated by high quality mature Tulip poplar, mixed upland Oaks and Beech. Associate species include: Hickory, Hornbeam, Blackgum and Dogwood. The understory contains native Spicebush and Mt. Laurel which can become dense if not controlled. Invasive plants although not abundant consist of Barberry and Wineberry. The stand has nice quality trees in the overstory however; no advance regeneration was found in any plots

This large sawtimber stand has the following diameter distribution:

Mature	26"+	51%
Sawtimber	11-23.9"	32%
Pole	6-10.9"	11%
Small tree	2-5.9"	6%

Currently the stand contains 112 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 180 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110 % stocking level. From a tree form and vigor stand point, 73% of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest using a two stage shelterwood harvest.
- Shelter wood harvest to reduce Basal area to 65 sq. feet per acre of good seed trees.
- Collect data 10 years later for regeneration to see if remaining sawtimber can be removed.
- A final harvest in a shelterwood series or the overstory removal of residuals which will release established regeneration from competition with the existing overstory.
- Steep north facing slopes along Deer Creek will need to be buffered at 50 ft. from stream and 4 ft. for every 1% slope.

A commercial saw log sale, removing 72 sq. ft. of mature trees and 24 sq. ft. of basal area in poor quality sawtimber (when merchantable timber is removed canopy gaps will increase sunlight to forest floor and aid in regeneration). The areas of dense shrubs and small poor-quality trees can be mowed to aid in preparing the site for restoration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
48-3	shelter wood harvest	26.43	2019
	collect data/prepare plan for harvest	26.43	2029
	final harvest if regeneration is adequate.		
	Prepare new plan	all	2035

## **Churchville: Forest Map 48, Stand 48-4, 11.84 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This stand is dominated by high quality mature Tulip poplar, mixed upland Oaks and Beech. Associate species include: Hickory, Hornbeam, Blackgum and Dogwood. The understory contains native Spicebush and Mt. Laurel which can become dense if not controlled. Invasive plants although not abundant consist of Barberry, Privet and Wineberry. The stand has nice quality trees in the overstory however; no advance regeneration was found in any plots

This large sawtimber stand has the following diameter distribution:

Mature	26"+	51%
Sawtimber	11-23.9"	32%
Pole	6-10.9"	11%
Small tree	2-5.9"	6%

Currently the stand contains 90 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 146 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 68% of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest using a two stage shelterwood harvest.
- Shelter wood harvest to reduce Basal area to 65 sq. feet per acre of good seed trees.
- Collect data 10 years later for regeneration to see if remaining sawtimber can be removed.
- A final harvest in a shelterwood series or the overstory removal of residuals which will release established regeneration from competition with the existing overstory.

A commercial saw log sale removing 47 sq. ft. of mature trees and 32 sq. ft. of basal area in poor quality sawtimber (when merchantable timber is removed canopy gaps will increase sunlight to forest floor and aid in regeneration). The areas of dense shrubs and small poor-quality trees can be mowed to aid in preparing the site for restoration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
48-4	shelter wood harvest	11.84	2019
	collect data/prepare plan for harvest	11.84	2029
	final harvest if regeneration is adequate.		
	Prepare new plan	all	2035

## **Churchville: Forest Map 48, Stand 48-5, 11.57 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This stand is dominated by high quality mature Tulip poplar, mixed upland Oaks and Beech. Tulip poplar is the most prevalent tree. Associate species include: Hickory, Hornbeam, Ash, Blackgum and Dogwood. Invasive plants although not abundant consist of Barberry, Stilt grass and Wineberry. The stand has nice quality trees in the overstory however; no advance regeneration was found in any plots

This large sawtimber stand has the following diameter distribution:

Mature	26"+	14%
Sawtimber	11-23.9"	75%
Pole	6-10.9"	7%
Small tree	2-5.9"	4%

Currently the stand contains 165 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 197 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 120% stocking level. From a tree form and vigor stand point, 70% of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest using a two stage shelterwood harvest.
- Commercial harvest to reduce Basal area to 80 sq. feet per acre of good seed trees.
- Buffer small stream along eastern boundary.
- Kill beech seedlings and saplings.

A commercial saw log sale removing 28 sq. ft. of mature trees and 38 sq. ft. of basal area of acceptable sawtimber and 30 sq. ft. of poor quality sawtimber; when merchantable timber is removed canopy gaps will increase sunlight to forest floor and aid in regeneration.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
48-5	Commercial harvest	11.57	2019
	Prepare new plan	all	2035

**Churchville: Forest Map 48, Stand 48-6, 6.14 Acres**



### **Overstory Summary Narrative**

Data was collected in 2017. This stand is dominated by high quality mature Tulip poplar. Associate species include: Hickory, Black Oak, Locust, Ash, Black gum and Sassafras. Invasive plants although not abundant consist of Barberry, Stilt grass, Autumn olive and Wine berry. The stand has nice quality trees in the overstory however; no advance regeneration was found in any plots

This large sawtimber stand has the following diameter distribution:

Mature	26"+	9%
Sawtimber	11-23.9"	79%
Pole	6-10.9"	19%
Small tree	2-5.9"	1%

Currently the stand contains 147 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 216 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 120% stocking level. From a tree form and vigor stand point, 71% of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability of the forest using a two stage shelterwood harvest.
- Commercial harvest to reduce Basal area to 80 sq. feet per acre of good seed trees.
- Kill beech seedlings and saplings.
- Treat with herbicide invasive plants.

A commercial saw log sale removing 20 sq. ft. of mature trees and 53 sq. ft. of basal area of acceptable sawtimber and 40 sq. ft. of poor quality sawtimber (when merchantable timber is removed canopy gaps will increase sunlight to forest floor and aid in regeneration).

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
48-6	commercial wood harvest	6.14	2019
	prepare new plan	all	2035

## **Churchville: Forest Map 48, Stand 48-7, 9.11 Acres**

### **Overstory Summary Narrative**

Data was collected in 2017. This stand is dominated by high quality mature Tulip poplar. Associate species include: Hickory, Maple, Beech, Ash, Blackgum and Virginia pine. Invasive plants although not abundant consist of Barberry Stilt grass, Autumn olive and Wine berry. No regeneration was present.

This large sawtimber stand has the following diameter distribution:

Mature	26"+	23%
Sawtimber	11-23.9"	50%
Pole	6-10.9"	16%
Small tree	2-5.9"	11%

Currently the stand contains 160 trees per acre with an average B.A. (Basal Area- a measure of stand density measured in square feet per acre taken at 4 ½ feet above the ground) of 134 sq. ft. per acre average. The number of trees correlated with the B.A. gives this stand a 110% stocking level. From a tree form and vigor stand point, 57% of the trees are acceptable.

### **Recommendations**

- The forest lacks natural regeneration, favor poplar and oak as crop seed trees
- Reduce deer browse and thin the stand to allow natural regeneration to ensure sustainability
- Stand improvement cut to reduce Basal area to 75 sq. feet per acre
- Kill beech seedlings and saplings
- Treat with herbicide invasive plants

The acceptable mature 32 sq. ft per acre, along with the acceptable sawtimber 40 sq. ft. and 4 sq. ft. of quality pole timber create the stocking need to provide a quality stand. The unacceptable stock can be removed in a pulp or fire wood thinning or restoration project.

<u>STAND</u>	<u>ACTIVITY</u>	<u>ACRES</u>	<u>Date</u>
48-7	TSI	9.11	2019
	Prepare new plan	all	2035

## EXPLANATIONS OF STAND MANAGEMENT RECOMMENDATIONS

The following information explains the actual processes of suggested practices from the Detailed Forest Study Data and should assist in carrying out the individual stand recommendations.

All silvicultural recommendations are for the purpose of reducing stocking to allow crop trees room to grow (TSI-Timber Stand Improvement) or to establish natural regeneration. Oak are the most ecologically important trees in the Chesapeake Bay Water shed and should be favored as a Forest Cover type (The Conservation Fund, “The State of Chesapeake Forest” 2006). *Quercus* is the genus in which all oaks are classified. This genus has three subgenera, of which only two are found in the United States; *Lepidobalanus* which includes the white oaks and *Erythrobalanus* which includes the red and black oaks. The red oak group takes two years to produce an acorn while white oaks develop acorns annually. Both produce maximum acorn production from age 50 to 200 years (Society of American Foresters, “Forest Cover Types of North America”, 1975).

All plants require sunlight to become established and survive. Adequate sunlight is crucial for successful oak regeneration. Trees that compete best for full sunlight are often found in the upper canopy of the forest.

Poplar trees require full sunlight to become established and are considered intolerant to shade while oaks are considered mid-tolerant and can establish but **not** thrive in partial shade.

The mature Oak and Oak Poplar forests in the Proving Ground are the result of continuous clearing or large-scale disturbances. Soil disturbance creates ideal seed beds for acorns to become established. Repeated fires aided oak regeneration and canopy removal provided adequate sunlight which increased the plants photosynthetic production stimulating regeneration.

A study by Hix et al (1991) found repeated browsing on oaks gives competing vegetation such as; red maple, black gum, beech and exotic species a greater advantage of occupying the forest.

## STAND RECOMMENDATIONS

Note: Deer must be controlled prior to any type of activities to increase regeneration in ALL Stands, as well as removal and control of undesirable vegetation that hinders the development of the desired natural regeneration.

### Forest Sustainability

Sustainable forestry requires a focus on growing new trees; we cannot practice sustainable forestry if we do not regenerate a healthy, young forest for future generations.

Most regeneration of hardwood forests occurs naturally, that is, without trees being planted; but many factors can affect forest regeneration. To regenerate naturally, the current forest must produce seedlings; stump sprouts, and root suckers that will become the next forest following a harvest. The main three factors affecting forest regeneration are:

- Deer impact,
- Competing vegetation
- and lack of light on the forest floor.

With regard to deer impact, through selective feeding deer have the ability to broadly affect forest plant communities. Specifically, they can reduce tree seedling numbers of preferred regeneration, such as oaks and tuliptree, as well as non woody plants, such as native wildflowers. In many areas, deer have reduced seedling numbers, shifted tree species composition to less desirable species, and slowed the growth of surviving seedlings. Research has shown that when the deer population density exceeds what the land can support, forest regeneration suffers. Deer have the ability to completely change the species found in the forest understory. Selective browsing can greatly reduce or eliminate preferred species or those not resilient to browsing. Obviously, this selective feeding favors less preferred, more resilient species. Deer food preferences vary by region and season, but in general, deer prefer oak, maple, ash, and tuliptree over species such as beech, sweetgum, and cherry. Deer, on average, consume four to eight pounds of browse per day for seven months of the year. Clearly, the deer herd has a tremendous potential to influence what grows in the forest.

## TYPES OF SILVICULTURAL SYSTEMS FOR REGENERATION

At the time of the inventories in 2001, 2003, 2009, 2011, 2014 and 2016 inventory work shows that the forest within GAPG exhibit extensive and intensive lack of natural regeneration. The sustainability of the forest, and its value, are dependent upon the continued recruitment of small trees, seedlings, shrubs, and herbaceous plants. Silvicultural treatments that guide the existing forest community toward the development of advanced regeneration (seedlings, saplings, etc.) are called ***reproductive methods*** and are rightly considered to be part of a complete silvicultural system. Compounding the constraints on the choice of regeneration systems is the presence of extremely high deer populations, which is the principal cause of the present lack of suitable advanced regeneration. Deer control needs to be a commitment, prior to any regeneration activity.

## GROUP SELECTION METHOD

Information From: *Maryland DNR Forest Service*

The group selection system does mimic natural forest processes by creating small canopy gaps. Such canopy gaps would normally occur due to individual and group mortality of trees. The periodic opening of canopy gaps leads to the formation of microclimates at and near the ground that are conducive to seedling emergence and development. Regeneration takes place under the protective cover of the older trees and approaches the process of the indigenous forest. The existing humus layer provides a favorable medium for seed germination and provides a protective environment for seedling development.

The group selection method, an uneven-aged silvicultural system, is used to convert an even-aged forest to an uneven-aged condition. Techniques to recreate adequate advanced regeneration through the group selection method include an initial preparatory felling to allow the best individual trees to expand their crowns and become more prolific seed producers, and five to eight years later the creation of one-half acre to one-acre plots. This method requires:

- a. The identification of individual trees by vigor and species that will contribute good genotypes for the next generation;
- b. Orderly guidance of the forest community to a site-specific condition; and
- c. Opening the forest canopy to allow the degree of light needed, to stimulate the development of the desired species of seedlings, to reach the forest floor. The release of the residual trees from crown level competition will also stimulate seed production, while continuing to provide watershed protection and an aesthetically pleasing environment.

**Advantages** of the group selection method also include (*Matthews 1989*):

- a. It is very flexible and well-suited to small forest areas where intensive working and close supervision are possible.
- b. It can accommodate a wide variety of species, from light-demanders to those that endure shade.
- c. Variation in sites can be matched to specific species and plant communities.
- d. It provides protection to tree species which are sensitive to frost, drought, and cold winds.
- e. The likelihood of damage by wind is reduced.
- f. The soil is protected through the gradual and cautious removal of the overstory.
- g. There is less risk of encroachment by invasive and exotic species.
- h. There is a reduced chance of insect infestation.
- i. Nitrogen sequestering remains high because the openings are buffered by adjacent Stands.
- j. The variation in heights and sizes adds to the aesthetic value of the areas being converted.

**Disadvantages** of the group selection method include:

- a. Silvicultural skill is needed in selecting groups for regeneration as well as for retention.
- b. The work of felling and extraction is scattered and at a small scale. It must be done by skilled workers under close experienced and knowledgeable supervision.

## Visualization of a Forest Stand after a Selective Harvest:

Stand Visualization System



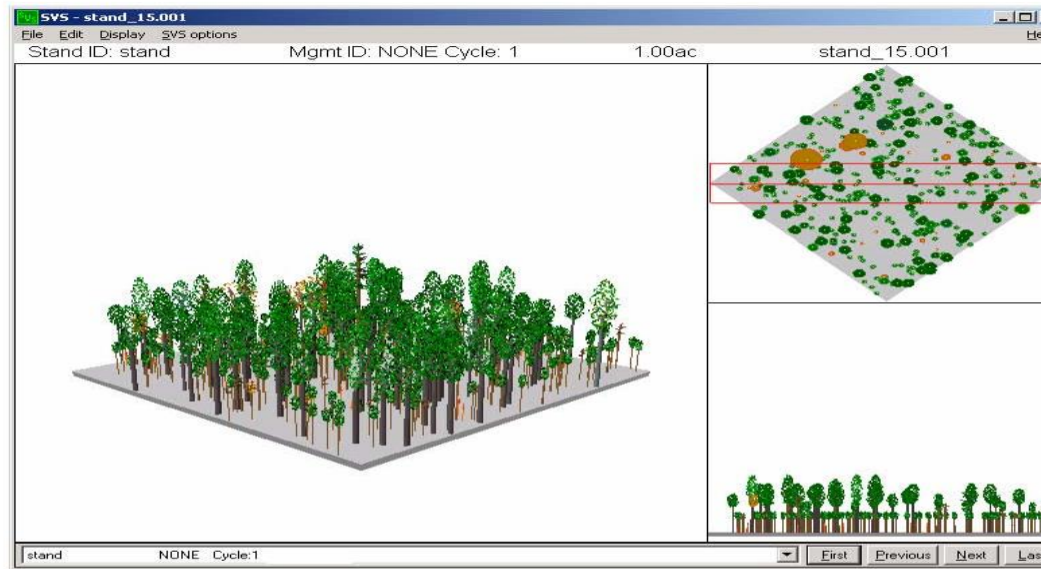
An option at GAPG is to aid the process of natural regeneration with artificial stocking to reduce the risk of failure, correct deficiencies in stock and provide the appropriate species composition to ensure that the Stand moves toward its optimum ecological range.

**Generalized Procedure:**

1. The Stand is reviewed to determine if the forest type is on its optimum site, or if the forest type will be redirected over the course of the initial phase of the group selection system.
2. The relative density of the dominant trees will be reduced to 50 percent for regeneration of shade intolerant species or 60 -70 percent for shade tolerant species.
3. Stocking of advanced regeneration will be reviewed periodically to determine the need for supplemental planting.
4. The second cut will occur when the forester has identified the satisfactory level of advanced regeneration. The second cut will lower the relative density to 25 percent. Trees that are left as the super dominants should be capable of withstanding the temporary open conditions and be resistant to wind throw and epicormic branching. These trees (25 percent) will form the Standards for this high forest configuration. These Standards will remain for 175 to 200 years.

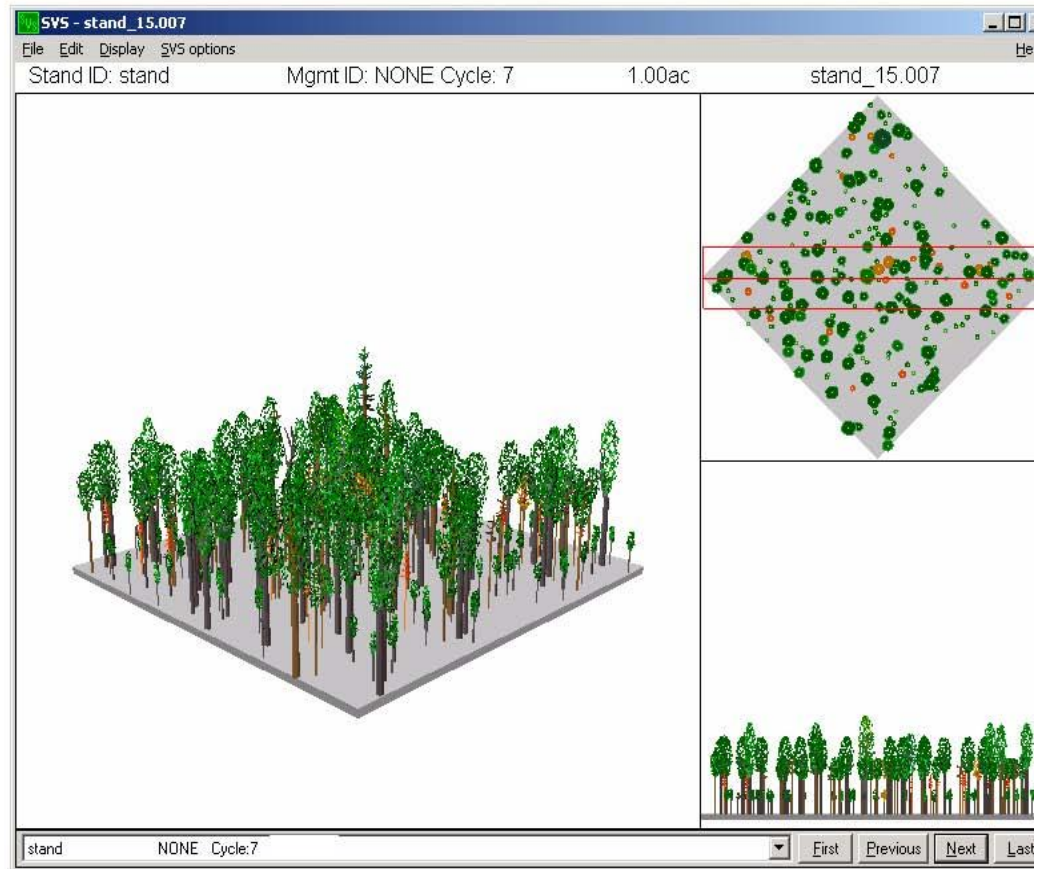
### Stand Visualization System Diagrams for Group Selection Regeneration Method:

Visualization is of a fully stocked Stand as is common throughout GAPG.

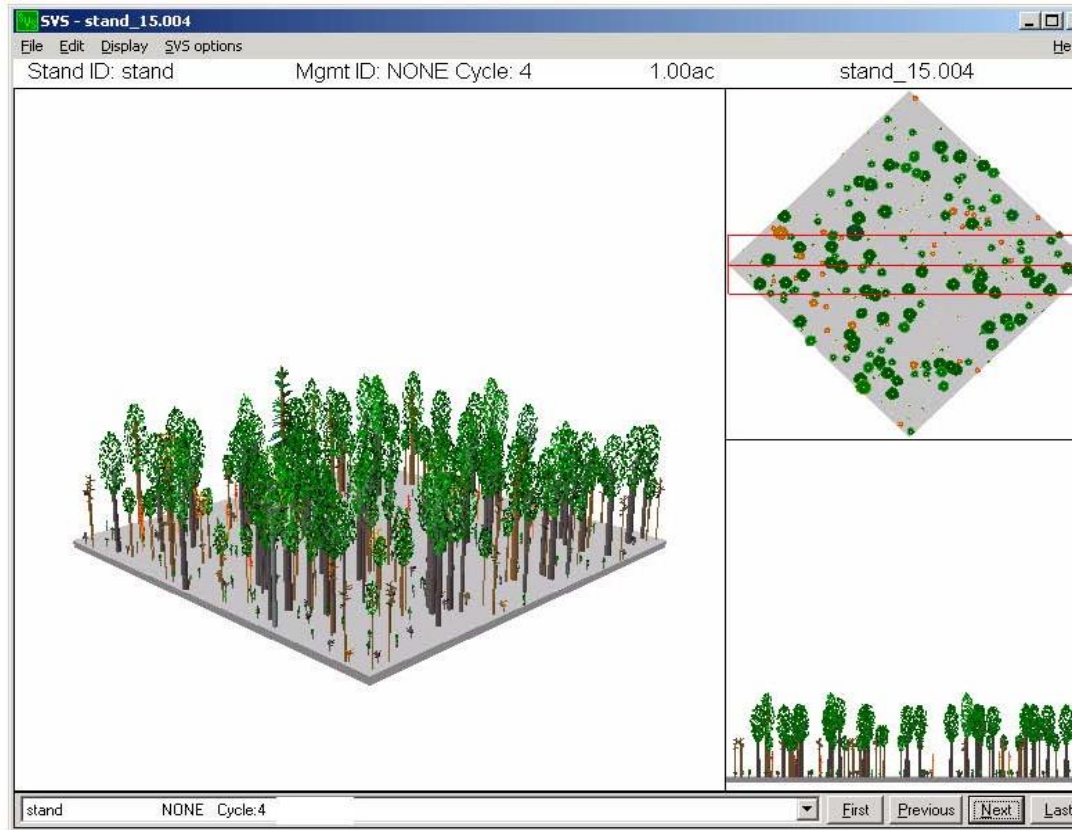




Visualization 15 years post group selection where groups of trees were removed to create larger canopy openings  $\frac{1}{2}$  acre or less.



Visualization 20-years after creating openings. The release of residual trees from crown level competition stimulates seed production.



## SHELTERWOOD METHOD

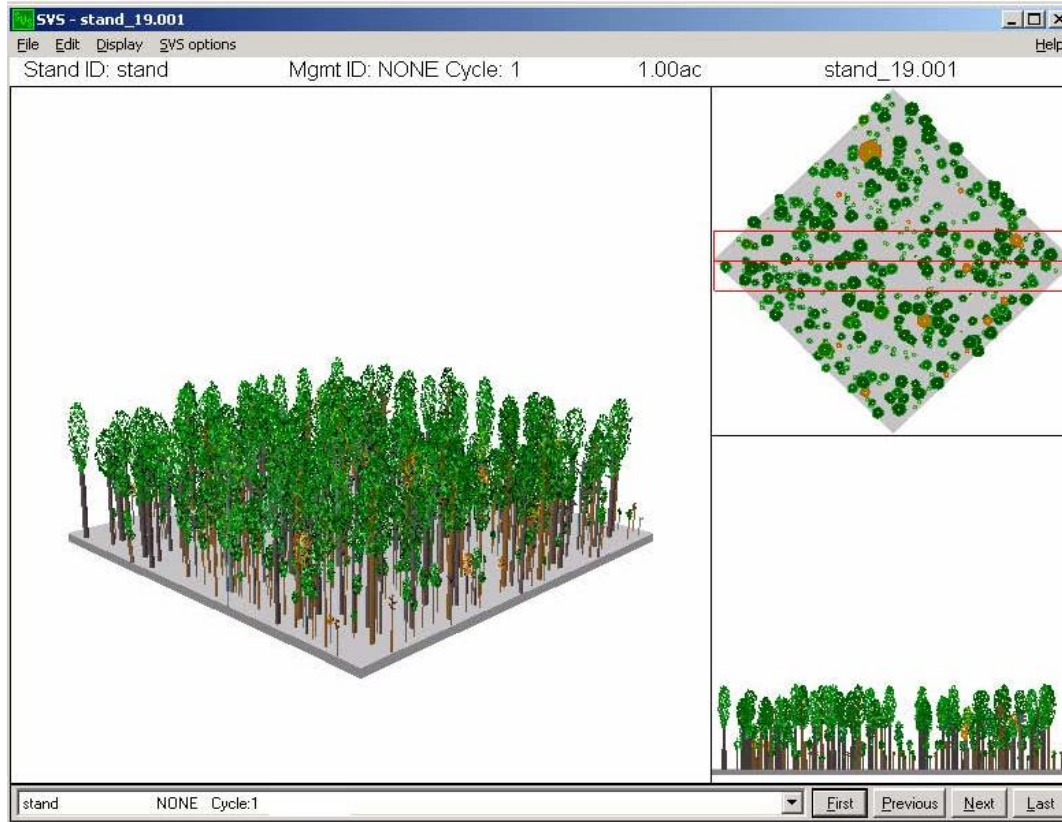
The shelterwood method produces an even-aged Stand, but in contrast to opening patches, this method commonly consists of a series of two or more partial cuts spaced over several years. The major ecological objective of a shelterwood is to create a partially shaded and protected environment in the understory where young trees can become established and grow. This is particularly beneficial for species that initially do not compete well with other trees and shrubs due to lack of sunlight. Once the desired reproduction is well-established, the remaining larger trees are harvested. One advantage of the shelterwood method is that it produces far less negative visual impact than a clear cut because the harvested area always is dominated by trees, while the debris (branches, tops, etc.) generated by the harvest is less visible.

A two or three cut shelterwood system has been used to reproduce a variety of hardwood species. In a three-cut system, the first cut removes enough of the Stand to stimulate the crowns to increase seed production and hastens the decomposition of soil surface organic matter to form a suitable seedbed. Several years later (commonly 5 yrs. to 10-15 yrs.), a second cut removes approximately half of the remaining stand to create conditions suitable for the establishment and early growth of young trees. Finally, several years later when adequate regeneration has become established, the remaining trees are harvested. Some care is necessary during the final harvest to minimize damage to the young, even-aged Stand that is developing. The final cut can be eliminated and mature trees can be left to grow creating a more uneven-aged forest.

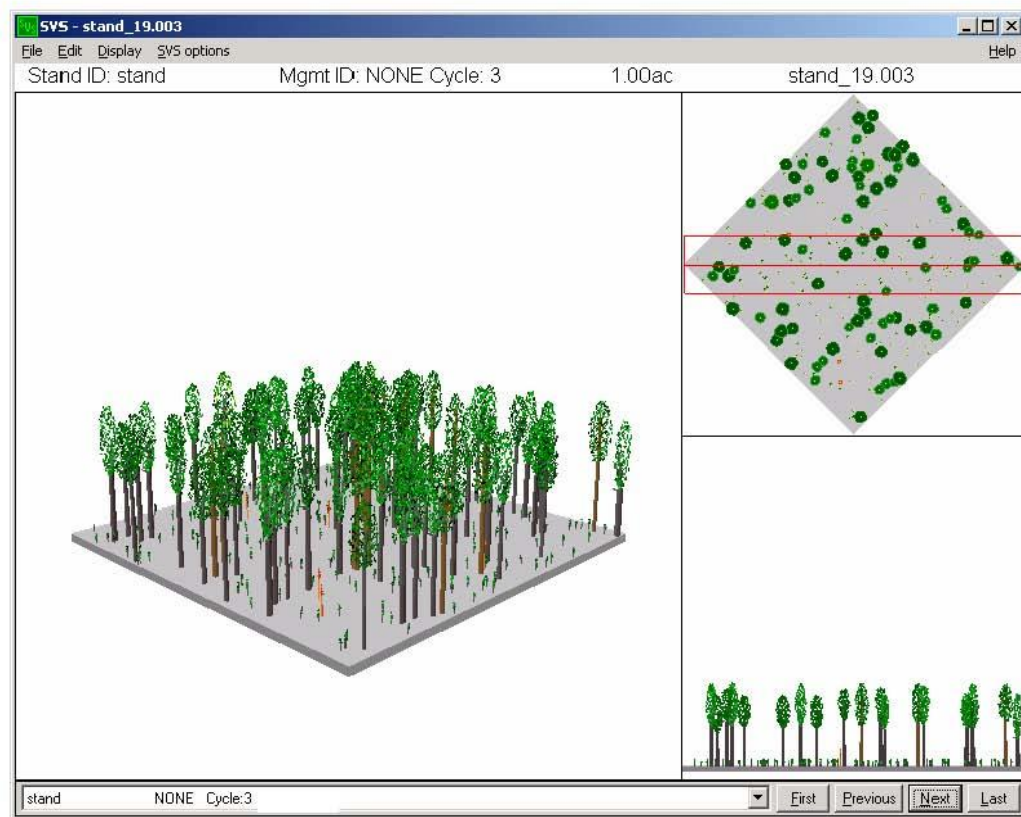
SHELTERWOOD	
Advantages	Disadvantages
<ul style="list-style-type: none"><li>▯ Reproduction of desirable species may be more certain than with clear cutting.</li><li>▯ Slash disposal less of a problem than with clear cutting.</li><li>▯ May be more effective with heavy-seeded species such as oaks.</li><li>▯ Less invasion of undesirable vegetation than with clear cutting.</li><li>▯ Opportunity for genetic improvement in the regenerated Stand.</li></ul>	<ul style="list-style-type: none"><li>▯ Requires a market for small and low-quality trees.</li><li>▯ Remaining trees must be wind-firm.</li><li>▯ Requires more technical skills of forester and logger than clear cutting.</li><li>▯ Removal cutting damages some young trees.</li><li>▯ Epicormic branching on trees in final harvest may result in decreased quality.</li></ul>

### Stand Visualization System Diagrams for Shelterwood Regeneration Method:

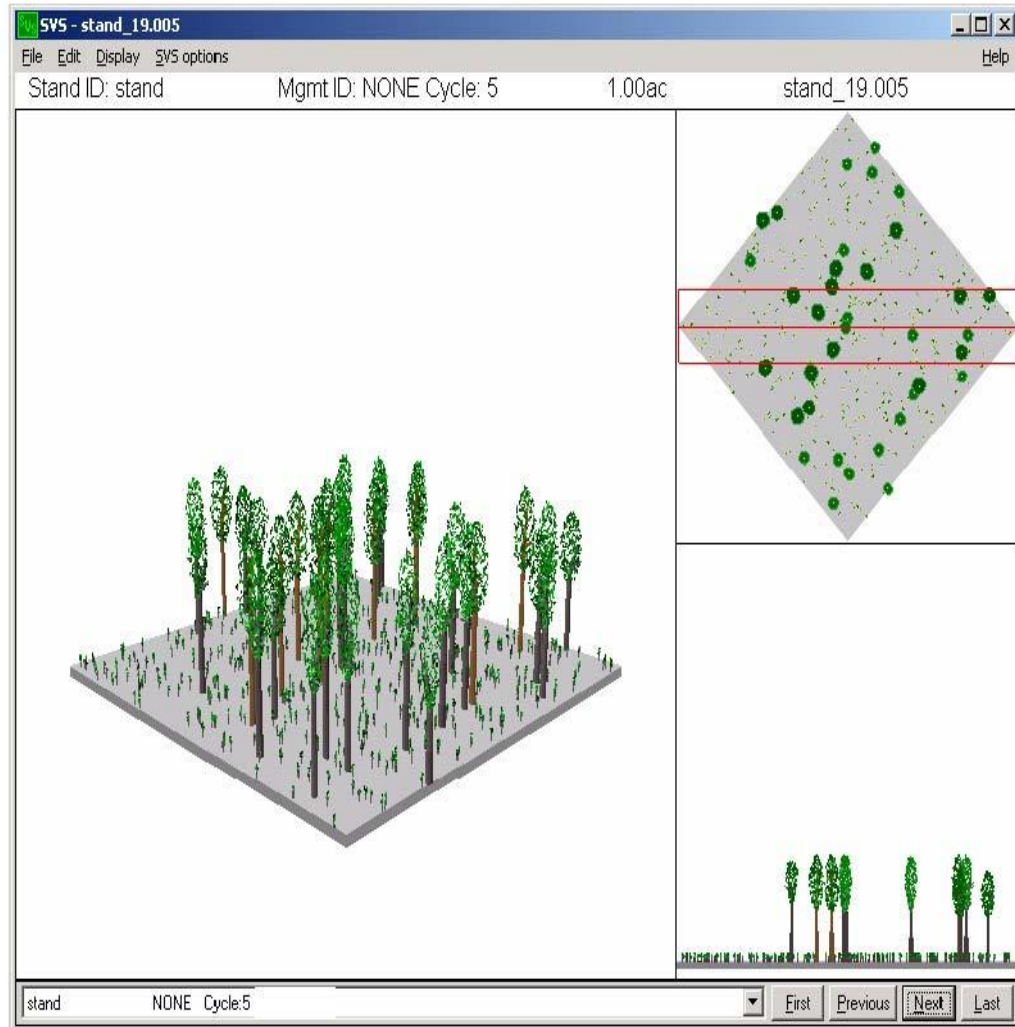
Visualization of overstocked Stand with little to no regeneration and a dense canopy.



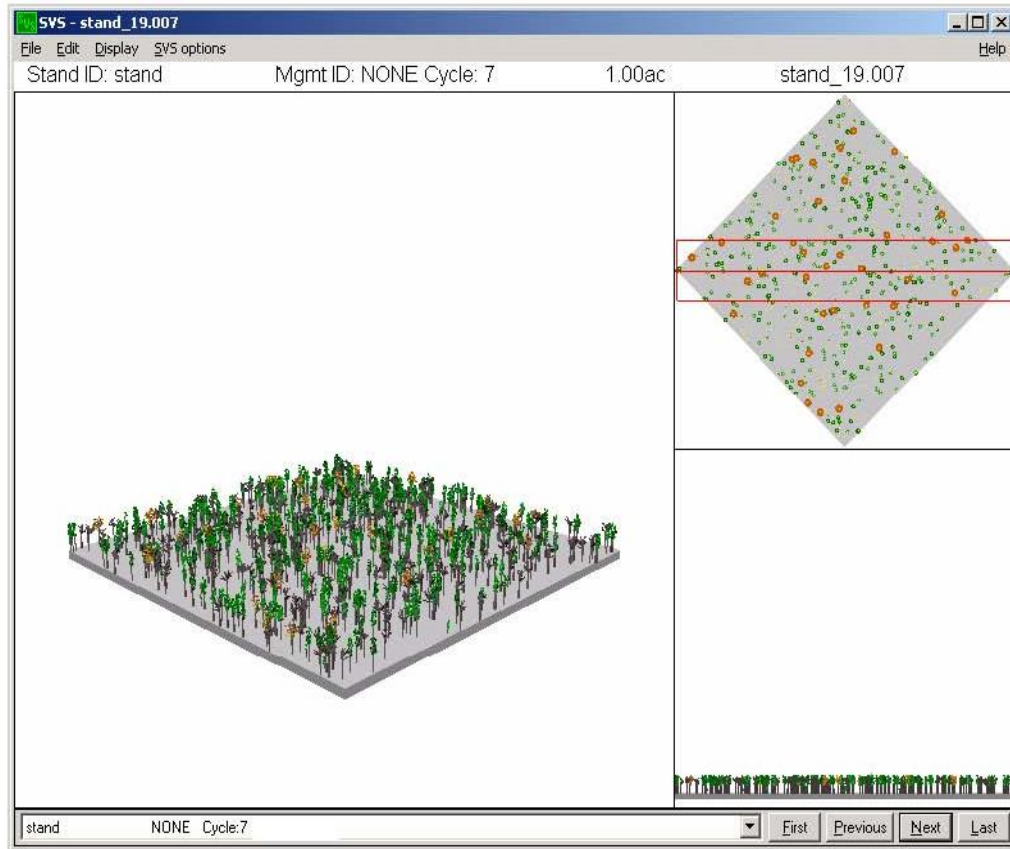
Visualization, first thinning involves removing a large portion of the trees, leaving high quality seed trees.



Visualization shows a second thinning further reducing Stand density 10 years after first thinning.



Visualization, twenty years after initial thinning all overstory trees are removed, allowing Oak and Poplar regeneration (1-3 inches in diameter) to receive full sunlight for maximum growth.





## SINGLE TREE SELECTION METHOD

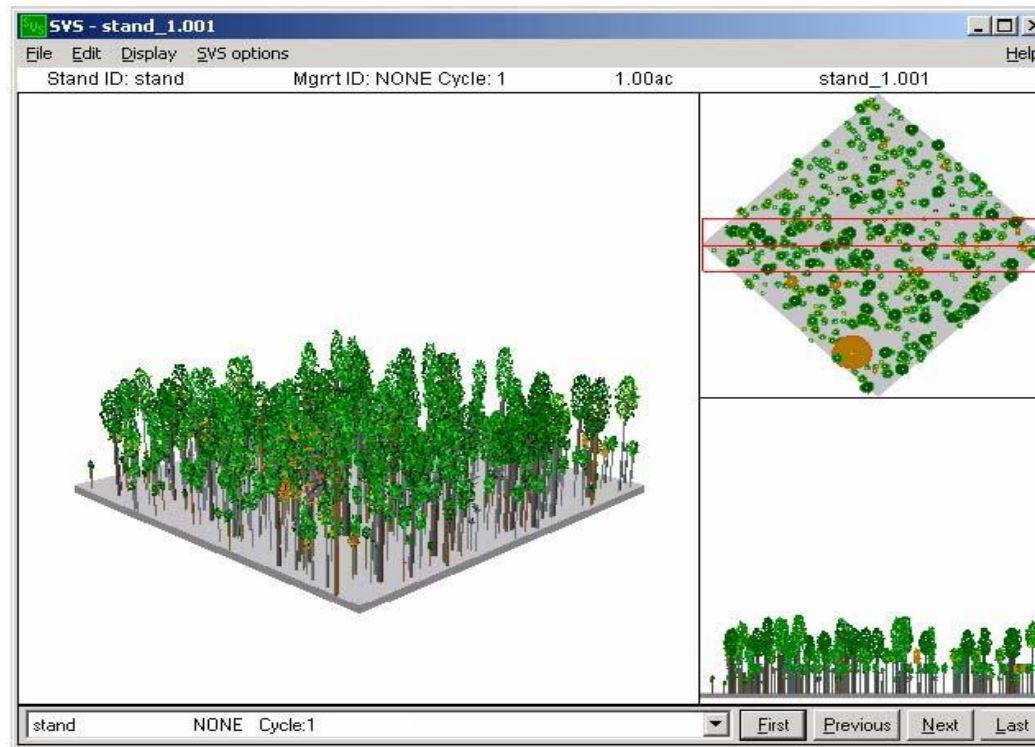
Selection is a regeneration method in which individual trees are periodically (commonly every 10-15 years) harvested based on their density, size, species, quality, condition, and spacing. Selection is used to create and maintain an uneven-aged Stand. When individual trees are selected for harvest (individual-tree selection), they are replaced either by new seedlings or by small trees already present. Individual-tree selection is best suited for shade-tolerant species. Aesthetically, individual selection has the least visual impact of any regeneration method. The overall integrity and appearance of the forest is only slightly modified, and after a few years much of the residue from the harvest will have decomposed.

SELECTION	
Advantages	Disadvantages
<ul style="list-style-type: none"><li>▯ Maintains continuous forest cover on land.</li><li>▯ Usually perceived as having less visual impact.</li><li>▯ Forest usually less susceptible to wind, insect, and disease damage.</li><li>▯ Reproduction not exposed to heavy competition from herbs and shrubs.</li><li>▯ Can combine intermediate and regeneration harvests into one.</li><li>▯ Some form of natural reproduction will occur.</li><li>▯ Beneficial to some forms of wildlife.</li></ul>	<ul style="list-style-type: none"><li>▯ Takes more skill to implement than other regeneration methods.</li><li>▯ More expensive in terms of inventory, marking, and harvesting.</li><li>▯ Trees harvested are variable in size.</li><li>▯ Some damage to residual trees may result.</li><li>▯ Some residual trees may develop epicormic branching.</li><li>▯ May be detrimental to some Wildlife species requiring openings and early successional vegetation.</li></ul>

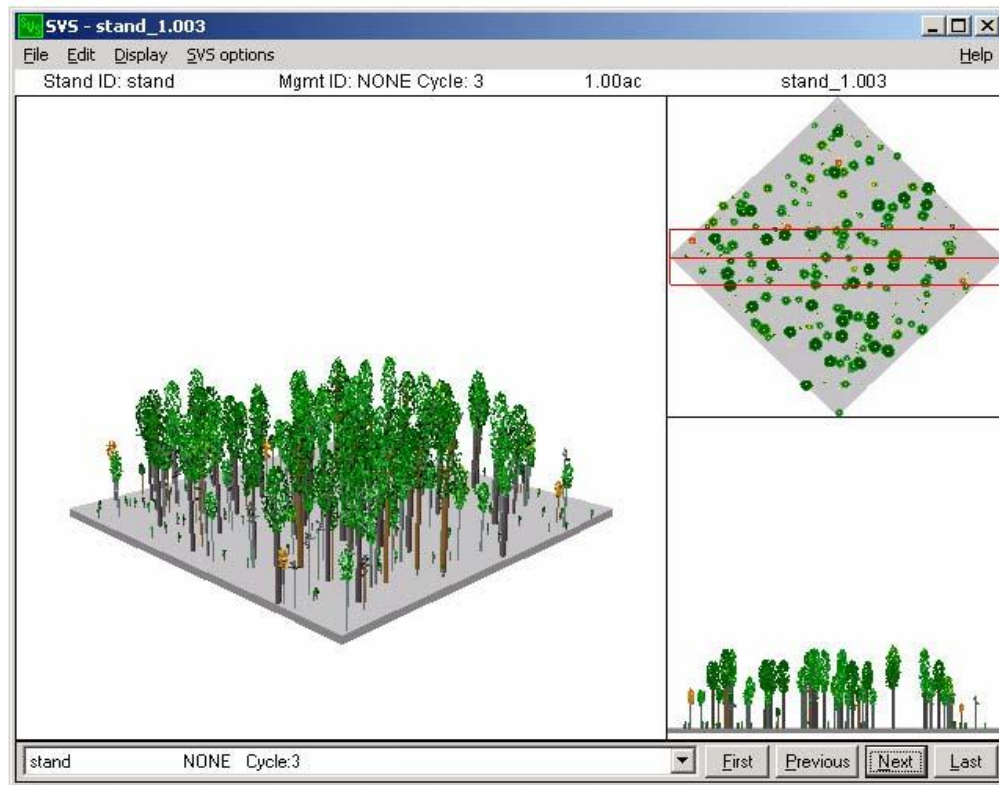


### Stand Visualization System Maps for Single Tree Regeneration Selection:

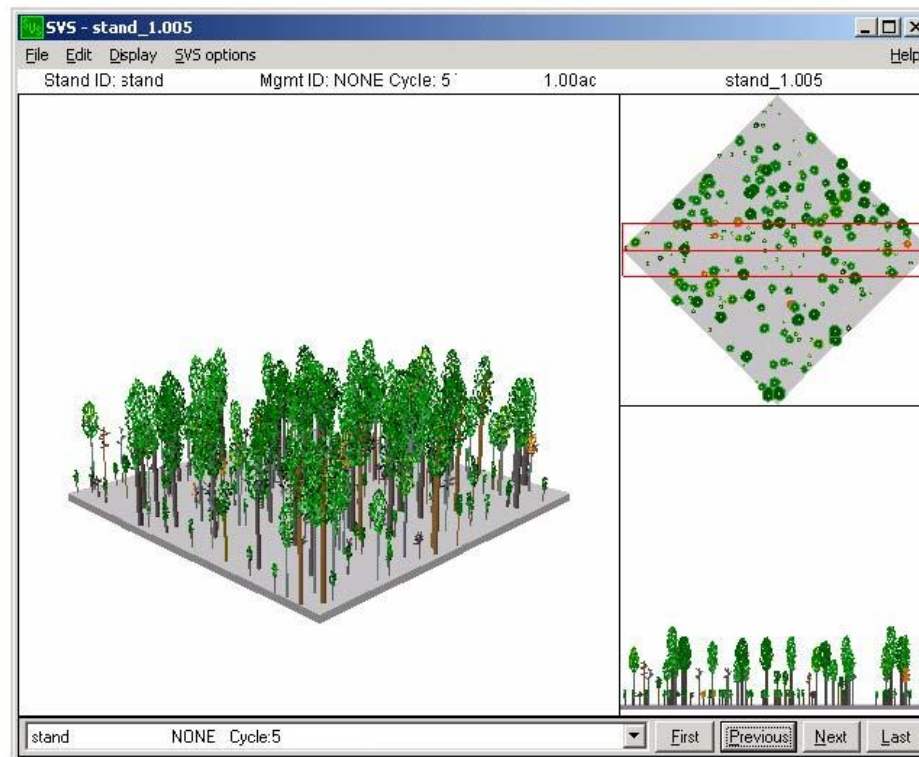
Visualization of a Stand fully stocked with a Basal Area of 150 Square Feet per acre; initial thinning reducing a high BA with visualizations in ten consecutive years.



Visualization ten years after the Basal was reduced to 80 Square Feet per acre, noted spacing and canopy gaps to allow sunlight to reach forest floor.



Twenty years following initial thinning to encourage oak regeneration.



## OLD GROWTH FOREST POTENTIAL

In the early 1900's nearly all forest in Maryland were cut down and the land was denuded. New forest growth now covers 43% of the State or approximately 2.6 million acres. The State has studied the, *Rare Threaten and Endangered species*, of both plants and animals that are found in Maryland. However, they lack knowledge on a very rare ecosystem known as, *Old Growth Forest*. Currently only .0002 percent of the State is known to contain Old Growth Forest or less than 1,000 acres.

The following criteria are helpful in evaluating a Stand:

1. Shade tolerant species are present in all age/ size classes
2. There are randomly distributed canopy gaps
3. There is a high degree of structural diversity characterized by multiple growth layers
4. There is accumulation of dead wood of varying sizes and stages of decomposition
5. Pit and Mound topography can be observed, if the soil conditions permit

Note: One factor researcher's can agree on is that Old Growth Trees must exceed a level at one half their obtainable maximum lifespan. For example, the lifespan of Tulip Poplar- *Liriodendron tulipifera* is 250 years. Half of maximum obtainable age must be present or 125-year-old Poplars.



## Management Techniques/Objectives

Structural Objective	Silvicultural Technique
Multi-layered canopy	<ul style="list-style-type: none"> <li>• Single tree selection using a target diameter distribution</li> <li>• Release advanced regeneration</li> <li>• Establish new cohort</li> </ul>
Elevated large snag densities	<ul style="list-style-type: none"> <li>• Girdling of selected medium to large sized, low vigor trees</li> </ul>
Elevated downed woody debris densities and volume	<ul style="list-style-type: none"> <li>• Felling and leaving, or</li> <li>• Pulling over and leaving</li> </ul>
Variable horizontal density	<ul style="list-style-type: none"> <li>• Harvest trees clustered around “release trees”</li> <li>• Variable density marking</li> </ul>
Re-allocation of basal area to larger diameter classes	<ul style="list-style-type: none"> <li>• Rotated sigmoid diameter distribution</li> <li>• High target basal area (34 m<sup>2</sup>/ha.)</li> <li>• Maximum target tree size set at 90 cm dbh</li> </ul>
Accelerated growth in largest trees	<ul style="list-style-type: none"> <li>• Full and partial crown release of largest, healthiest trees</li> </ul>

## ENVIRONMENTAL CONCERNS

Protecting the soil and water resources is an important concern during forest regeneration activities. The removal of trees typically requires the use of heavy equipment that disturbs the porous organic layer of the forest floor. The mineral soil is then exposed to the erosive forces of raindrops and surface runoff. Soil may move down slope off the area and become sediment in the streams. The implementation of best management practices (BMPs) can substantially reduce soil erosion and its negative effects. BMPs include such activities and considerations as the proper location and construction of skid trails and management roads; preservation of forested buffer strips along streams; diversion of runoff into the forest from roads and trails; and seeding of landings, roads, and trails upon completion of the harvest. For specifications and guidelines see Timber Harvest Regulations in the BMP section.

Prior to any silvicultural operations, a Maryland licensed forester should certify that erosion and sediment control plans for Forest Harvest Operations have been designed in accordance with approved ordinances, regulations, standards and criteria as stated in (COMAR 26.17.01.07.B.3.i). GAPG is not currently responsible to follow Maryland State law or regulations required for an erosion and sediment control plan before undertaking any earth disturbing activity in excess of 5,000 square feet or 100 cubic yards. However, the process application and proper BMP's for a successful operation should be completed and filed in house at the Proving Ground. The critical area law for Forest Harvest Operation **does apply** to GAPG. For specifications and guidelines see the BMP section.

## **GENERAL RECOMMENDATIONS FOR CONTROL (DEER, AND EXOTIC, INVASIVE PLANT SPECIES)**

This section of the Assessment and Management Plan contains recommendations for the following categories of management actions:

- Insect Control
- Deer Control
- Invasive Plant Control
- Forest Restoration and Invasive Plant Control
- Wildlife Recommendations

### **INSECT CONTROL**

The most pressing threat to the forest is the presence of Gypsy Moth, which defoliate Oak and other hardwoods. Although not found in the most recent study the moth species was present just south of the Magnolia gate on Interstate 95.

### **DEER CONTROL**

Due to the excessive browsing and lack of natural regeneration, the deer population far exceeds the carrying capacity of the forest, greatly affecting regeneration of the forest. Studies show, according to the 2006 publication, *The State of the Chesapeake Forests*, that densities greater than 20 deer per square mile restrict regeneration and diversity of woody vegetation. Densities of even ten deer per square mile can limit the full regeneration of the forest under stories.

Deer control, to be effective, should be in the form of hunting. Additional control should be in the form of sharp shooters who can hunt at night when traffic at the Garrison slows down. Currently 72% of all inventoried plots lacked commercial regeneration and any effort to restore and regenerate the forest for the future must include deer control or the efforts will be futile.

### **INVASIVE PLANT CONTROL**

Open fields and edges adjacent to the forest, which are more prone to invasive plants, should be inspected. Invasive plants should be controlled to prevent their spread into the forest.

### **FOREST RESTORATION AND INVASIVES CONTROL**

The following goals for integrated restoration of the forest at GAPG are recommended:

#### **Goals:**

- Restore the forest's ecological integrity by reducing the environmental stresses imposed by exotic invasive plants.
- Restore the natural distribution of native trees and shrubs favor oak species.
- Restore natural tree regeneration to levels adequate to quickly recover control of hydrology and nutrient cycling following large-scale disturbances.

The restoration process can be done on any scale with the following sequence in order to add balance to the required silvicultural activities. Mechanical, manual and chemical treatments will all be part of the tool box for eradication and control. A small tractor or Bob-cat, on level-to-moderate slopes, can push or pull out some of the larger shrubs and vines that are hindering the establishment of native plants. Smaller shallow-rooted plants can be manually pulled out or can be chemically treated by spot spraying selected shrubs and vines. Cut stumps can also receive an herbicide application. The control will be vital to the success of the re-establishment. Prior to eradication of any alien plants, native trees or shrubs in close proximity, if using a chemical treatment, should be flagged for identification to remain and be protected from herbicides. Other military bases have “Weed Warrior” programs where volunteers spend a day eradicating invasives.

***Vines:*** Vines should be controlled first. Vines on the site include: Oriental bittersweet, Japanese Honeysuckle, tear thumb and grapevine. Grapevine is a native vine and an excellent wildlife food but should be cut if it becomes too aggressive. Vines can be controlled by the three methods described above. The larger vines too tall to spray should be cut first then sprayed. **Systemic** herbicides are most effective and include glyphosates and triclopyr. Both herbicides will migrate into the roots when sprayed on the foliage and kill the entire plant. Triclopyr is also effective as a stump treatment when painted on freshly cut stumps. Both herbicides, when applied as a foliar spray, should be used when the plants are in full foliage and actively growing.

***Alien Shrubs:*** These shrubs include: multiflora rose, autumn olive, Japanese honeysuckle, Japanese barberry, privet and wineberry. Where possible the larger shrubs can be pushed or pulled out with equipment preferably before they are full with seed. Where cutting is appropriate, treat the stumps with triclopyr to prevent re-sprouting. Smaller shrubs can be dug out or sprayed. Foliar spray is most effective but should be limited to spot spraying, not broadcast spraying, which could damage natives. Systemics are effective for foliage application.

***Grasses:*** The major grass of concern is Japanese stilt grass, which has no biological control. **Systemic** herbicides are most effective and include glyphosates and triclopyr.

***Follow up:*** No treatment will be effective with one application since sprouting and root suckering usually occurs. Birds also spread the seed and new plants may become established due to available sunlight once larger shrubs are removed. Inspect the site throughout the growing season and spot spray the leafed-out plants or cut and treat the stumps.



## INVASIVE PLANTS AT APG

The following descriptions and preferred control methods are provided for the major invasive plants at APG. The source of photos is *Least Wanted* (Swearingen, Jil M., National Park Service, Washington, DC, <http://www.nps.gov/plant/alien>).

### **Multiflora rose** (*Rosa Multiflora*)

Characteristics: thorny shrub, with clusters of white to pink flowers. Multiflora rose develops bright red fruit or rose hips. It is spread by Wildlife dispersing the seed and by forming new plants.

Control: Frequent cutting or mowing of the plants through the growing season is effective. Application of triclopyr to freshly cut stumps and spraying re-growth with an herbicide during the growing season may be the most effective.



### **Japanese Honeysuckle** (*Lonicera japonica*)

Characteristics: Japanese honeysuckle is a semi-evergreen vine, with white to yellow tubular flowers. It is spread by seeds dispersed by wildlife.

Control: prescribed burning and herbicides are a good method of control. While mowing may reduce the spread of vegetative stems (on R/W), spraying herbicides on the leaves of the plant is found to be most effective. It may be necessary to re-spray sprouting plants.



**Honeysuckle Shrub (*Lonicera spp.*)**

Characteristics: a tall bush from 6 to 15 feet high, with white to yellow flowers and red to orange fruits with many seeds. It is spread by Wildlife dispersing seeds and by vegetative sprouting.

Control: Hand removal of small plants and treatment with herbicides are the only methods of treatment.



**Oriental bittersweet (*Celastrus orbiculatus*)**

Characteristics: woody, deciduous vine with glossy finely toothed leaves. Oriental bittersweet has abundant clusters of small greenish flowers, globular greenish yellow fruits and red seeds.

Control: vines can be pulled out by the root, or cut to ground level. Re-sprouting leaves can be sprayed with a herbicide.



Oriental Bittersweet (*Celastrus orbiculatus*) growing at Trustom Pond National Wildlife Refuge Photo by Lisa Gould

**Tear Thumb (*Polygonum perfoliatum*)**

Characteristics: fast growing weeds with vine-like stems and light blue green triangular leaves. Spines on stems are downward curving. Tear thumb bears a blue fruit and black seeds.

Control: The roots pull out easily to remove plants by hand. The most effective treatment is spraying with glyphosate and later applying a pre-emergent to the soil to prevent seeds from germinating.



**Japanese Stilt Grass (*Microstegium vimineum*)**

Characteristics: The leaves are pale green, lance-shaped, asymmetrical, 1-3 in. (3-8 cm.) long, and have a distinctive shiny midrib. Japanese stilt grass is especially well adapted to low light conditions. It threatens native plants and natural habitats in open to shady, and moist to dry locations. Where deer are over-abundant, they may facilitate its invasion by feeding on native plant species and avoiding stilt grass.

Control: For extensive stilt grass infestations, use of a systemic herbicide such as glyphosate is a more practical and effective method. Be careful to avoid application to non-target plants because glyphosate is a non-specific herbicide that will kill or damage most plant species it contacts.





**Wineberry** (*Rubus phoenicolasius*)

**Characteristics:** The hairs give the canes a reddish color when seen from a distance. Under favorable conditions canes may grow up to 9 feet. Leaves consist of three heart-shaped, serrated leaflets with purplish veins and are silvery white tomentose on the underside

**Control:** Manual, mechanical and chemical means of control are available. Removal of plants by hand pulling or use of a 4-prong spading fork can be effective especially if the soil is moist and the roots and any cane fragments are removed or by treating the canes with a systemic herbicide like glyphosate or triclopyr.



**Japanese Barberry** (*Berberis thunbergii* DC.)

**Characteristics:** This multi-branched dense shrub grows to 2.5 m (8.2 ft). Seedlings may grow 2-4 ft in one season. The semi-evergreen leaves are alternate, or grow in alternate clusters. They are entire, and 0.4-1.2 in. long. Leaves are bright green to burgundy, and wedge-shaped at the base. Twigs are brown, three-ridged downward from the node, with simple thorns.

**Control:** Mowing is appropriate for initial small populations. Repeated mowing or cutting will control the spread of Japanese barberry but will not eradicate it. Stems should be cut at least once per growing season as close to ground level as possible. Apply a 2% solution of glyphosate or triclopyr and water plus a 0.5% non-ionic surfactant to thoroughly wet all leaves.



**Tree-of-Heaven - *Ailanthus altissima***



Characteristics: a rapidly growing, deciduous tree in the mostly tropical quassia family (Simaroubaceae). Mature trees can reach 80 feet or more in height. *Ailanthus* has smooth stems with pale gray bark, and twigs that are light chestnut brown, especially in the dormant season. The wood of *Ailanthus* is soft, weak, coarse-grained and creamy white to light brown in color. All parts of the tree, especially the flowers, have a strong, offensive odor, which some have likened to cat urine

Control: Targeting large female trees for control will help reduce spread by seed. Young seedlings may be pulled or dug up, preferably when soil is moist. Care must be taken to remove the entire plant including all roots and fragments as these will almost certainly re-grow. It can be effectively controlled using any of several readily available general use herbicides such as triclopyr or imazapyr. Follow label and state requirements. The herbicides may be applied as a foliar (to the leaves), basal bark, cut stump, or hack and squirt treatment. Basal bark application is one of the easiest methods and does not require any cutting. It works best during late winter/early spring and in summer. The cut stump method is useful in areas where the trees need to be removed from the site and will be cut as part of the process. The hack-and-squirt or injection method is very effective and minimizes sprouting and suckering when applied during the summer.

**References:** <http://www.nps.gov/plants/alien/fact/aial1.htm>, [www.nps.gov/plants/alien](http://www.nps.gov/plants/alien)

**Autumn Olive**

*Elaeagnus umbellata*



### **Background**

Autumn olive was introduced into the United States in 1830 and widely planted as an ornamental, for Wildlife habitat, as windbreaks and to restore deforested and degraded lands.

### **Distribution and Ecological Threat**

Autumn olive is commonly found at APG. It is drought tolerant and thrives in a variety of soil and moisture conditions. This trait allows it to invade grasslands, fields, open woodlands and disturbed areas. It threatens native ecosystems by out-competing and displacing native plant species, creating dense shade and interfering with natural plant succession and nutrient cycling. **Description and Biology**

-Plant: deciduous shrub that can grow to 20 feet in height; stems, buds and leaves have a dense covering of silvery to rusty scales.

-Leaves: egg or lance-shaped, smooth margined and alternate along the stem; underside of leaves covered with silver-white scales.

-Flowers, fruits and seeds: plants begin to flower after three years. Small, light yellow, aromatic flowers appear in June and July; fruits are small, round, pink to reddish and dotted with scales.

-Spreads: by seed, although some vegetative propagation also occurs. Birds and mammals disperse fruits.

### **Prevention and Control**

Do not plant autumn olive. Individual young plants can be hand-pulled, ensuring that roots are removed. Cutting, in combination with herbicide application, is effective. Hedges can be cut down using a brush type mower, chain saw, or similar tool, and stumps treated with a systemic herbicide like glyphosate or triclopyr. Application of these herbicides to foliage is also effective but is likely to impact non-target species. Herbivorous animals are not known to feed on it and few insects seem to utilize or bother it. Canker disease is occasionally a problem but not enough to be useful as a control agent.

## **FOREST MANAGMENT RECOMMENDATIONS FOR WILDLIFE**

Wildlife abounds at GAPG; it is home to 55 neo tropical bird species, more than 40 species of reptiles and amphibians, nearly 250 species of birds, and more than 40 species of mammals.

Wildlife has four basic requirements for survival: food, water, cover and breeding space. Little can be done to provide space and water. However, food and cover can be managed for the benefit of wildlife. Management of Wildlife is based on ecological principles. Forest Wildlife management on this tract can be in the form of attracting Wildlife species by creating natural snags and by creating an edge through developing access roads or trails. An edge allows a variety of habitats to exist in close proximity to each other. Large and small mammals will utilize even small openings.

Neotropical migratory birds are long-distance migrants that breed in North America and winter in Central and South America. They represent well over half (119 of 202) of all bird species that breed in Maryland and over two thirds of the breeding bird species in the eastern United States. This large, diverse group includes a variety of songbirds including warblers, thrushes, vireos and tanagers, as well as our state bird, the Baltimore Oriole. Other Neotropical migrants include Maryland's smallest bird, the Ruby-throated Hummingbird, nighthawks, swallows, cuckoos and a number of hawk and woodpecker species. Recent and growing international concern over declining populations of many Neotropical migrant species has prompted conservation initiatives throughout the Western Hemisphere. The loss and fragmentation of habitat, especially on the breeding grounds, have been implicated as important factors in these declines. Species of particular concern are forest and grassland breeding birds that require large contiguous tracts of habitat in which to successfully breed. The loss of habitat where Neotropical migrants concentrate during migration is also drawing increasing attention within the scientific and conservation communities.

A source of concern at GAPG is fragmentation caused by utility rights-of-way, paved and unpaved road ways and expansion in the form of structures. Species can also be impacted due to habitat degradation resulting from over browsing of native forest vegetation by white-tailed deer, and invasions of exotic, invasive plant species. The largest, most-contiguous and least-disturbed forest tracts are considered priority conservation areas for forest-nesting birds. GAPG is considered regionally important given its relatively large size and location within a predominantly forested landscape and the potential for even greater habitat quality through the reduction of deer density.

The following are general Wildlife recommendations for GAPG:

- 1. Create and maintain soft forest edges.**

Most forest borders at GAPG are hard abrupt edges. Forest birds nesting in forests near hard (vs. soft) forest edges tend to experience low nest success. Hard edges also provide little if any nesting habitat for early successional forest and edge-nesting birds. Managing forest borders as soft feathered edges will increase reproductive success of forest breeding birds. It also represents a tremendous opportunity to increase both the quantity and quality of edge habitat without causing additional forest loss or fragmentation.

- 2. Reduce the availability of feeding areas for non-forest dwelling birds.**

Control the habitat for Brown-headed Cowbirds, Common Grackles and European Starlings in artificial non-forested habitats (e.g., grassy roadside berms, forest openings, frequently mowed fields) using the following management practices:

- a. Along roads that must be maintained, maintain canopy closure over the roadbed and establish a soft forest-roadside edge.
  - b. In fields, maintain a grass height of at least 10 inches during April - August.
- 3. Monitor and control white-tailed deer populations at or below carrying capacity to reduce over browsing of forest understory vegetation.**
- The loss of forest structural diversity and changes in forest composition due to high deer densities have had substantial and long-term impacts on the ecological integrity of the forest communities and their ability to support FIDS. Forest interior dwelling species that require a dense shrub and/or herb layer probably have been most seriously affected (e.g., Hooded Warbler, Kentucky Warbler). Effective forest breeding bird conservation requires maintenance of deer densities at or below habitat carrying capacity. A combination of regulated hunting and a reduction in the amount of hard edge habitat are recommended.
- 4. Implement the following field mowing practices.**
- a. Do not mow fields during April-August, the breeding season for most grassland bird species.
  - b. If mowing must occur during April-August, minimize impacts to nesting birds using the following guidelines:
    - (1) Limit mowing to those periods outside of May-early July, the peak nesting period for most grassland birds in this region.
    - (2) Mow on a rotational basis, leaving at least half of the field un-mowed during May-early July, or for at least 6 consecutive weeks within this period. Allow the un-mowed portion to occur in one large contiguous block or, minimally, leave un-mowed areas in large blocks
    - (3) Maintain a cutting height of at least 10 inches.
    - (4) Do not mow at night.
  - c. To increase habitat diversity within fields, use an annual rotational mowing system in which some sections are left un-mowed each year.
  - d. Favor early spring (March -early April) mowing over late summer - fall (August - October) mowing to provide winter habitat for grassland birds
- 5. Create and maintain soft edges along grassland-forest borders.**
- Soft, feathered edges at least 10 feet in width provide breeding habitat for a variety of early successional forest and edge-nesting birds that might otherwise be absent or much less abundant in grassland if only a hard forest edge or border existed. They also provide hunting and singing perches for many grassland birds and may reduce nest predation rates for birds nesting in the adjacent forest.
- 6. Create snags.**
- Standing dead trees (snags) and dead parts of live trees offer both room and board for many forms of wildlife. Tree cavities in live or dead trees are used by 35 species of birds and 20 species of mammals. The objective is to create 3 snags per acre (minimum). In addition to the Standing snags, trees can be felled and left on the ground. Downed logs create a new ecosystem, as



decomposed logs provide new habitats for micro-organisms, insects, amphibians, reptiles, and plants.

There is life in dead trees and the GAPG forest is currently fully-stocked with plenty of trees to create snags.

Snags can be created by girdling, which involves cutting a band between 1"-6" wide through the bark and completely around the tree. This practice will kill the tree, thus creating a snag. Maple or tulip poplar trees of poor form make excellent candidates for snag creation because of their soft wood, which is easily girdled, and they are also more easily excavated by cavity-building Wildlife species. By selecting trees of poor form, the quality of the forest can be improved at the same time. At least one tree per acre that is greater than 18 inches in diameter should be chosen because pileated and red-bellied woodpeckers will not utilize smaller trees. Oak trees should not be used for creating snags because of the contribution that oak species make to the forest acorn crop, the majority of the hard mast in the forest. Favoring the oaks as crop trees will ensure good crown growth, thus insuring good acorn production for forest regeneration.

## ACCESSING FOREST HEALTH

Forest management through the help of a forest professional is the way to achieve and maintain your woodland health. The first step in managing your forest is through regular health assessments of the dominant tree species.

Many tools are used to help forest professionals maintain healthy woodland ecosystems. Long term monitoring through yearly assessments of the forests well being is necessary to maintain and protect the overall fitness of your woodland.

The purpose of this section, “Assessing Forest Health”, is to describe the diseases and insects that are commonly observed in the dominant woodland species throughout the GAPG and suggested actions if detected.

This paper will discuss treatments to the following species:

- Oaks
- Red Maple
- Sweet Gum
- Tulip Poplar

### **Oak Decline**

Although the most frequent outbreaks of oak decline have been in southern New England, the Middle Atlantic States, and the Southeastern States, the disease has occurred throughout the range of oak in both forest and urban locations. It is not limited to any one specie or species group. Outbreaks have been most frequent and severe among red (*Quercus rubra*), scarlet (*Q. coccinea*), pin (*Q. palustris*), and black oak (*Q. velutina*) in the red oak group and among white (*Q. alba*) and chestnut oak (*Q. prinus*) in the white oak group.

### **Disease Progression**

Trees are weakened by environmental stresses such as drought, waterlogging, frost or by pests such as defoliating or sucking insects. Weakened trees are then invaded and killed by insects and diseases that cannot successfully attack healthy trees. Usually the progression of decline is slow, occurring over several years.

Trees affected by oak decline show a general and progressive dying back from the tips of the branches. Other symptoms include production of chlorotic, dwarfed, and sparse foliage; development of sprouts on main branches and stem; and premature autumn leaf color and leaf drop. Often, growth is reduced before the appearance of symptoms. The amount of food stored as starch is reduced, especially in the roots.

The initiating stress factors associated most frequently with oak decline are drought, frost injury, or insect defoliation. Trees on ridge tops and in wet areas suffer most severely from drought. Frost often affects trees growing in valleys and frost pockets. Defoliated trees that refoliate the same season may exhibit dieback symptoms the next year. Other factors such as leaf diseases and soils that are waterlogged compacted, or shallow have occasionally been implicated in oak decline. Waterlogging is especially important in the heavier clay soils of the Midwest. Stress factors may be more frequent and severe in urban forests, where trees are often subjected to disturbances associated with human activities.

These stress factors often weaken trees so much that they succumb, sometimes suddenly, to the root killing and girdling actions of insects and diseases. The two major pests associated with oak decline are *Armillaria mellea* (Vahl: Fr.), a root disease commonly called armillaria root rot, and *Agrilus bilineatus* (Weber), the two lined chestnut borer.

### **Diagnosing Oak Decline**

Dieback symptoms can result from the effects of stress alone. Indeed, stress, if sufficiently severe or prolonged, can result in tree mortality. However, the continued decline and death of stressed oaks usually results from lethal attacks by armillaria root rot and two lined chestnut borers. Final symptoms of oak decline primarily reflect the root killing and girdling effects of these organisms. In attacked trees, leaves sometimes fail to develop in the spring or wilt shortly after bud break; sometimes they wilt or brown suddenly in the latter part of the growing season.

A characteristic of oak decline is that it may develop suddenly on many trees in the area affected by the initiating stress factor. However, within the affected areas decline and mortality occur in patterns, which may reflect the intensity and severity of the stress, the distribution of the hosts, the aggressiveness of armillaria root rot, and the abundance of two lined chestnut borers, coupled with site features such as poor or excessive soil drainage and frost pockets (see figure below)



*Pockets of oak mortality resulting from the interaction of stress, insects, diseases, and site factors.*

In many instances, the species that are affected and their location can provide clues to the cause of oak decline. For example, symptoms only on white oaks or only on red oaks might suggest that preferential insect defoliation was the cause. Frost may be implicated if damage is limited to trees growing in depressions or valley bottoms.

Symptom development can also indicate the stage of decline and approximate beginning of the problem. The age of bole sprouts and patterns of radial and terminal growth can be used to estimate the events that triggered their development. Although some trees die soon after being stressed, others may not succumb for 5 years or more. The timing of peak mortality, if known, can give some indication of when the stress may have occurred. For example, mortality is usually highest 2 years after heavy insect defoliation. Such tree growth information, when coupled with an analysis of weather and forest records, can be used to develop a composite picture of the cause and stage of the oak decline problem.

In the diagnosis of oak decline, it is important to determine if stress factors are associated with the specific problem and at the same time, to rule out the involvement of primary pathogenic organisms such as the oak wilt fungus.

Oak wilt caused by the fungus *Ceratocystis fagacearum* (Bretz) Hunt has been reported from the Lake States east to Pennsylvania and south to Texas. It has not been found in New England, New York, or New Jersey. All oak species are susceptible to the fungus. Red oaks are more susceptible than white oaks.

## **Control**

The unique relationship of cause and effect, and patterns of distribution of oak decline must be considered, and control efforts should focus on reducing or preventing the predisposing stress factors.

In the forest, factors such as drought and frost cannot be controlled. However, management can reduce their effects. Thinning can reduce competition for moisture and nutrients and promote better physiological condition of the remaining trees. Silvicultural practices designed to encourage species best adapted to the site can help reduce the effects of drought or frost. Removal of weak and dying trees may also reduce or delay population buildup of the two lined chestnut borer. Stress from insect defoliation can be reduced or eliminated in high-value forest stands by spraying the trees with insecticides.

Landowners can get specific information on insecticides available for control from cooperative extension agents or local forestry officials.

In urban sites, additional control measures are feasible. Moisture shortages can be alleviated by watering, mulching to reduce competition from sod, and reducing or avoiding soil compaction. Trees can also be treated to control sucking and defoliating insects and disease organisms that cause defoliation. Nutritional deficiencies can be corrected by fertilizing. These practices eliminate some forms of stress and promote good physiological condition.

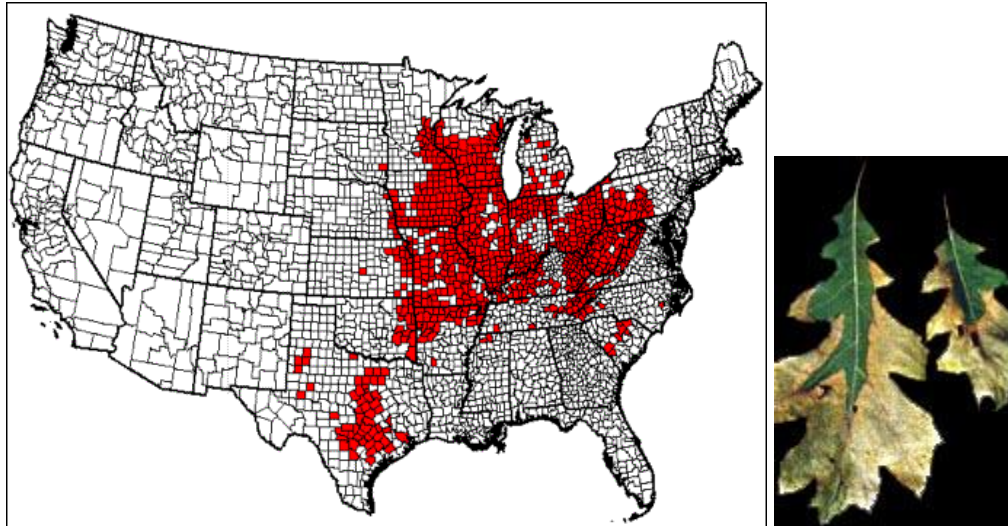
Oak decline is initiated by stresses, which can disappear before effects are manifested. A systematic evaluation of the problem can usually reveal the initiating factors and the agents responsible for mortality. Practices to promote good tree health can reduce the potential impacts of damage by oak decline.

## **Oak Wilt**

Oak wilt is an aggressive disease that affects many species of oak (*Quercus* spp.). It is one of the most serious tree diseases in the eastern United States, killing thousands of oaks each year in forests, woodlots, and home landscapes.

## **Distribution**

Oak wilt was first identified in 1944. The fungal pathogen that causes the disease, *Ceratocystis fagacearum*, is thought by most to be native to the eastern United States, but difficulty in isolating and identifying the fungus delayed recognition of the extent of its impact until the 1980's. Some plant pathologists think that oak wilt is an exotic disease, arriving in North America in the early 1900's, but the fungus has never been reported from any country other than the United States. The disease has also become much more apparent in some local areas since the 1980's because of increased tree wounding, due primarily to home construction in oak woods. The current known distribution of oak wilt is shown in red.



In 1998, oak wilt was distributed over much of the eastern United States.

### Hosts

Oaks can be organized into three main groups, based on leaf shape: red oaks, white oaks, and live oaks. Trees in the red oak group have fan-shaped leaves with sharply pointed tips; those in the white oak group have fan-shaped leaves with rounded or blunt tips; and trees in the live oak group have oval leaves with rounded tips.

All species in the white oak group are moderately resistant to oak wilt, but if infected, trees can be killed over a period of one to several years. Resistance in white oaks appears to be related to characteristics of physiology and morphology. Upon wounding, infection, or as a part of the natural aging process, white oaks tend to form minute plugs called *tyloses* in their sapwood vessels. These plugs make the wood of white oaks impermeable to water, and also appear to prevent the fungus from moving throughout the vascular system of the tree.

The tendency for white oaks to form tyloses also explains why these are the species of choice for wood used in cooperage for storing wine and whiskey. The presence of tyloses ensures that barrels made from white oak wood will not leak.

Throughout the range of oak wilt in the United States, red oaks are the most important hosts, but susceptibility varies somewhat by species. Mortality in red oaks can occur within 3 weeks after infection by the oak wilt pathogen under some circumstances. Recovery from oak wilt infections in red oaks can occur, but is rare. Texas live oak (*Q. virginiana*) is moderately susceptible to the disease, but because of its tendency to form large, root-connected clones through which the disease can spread, it is also considered to be an important host.

Although the disease is not known west of Texas, inoculation studies have shown that most oaks in the red oak group, including several western species, are susceptible to the disease, and are at risk should the fungus ever be transmitted to them in their native habitat (Appel, 1994).

## Symptoms

Oak wilt disease symptoms progress differently in red oaks, white oaks, and Texas live oak.

### Red Oak Group

Oak wilt is usually identified in red oaks by the symptoms of rapid leaf discoloration and wilting. Often the initial symptom is a subtle off-green color shift that may be visible in the upper portion of the tree crown. This symptom is apparent in the northern part of the disease range in late June to early July. Shortly after this initial color shift, the leaves begin to wilt from the top of the crown downward. As the disease progresses, individual leaves quickly discolor, taking on a "bronzed" appearance. The discoloration progresses around the margins of the leaf from the tip to the base (Fig. 1B). The progressing discoloration may be interrupted by the leaf veins, as shown in the white oak leaf in Fig. 1A, or may affect the entire upper portion of the leaf, as shown in the red oak leaf in Fig. 1B.

Leaves are cast rapidly as the infection progresses. Commonly, infected trees are almost entirely defoliated within a few weeks of symptom onset. Fallen leaves usually are brown at the tips and margins, and sometimes green at the base and along the lower veins. Trees are often killed in groups or disease "centers," when infection occurs through grafted roots.

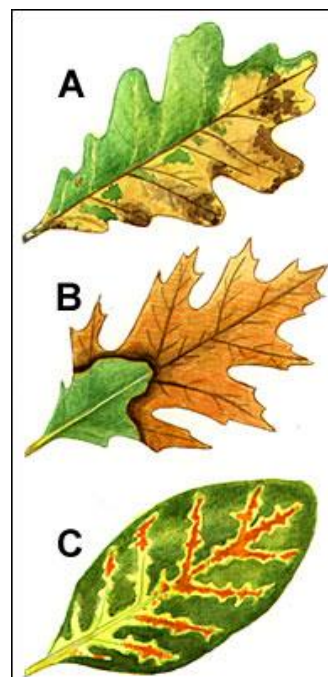


Figure 1. Symptoms of oak wilt in A. white oak, B. red oak

Occasionally the outer ring of vessels of diseased trees will be plugged with a brown substance that may be visible in cross sections as a ring or a series of dark spots through the outer sapwood, and in tangential cuts as longitudinal streaking of wood exposed after removing the bark. However, this is not always obvious to an untrained observer, especially in the red oaks. The discoloration may be very light or appear as flecks in such sections. Discoloration is most readily seen in tangential cuts on branches.

### White Oak Group

White oaks usually die slowly, one branch at a time, over a period of one to many years. Wilting and death of leaves on individual branches occur in a similar fashion to the disease in red oaks, but usually progresses much more slowly. Affected leaves exhibit a pattern of discoloration similar to that seen in red oaks, with discoloration proceeding from the margins to the base, sometimes interrupted by the leaf veins (Fig. 1A). Brown streaking in the outer growth rings is often readily apparent even to an untrained observer in infected white oaks and bur oaks, but may be missing.

<http://na.fs.fed.us/> - Northeastern Area USDA Forest Service

## Control

Stopping spread of the fungus through common root systems is most important and can be done by mechanical barriers using a vibratory plow with a 5-foot blade. Barriers in the soil must be positioned outside of trees with the fungus. Often two lines are recommended: a primary line outside of apparently

healthy trees and a secondary barrier outside of every obviously infected tree. The fungus can be in a tree for 2-3 weeks without leaf symptoms appearing. Barrier placement requires experience. If buried utilities are present, the soil sterilant, Vapam, can be used, but it is not nearly as effective as the mechanical barrier.

Overland spread by insects can be prevented by following these guidelines on when to prune and when to paint.

**High Risk Period.** April, May, and June. Don't wound or prune! If trees are accidentally wounded or pruning is unavoidable, cover the wounds immediately-within minutes-with one of the preferred materials such as water-based paint or shellac.

**Low Risk Period.** July through October. On rare occasions-depending on weather conditions and insect populations-infections may occur. Covering wounds is optional.

**Safe Period.** November through March. This is the preferred time for pruning since the fungal pathogen and insect vectors are inactive.

Tree climbing irons should never be used on living oak trees.

As further precaution, infected red oaks on which spores may form in spring should be eliminated by debarking, burning, burying, or wrapping and sealing in 4-6 ml plastic until July 1. Experience is needed to detect these trees before spores are produced. The spores are carried by the sap beetles to wound oaks during May and June.

Logs from wilting, or recently wilted trees should not be moved in any form, including firewood, to areas where oak wilt is not present. Oak wilt mats may form on these logs. Long distance movement of firewood obtained from such logs has accounted for establishment of oak wilt centers in distant areas that previously had been unaffected by the disease.

In high value white oaks, systemic injection with propiconazole by qualified arborists may prevent infection of trees adjacent to oak wilt affected ones. Propiconazole treatment of white oaks exhibiting early symptoms of oak wilt (less than 30% of crown affected) can also prevent further disease development for at least 2 years.

<http://www.extension.umn.edu/distribution/naturalresources/DD3174.html> - University of Minnesota College of Food, Agriculture and Natural Resources

### ***Bacterial Leaf Scorch***

#### **Symptoms**

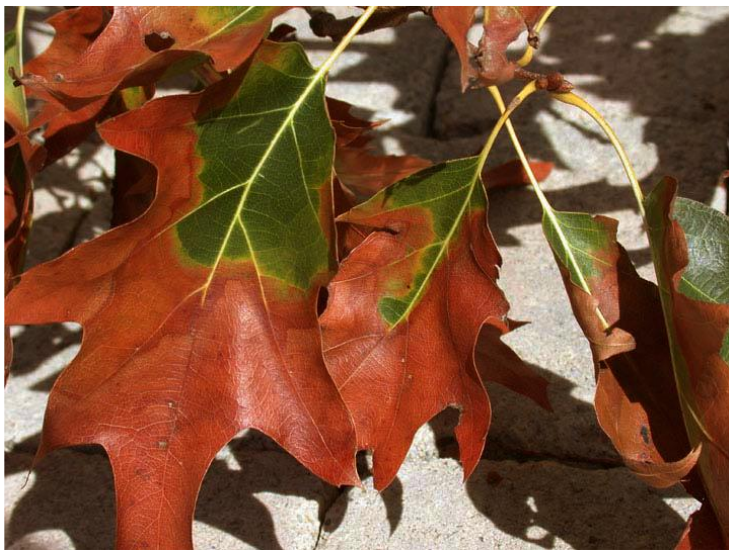
Trees infected with *Xylella fastidiosa* exhibit marginal leaf necrosis, or browning, bordered by a pale halo band separating the dead or scorched tissue from the green tissue. Leaf discoloration begins at the leaf margin and moves toward the midrib. Symptoms recur each year and spread over the tree's crown, thus, reduction in growth and dieback are common in affected trees.

In the early stages of this disease, portions of the tree remain unaffected, while other branches exhibit symptoms typical of the disease. Infected leaves in red oaks exhibit a pronounced, marginal discoloration



with a dull red or yellow halo between scorched and green tissues (see below). Due to determinant growth, all leaves on oak develop symptoms at the same time. As the disease progresses, more branches develop symptoms. Within plantings, disease incidence usually appears randomly; trees neighboring severely affected trees are often not affected. Leaf symptoms in pin oak are not as distinct, but the distribution of the disease within the canopy and between trees is the same.

In all known oak hosts, symptoms usually occur in mid- to late-summer on leaves of one or more branches in the canopy. Affected leaves may curl and drop prematurely. As the infection progresses over several years, branches die, and the tree declines. Affected trees eventually decline to the point where they must be removed. The process of tree decline may occur quickly or slowly depending on the tree or the environment. Epicormic sprouts can be prominent on severely diseased trees, and scale insects, borers, Armillaria root rot, and other biotic diseases may be present as secondary pests.



Symptoms of marginal leaf scorch on northern red oak. (Photograph courtesy of A. B. Gould.)



## ***Vectors***

Because this bacterium occurs in the xylem of plants, it is not surprising that all currently known vectors are xylem-sap feeding insects. A recent finding has been the identification of treehoppers (Membracidae) as potential vectors.

## **Management Strategies**

There is no effective preventative treatment or cure for bacterial leaf scorch, so one should expect diseased trees to be gradually lost over the years. The best remedy for bacterial leaf scorch is tree replacement. However, in the meantime, infected trees can be made to look somewhat presentable for a few more years if the dead wood is pruned out. Careful scouting combined with judicious pruning can help to rid the tree of symptomatic branches especially since there are no chemicals registered for treatment.

- ▯ Leafhoppers, which spread the disease, are active most of the growing season making it impractical to control this disease by insecticidal treatments. Transmission of this disease is so unpredictable that efforts to prevent it by preventing vector feeding are likely to be futile.
- ▯ Trunk injections with antibiotics have been shown to suppress symptoms. Treatments must be made annually in late May or early June. The antibiotic oxytetracycline has been tested as a treatment, but it only caused the remission of symptoms; it did not provide a cure.
- ▯ Pruning has been another possible treatment; however, with only limited success in delay of scorch development. Pruning has been devoted to public safety in trees that have shown some natural resistance to the disease.
- ▯ Mulching and irrigating during periods of little rainfall will reduce moisture stress and possibly delay scorch development.
- ▯ The effects of fertilization are still unclear with this disease. Fertilizing should be performed when a soil or leaf analysis shows a nutrient deficiency.
- ▯ Removing trees has been necessary to maintain safety and is considered when trees no longer add to the landscape.

<http://www.usna.usda.gov/Research/BacterialLeafScorch.html> - US National Arboretum

**\*BLS is commonly found in other tree species such as sycamore, elm and red maple. Please follow the above guidelines.**

### **Smooth Patch Disease**

*Aleurodiscus oakesii*, is a small but very common and overlooked fungus that decompose the rough, dead outer bark of trees. However, its effects can be seen from quite a distance. Although *A.oakesii* is not a parasite, it lives on the bark of trees, primarily oaks. Over time this results in smooth grayish patches that are adjacent to the normal, rough bark. These patches may expand slowly over time, coalescing to form smooth grayish areas that are several feet in length.



Oak trees with smooth patch – Purdue Extension

These smooth patch fungi, however, do not cause cankers or internal decay. They cause no known harm to the tree.

## **Oak anthracnose**

### **Symptoms**



This disease is most serious on white oaks. Individual trees can be severely damaged from repeated infection by the fungus *Gnomonia quercina*. Individual leaves develop irregular brown, dead areas and may be slightly cupped or distorted. The fungus also attacks and kills leaf buds and new shoots. Repeated attacks will cause a stunted, brooming effect to diseased branches.

Anthracnose fungi overwinter in leaf debris on the ground and/or in dead areas of the bark on the tree, called cankers. In early spring, spores of the fungus are produced in fruiting structures and are dispersed by splashing rain. These spores infect expanding leaf buds, shoots, or in some cases young leaves.

The infection process is favored by relatively cool temperatures and prolonged periods of leaf wetness. Therefore, the disease tends to be more severe during wet, cool springs. After infection, the anthracnose fungus colonizes leaf tissue and begins to produce new fruiting structures and spores capable of reinfecting expanding leaf tissue. Disease development may continue throughout the spring into early summer if favorable weather persists. These diseases tend to be less of a problem during hot, dry summer weather.

## Control

Anthracnose rarely causes significant damage to shade trees in the area; consequently, specific control measures generally are not required. The disease also can increase susceptibility to other disease or insect problems in areas where trees are attacked year after year.

Several cultural practices can reduce the severity of anthracnose. Removal of dead leaves in the fall will help limit the amount of fungal inoculum present for infection of new leaves the following spring. However, this practice rarely eliminates the problem, especially for those anthracnose fungi that may also survive in blighted twigs on the tree.

Proper tree spacing and placement to promote good air circulation reduces the number of hours leaf surfaces remain wet, and decreases the likelihood of fungal infection. Many trees recover rapidly from anthracnose if they are maintained in a vigorous condition.

Trees should be watered and fertilized regularly. In some cases, nitrogen fertilization may actually increase the tree's tolerance or resistance to anthracnose.

Red oaks tend to have fewer problems with the disease than the white oak group; and there appears to be variation in individual elms and black walnuts to their respective anthracnose diseases. Avoid planting highly susceptible trees in areas with poor air circulation.

For forests, monitoring of overall stand health is recommended, with removal of severely diseased trees if disease pressure is high throughout stand population.

**\* Anthracnose foliar disease is commonly found in other tree species such as sycamore, elm, hickory and red maple. Please follow the above guidelines.**

## Gypsy Moth



The gypsy moth, *Lymantria dispar* Linnaeus, is one of the most notorious pests of hardwood trees in the Eastern United States. Since 1980, the gypsy moth has defoliated close to a million or more forested acres each year. In 1981, a record 12.9 million acres were defoliated. This is an area larger than Rhode Island, Massachusetts, and Connecticut combined.

Gypsy moth infestations alternate between years when trees experience little visible defoliation (gypsy moth population numbers are sparse) followed by 2 to 4 years when trees are visibly defoliated (gypsy moth population numbers are dense).

The gypsy moth is not a native insect. It was introduced into the United States in 1869 by a French scientist living in Massachusetts. The first outbreak occurred in 1889. By 1987, the gypsy moth had established itself throughout the Northeast. The insect has spread south into Virginia and West Virginia, and west into Michigan. Infestations have also occurred in Utah, Oregon, Washington, California, and many other States outside the Northeast.

### Life Cycle

The gypsy moth passes through four stages: egg, larva, pupa, and adult (moth stage). Only the larvae damage trees and shrubs.





*Female gypsy moth laying eggs.*

Gypsy moth egg masses are laid on branches and trunks of trees, but egg masses may be found in any sheltered location. Egg masses are buff colored when first laid but may bleach out over the winter months when exposed to direct sunlight and weathering.

The hatching of gypsy moth eggs coincides with budding of most hardwood trees. Larvae emerge from egg masses from early spring through mid-May.

### **Hosts**

Gypsy moth larvae prefer hardwoods, but may feed on several hundred different species of trees and shrubs. In the East the gypsy moth prefers oaks, apple, sweetgum, speckled alder, basswood, gray and white birch, poplar, willow, and hawthorn, although other species are also affected. The list of hosts will undoubtedly expand as the insect spreads south and west.

### **Factors That Affect Gypsy Moth Populations**

Natural enemies play an important role during periods when gypsy moth populations are sparse. Natural enemies include parasitic and predatory insects such as wasps, flies, ground beetles, and ants; many species of spider; several species of birds such as chickadees, blue jays, nuthatches, towhees, and robins; and approximately 15 species of common woodland mammals, such as the white-footed mouse, shrews, chipmunks, squirrels, and raccoons.

The *Calosoma* beetle, a ground beetle of European origin, cuckoos, and flocking birds, such as starling, grackles, and red-winged blackbirds, are attracted to infested areas in years when gypsy moth populations are dense.

Diseases caused by bacteria, fungi, or viruses contribute to the decline of gypsy moth populations, especially during periods when gypsy moth populations are dense and are stressed by lack of preferred foliage.

Wilt disease caused by the nucleopolyhedrosis virus (NPV) is specific to the gypsy moth and is the most devastating of the natural diseases. NPV causes a dramatic collapse of outbreak populations by killing both the larvae and pupae. Larvae infected with wilt disease are shiny and hang limply in an inverted "V" position.

Weather affects the survival and development of gypsy moth life stages regardless of population density. For example, temperatures of -20°F. (-29°C.) lasting from 48 to 72 hours can kill exposed eggs; alternate periods of freezing and thawing in late winter and early spring may prevent the overwintering eggs from hatching; and cold, rainy weather inhibits dispersal and feeding of the newly hatched larvae and slows their growth.

### **Managing the Gypsy Moth**

A number of tactics have the potential to minimize damage from gypsy moth infestations and to contain or maintain gypsy moth populations at levels considered tolerable. These tactics include monitoring gypsy moth populations, maintaining the health and vigor of trees, discouraging gypsy moth survival, and treating with insecticides to kill larvae and protect tree foliage. The tactic or combination of tactics used will depend on the condition of the site and of the tree or stand and the level of the gypsy moth population. Tactics suggested for homeowners are probably too costly and too labor intensive for managers to use in forest stands.



*Gypsy moth larvae emerging from egg mass.*

### **Silvicultural Guidelines for Forest Stands and Woodlots**

Several interrelated factors determine the vulnerability of forest stands and woodlots to gypsy moth defoliation. An awareness of these factors will enable land managers and woodlot owners to prescribe silvicultural actions that will minimize the impact caused by gypsy moth defoliation. Three of these factors include the abundance of favored food species (mainly oaks), site and stand factors, and tree conditions.

Stands of trees that are predominately oak and grow on poor, dry sites (such as sand flats or rock ridges) are frequently stressed and often incur repeated, severe defoliations. Trees growing under these conditions frequently possess an abundance of structural features such as holes, wounds, and deep bark fissures that provide shelter and habitats for gypsy moth larvae and aid their survival.

Stands of trees that are predominantly oak but grow on protected slopes or on sites with adequate moisture and organic matter are more resistant to defoliation by the gypsy moth.

Slow-growing trees on poor sites frequently survive a single, severe defoliation better than fast-growing trees typically found on well-stocked better sites.

More trees are killed in stands that contain mainly oak species than in oak-pine or mixed hardwood stands.

Subdominant trees are killed more rapidly and more often than dominant trees.

### **Silvicultural Treatment-What and When?**

Appropriate silvicultural treatment will be determined by an anticipated occurrence of gypsy moth defoliation, by characteristics of the stand, and by the economic maturity of the stand. Foresters refer to treatments discussed here as "thinning's." Thinning's are cuttings made in forest stands to remove surplus trees (usually dominant and subdominant size classes) in order to stimulate the growth of trees that remain.

***Predefoliation treatments:*** When gypsy moth defoliation is anticipated, but not within the next 5 years, **predefoliation thinning** to selectively remove preferred-host trees can reduce the severity of defoliation, increase the vigor of residual trees, and encourage seed production and stump sprouting. Thinning's should not be conducted in fully stocked stands that will reach maturity within the next 6 to 15 years. Thinning results in a short-term "shock effect" to residual trees. This shock effect, coupled with defoliation-caused stress, renders trees vulnerable to attack by disease organisms such as *Armillaria*.

In fully stocked stands that will reach maturity within the next 16 or more years, two kinds of thinning can be applied. The method of thinning should depend on the proportion of preferred host species present.

If more than 50 percent of the basal area in a stand is preferred host species (mainly oaks), **presalvage thinning** should be applied. Presalvage thinning is designed to remove the trees most likely to die (trees with poor crown condition) from stress caused by gypsy moth defoliation.

If less than 50 percent of the basal area in a stand is in preferred host species, **sanitation thinning** can be applied to reduce further the number of preferred host trees. This will result in fewer refuges for gypsy moth larvae and in improved habitats for the natural enemies of the gypsy moth.

***Treatment during outbreaks:*** If defoliation is current or is expected within the next 5 years, thinning's should be delayed because of potential "shock effect." High-value stands can be protected by applying pesticides. In low-value stands or those that are at low risk (less than 50 percent basal area in preferred host species), protective treatments are optional.

***Post-outbreak treatments:*** After a defoliation episode, the land manager or woodlot owner should pursue efficient salvage of dead trees, but should delay decisions about additional salvage, regeneration, or other



treatments for up to 3 years. At the end of 3 years, most defoliation-caused mortality will be complete and the need for treatments can be assessed on the basis of damage level, current stocking conditions, and stand maturity.

Above portions on gypsy moth are from: <http://www.na.fs.fed.us/SPFO/pubs/fidls/gypsymoth/gypsy.htm>

### **Orangestriped Oakworm**



## Symptoms

**Identifying the Insect** - The larvae of the orange striped oak worm are black with eight narrow yellow stripes, the pink striped oak worm larvae are greenish brown with four pink stripes, and the spiny oak worm larvae are tawny and pinkish with short spines. Larvae are about 2 inches (50 mm) long and have a pair of long, curved "horns". The adult moths are a similar yellowish red, with a single white dot on each of the forewings.

**Identifying the Injury** - Young larvae feed in groups, skeletonizing the leaf. Later they consume all but the main veins and usually defoliate one branch before moving onto another. Older larvae are less gregarious and can be found crawling on lawns and the sides of houses.

## Control

Natural enemies generally prevent widespread defoliation. Chemical control may be needed for high value trees, but is rarely recommended.

## Red Maple

Red maple is considered very susceptible to defects, such as decay and structural defects in branching and form. Especially on poor sites, red maple often has poor form and considerable internal defects. Discoloration and decay advance much faster in red maple than in sugar maple.

Although many insects and diseases feed upon and infect this species, it is considered very resistant to these damaging agents. However, because of its thin bark, it is susceptible to mechanical and fire damage. Much of the time secondary decay fungus and pathogens produce significant heart rot after bark damage to trunk.

## Sweet Gum

### Distribution

Sweetgum (*Liquidambar styraciflua* L.) occurs naturally in the Southeastern United States.

### Disease

Sweetgum is rarely attacked by insects but is frequently marred by trunk canker and trunk lesion caused by *Botryosphaeria ribis*. This disease causes sunken areas on the trunk and profuse "bleeding". Infected bark and sapwood will be brown and dead. There is no chemical control for canker diseases. Severely infected trees will die or produce large cavities or rotted portions on the lower trunk. Sweetgum is predisposed to this disease when the trunk is damaged.



*Botryosphaeria ribis* canker on trunk.

Leaf spots of various types may attack Sweetgum, causing premature defoliation, but are not serious.

#### **Management Considerations - Monolithic Stands**

Recently cleared coastal areas are frequently repopulated with sweet gum. The vigorous regrowth of this species will suppress the regeneration of other more desirable woody plants; virtually creating a sweet gum desert. Thus, areas that are normally dominated by other higher value species, such as oak, will be suppressed because of the aggressive repopulation of sweet gum. Stands of sweet gum on high quality sites should be thinned before the largest trees exceed 6 inches in diameter at breast height; otherwise, vigor and growth of most other tree species are reduced or eliminated.

#### **Tulip Poplar**

##### **Distribution**

Tulip poplar is exacting in soil and moisture requirements. It does best on moderately moist, deep, well drained, loose textured soils; it rarely grows well in very dry or very wet situations. It will tolerate a pH of 4.5 to 7.5.

##### **Pests and Potential Problems**

Tulip poplar is unusually free from insects and disease. The yellow-poplar weevil, nectria canker, and fusarium canker are three of the more important enemies of this species; but are rarely considered a threat to overall stand health.

This species is prone to wind damage and ice damage in exposed situations.

## **Recommendations Regarding Fuel Loads**

Propane can result in a large-scale forest fire:

-Several fire prevention and propane industry references recommend maintaining a 10-foot clearance between liquid fuel/propane storage tanks and combustible vegetation.

-Fuel breaks and Fire breaks can help solve problems.

-A fire break is defined as a strip of bare soil or fire-retardant vegetation meant to control or stop the spread of fire.

-Fuel breaks are strips or blocks of vegetation that have been altered to both slow and control the spread of fire.

-Some notable benefits and purposes to use Fuel and Fire breaks are:

- Wildfire hazards are reduced
- Greater safety to fire fighters by creating a defensible area
- Reduced intensity of wildfire
- If applied in a woodland, trees may respond to increased growing space with improved growth
- Improved access Improved visual quality
- Generally, reduce the fuel volume, break up the fuel continuity and eliminate the fuel chain between structures and surrounding forest vegetation
- If trees are involved, space the crowns to allow heat to escape. Prune dead lower limbs on larger trees and remove accumulations under them. Pruning also improves the visibility around the structure and helps tree growth. Also, interrupt any connection between the ground and the possible for a fire to “step-up” into the crowns. Adequately dispose of any slash created from installing this practice.

## **CONCLUSION**

Natural events like wildfires, wind, diseases, and insects are important factors in forest ecosystems. The ongoing challenge for forestry professionals is to achieve and maintain healthy forests with a balanced approach to the naturally occurring events.

Actively scouting or monitoring areas at risk due to unnatural or extreme conditions is the first step in maintaining healthy woodlands. Both active and passive management can have some short-term adverse impacts and cannot eliminate all forest health or wildfire hazards. A substantial and growing body of research and professional experience, however, shows that active management can produce much more reliable and positive results than a passive-management approach.

## **APPENDIX J**

Sustainable Range Vegetation Management Plan



# **SUSTAINABLE RANGE VEGETATION MANAGEMENT PLAN**

**U.S. Army Aberdeen Proving Ground  
October 2020**



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Attachment 1 Federal Consistency Determination

## **LIST OF ACRONYMS AND ABBREVIATIONS**

APG	Aberdeen Proving Ground
ARL	Army Research Laboratory
ATC	Aberdeen Test Center
ATEF	Automotive Technology Evaluation Facility
CARA	20 <sup>th</sup> Chemical, Biological, Radiological, Nuclear, Explosives Command – Analytical and Remediation Activity
CBC	Chemical Biological Center
DPW	Directorate of Public Works
GIS	geographic information system
LWE	Littoral Warfare Environment
OB/OD	Open Burning/Open Detonation
PAAF	Phillips Army Airfield
PDTDF	Prototype Detonation Test and Destruction Facility
REC	record of environmental consideration
RRB	Recoilless Rifle B
SUGV	Small Unmanned Ground Vehicle
UGV	Unmanned Ground Vehicle
U.S.	United States
UTF	Underwater Explosion Test Facility
UXO	unexploded ordnance

## **1. INTRODUCTION**

### **1.1 PURPOSE**

The sustainment of the military mission requires that range areas remain available and accessible for testing and training activities. Range operations require lines of sight and access for data collection, scoring, target placement, SAFETY OF PERSONNEL, and other activities required to execute a successful test. For safety considerations, many range areas are only accessed when they are required for testing and training operations, so that personnel are not exposed to unnecessary risks from unexploded ordnance (UXO). In addition, resources (funding and labor) for annual vegetation management continue to be limited. Delaying vegetation management for safety and resource considerations, coupled with the aggressive spread and regeneration of early successional tree species into operational range areas, impedes access to ranges and hinders the ability to execute testing and training missions.

The purpose of this Sustainable Range Vegetation Management Plan is to prescribe environmentally sound practices for managing vegetation on range areas, with a multi-year time frame in mind. To ensure compliance with Maryland's Coastal Zone Management Program, this Sustainable Range Vegetation Management Plan is accompanied by a Federal Consistency Determination (Attachment 1). The Federal Consistency Determination quantifies the one-time offsets for periodic maintenance clearing of vegetation. This Sustainable Range Vegetation Management Plan is a component plan and appendix to the APG Integrated Natural Resources Management Plan.

Implementation of this plan will require continued coordination with the Garrison Directorate of Public Works (DPW) – Environmental Division, Natural Resources Team to ensure compliance with multiple subject areas (forests; wetlands; rare, threatened, endangered plants; bald eagles; migratory birds; bats; other threatened, endangered, protected species), and may require submission of a Record of Environmental Consideration (REC) for individual action (see Section 2).

### **1.2 SCOPE**

This Sustainable Range Vegetation Management Plan prescribes vegetation management practices and timeframes for ranges on U.S. Army Aberdeen Proving Ground (APG). This plan addresses existing ranges operated by the Army Research Laboratory (ARL), the Aberdeen Test Center (ATC), the Chemical Biological Center (CBC), and the 20<sup>th</sup> Chemical, Biological, Radiological, Nuclear, Explosives Command – Analytical and Remediation Activity (CARA). This plan may be updated and amended in the future, as warranted, to include additional range areas. However, any new range constructions or expansion of existing ranges will require a separate Federal Consistency Determination.

### **1.3 RESPONSIBILITIES**

The development of this plan is a collaborative effort between Garrison and tenant organizations that have a vested interest in range sustainment on the installation.

#### **1.3.1 Garrison**

The DPW Environmental Division – Natural Resources Team provides guidance and recommendations on vegetation management activities to ensure mission sustainment in accordance with legal requirements. The Natural Resources Team is responsible for:

- Updating this plan, with input from the tenant organizations
- Developing and submitting the plan's General Consistency Determination
- All communications with regulators
- Providing input to controlled burn plans
- Coordinating aerial herbicide application with the tenant environmental personnel, ATC Range Operations Division, and ATC Airfield Operations, as well as the DPW Integrated Pest Management Coordinator

The DPW Integrated Pest Management Coordinator is responsible for:

- Maintaining the license to apply herbicide
- Overseeing the application of all herbicide on the installation
- Approving herbicides proposed for use
- Overseeing the preparation of the herbicide
- Maintaining list of individuals approved to spray under license

The Directorate of Emergency Services (DES) – Fire Department is responsible for helping to plan the controlled burns, and for coordinating with the ATC Controlled Burn Manager to execute the controlled burns.

#### **1.3.2 Tenant**

##### **1.3.2.1 Range Managers**

The tenant range managers are responsible for meeting the recommendations of this plan for their range. If range managers possess the appropriate equipment to conduct the maintenance, they will execute the plan as prescribed. Range managers are responsible for ensuring maintenance of the equipment that is provided to the range.

##### **1.3.2.2 Environmental**

The tenant environmental personnel are responsible for submitting appropriate documentation to fulfill the requirements of the National Environmental Policy Act (NEPA). For this plan, tenants are required to submit a Record of Environmental Consideration (REC) to the DPW NEPA office prior to any vegetation maintenance other than grass mowing.

The tenant environmental personnel are responsible for tracking the range vegetation maintenance across their ranges to ensure that each range is meeting the

recommended timelines. Maintenance will be tracked by calendar year of execution, month and day not required, to allow for flexibility with range schedules.

The tenant environmental personnel are responsible for reporting range vegetation maintenance to the DPW Natural Resources Team annually by 1 March.

#### **1.3.2.3 Range Operations**

The Commander of ATC is the Range Officer in Charge for APG. The ATC Range Operations Division provides control and coordination for range operations on APG land, water, and restricted airspace. The ATC Range Operations Division is responsible for reviewing, approving, and scheduling range work requests (from all tenants) for vegetation maintenance on all ranges; and for clearing work crews into downrange areas.

The ATC Range Operations Division will appoint a Controlled Burn Manager. The Controlled Burn Manager is responsible for coordinating controlled burn activities with the DES Fire Department, ATC Aviation Operations Division, tenant range managers, tenant environmental personnel, and the DPW Natural Resources Team.

Currently, the Controlled Burn Manager only coordinates controlled burns on ATC ranges. There is no current identified need for controlled burns on ARL or CBC ranges. If a future burn is required on an ARL and/or CBC range, then a formal written agreement between commands will be established in advance (i.e., interagency agreement).

#### **1.3.2.4 Aviation Operations**

The ATC Aviation Operations Division is responsible for providing aerial support to controlled burn and herbicide application activities. Pilots for herbicide application must possess: 1) a valid license from the Maryland Department of Agriculture for aerial herbicide application, and 2) a category 11 (aerial application pest control) certification from a DoD-sponsored course.



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## 2. METHODS OF VEGETATION MANAGEMENT

There are three primary means of managing vegetation on ranges: mechanical, controlled burning, and herbicidal spraying. Each method was considered for every range, and the prescriptions in this plan outline the best methods for each range. In some cases, multiple methods may be viable for a given area.

Any proposed activity, except routine (at least twice per year) grass mowing, requires submission of a REC to the DPW NEPA office. There may potentially be time of year restrictions or other impact minimization measures for bald eagle nesting or other protected species, a requirement for a site visit coordinated with the DPW Natural Resources Team, or other site-specific requirements; these requirements will be captured upon review of the REC.

### 2.1 MECHANICAL MANAGEMENT

Mechanical management includes: mowing, cutting, trimming, or other above ground methods that involve mechanical equipment in the control of vegetation. Mechanical management does not include grubbing, stump grinding, or stump removal. All tree trimming or cutting must be coordinated in advance with the DPW Forester.

Best management practices for mechanical maintenance include:

- No grubbing, stump grinding, or stump removal
- No bulldozing
- Limit ground disturbance from equipment, utilize ground mats if necessary
- Do not dump or push debris (logs, branches, trimmings, etc) into wetland areas or waterways
- Make clean flush cuts (to branch collar) when trimming limbs
- Always remove dead or damaged branches
- Trim branches contacting buildings and structures or encroaching on roads and signs
- Remove less than ¼ of tree crown per year
- Remove branches from no more than lower 1/3 of main trunk of tree (when limbing up for clearance)
- Refer to APG Forest Management Plan (appendix to APG Integrated Natural Resources Management Plan)
- Submit REC to the DPW NEPA office prior to any mechanical management, except routine (at least twice per year) grass mowing

### 2.2 HERBICIDAL SPRAYING

There are circumstances where mechanical management alone is less effective at curtailing vegetative growth and herbicidal spraying is needed to supplement vegetation management. Herbicides are particularly effective for spot treating around building and

pad perimeters, along fences, and within gravel pads and roads, and as a precursor to controlled burns for common reed control. All herbicidal spraying must be coordinated in advance with the DPW Integrated Pest Management Coordinator. Spray activities must occur under the APG herbicide license. Herbicidal applications must be conducted by a certified pesticide applicator, with all volumes reported to the DPW Integrated Pest Management Coordinator using form DD 1532-1.

Best management practices for herbicidal spraying include:

- Avoid herbicide applications if rainfall is expected within 24 hours
- Minimize drift onto non-targeted vegetation, be aware of wind speed and direction
- Use minimal volume and dose necessary to control vegetation
- Wear appropriate personal protective equipment (as specified by applicable laws, regulations and/or the pesticide label)
- Refer to APG Integrated Pest Management Plan
- Submit REC to the DPW NEPA office prior to any herbicidal spraying

## **2.3 CONTROLLED BURNING**

All controlled burning activities must be coordinated in advance with the ATC Controlled Burn Manager, who coordinates with the DES Fire Department. All controlled burns (also called open burns) need Harford County Health Department permits. Each semiannual permit specifies all burns anticipated during the upcoming six-month period (January-June and July-December). The ATC Controlled Burn Manager and DES Fire Department must coordinate with the DPW Environmental Division, Air Program Team prior to each six-month period to obtain such a permit. Controlled burns are not permitted from 1 June to 31 August. The Garrison-appointed Wildland Fire Manager is the lead on setting and managing the fires in accordance with the APG Integrated Wildland Fire Management Plan. A controlled burn plan is submitted for Garrison approval by the ATC Controlled Burn Manager prior to burn season each year.

Best management practices for controlled burning include:

- Evaluate meteorological conditions when scheduling controlled burns
- Provide trained fire management professionals for execution of controlled burns
- Keep helicopters with “bambi buckets” on standby during controlled burns
- Utilize back burns as appropriate to keep fire within boundaries and/or to protect sensitive areas (e.g., test infrastructure, bald eagle nests, etc.)
- Maintain and utilize fire breaks and fuel breaks
- Conduct pre- and post-burn monitoring to evaluate effectiveness of fire at eliminating fuel load while sustaining mission land and ecosystem
- Refer to APG Integrated Wildland Fire Management Plan (appendix to APG Integrated Natural Resources Management Plan)
- Submit REC to the DPW NEPA office prior to any controlled burn

### 3. RANGE PRESCRIPTIONS

The following sections prescribe methods and frequencies for managing the vegetation on existing APG ranges. The range boundaries are based on the DPW Real Property Inventory and Range Operations firing lines. These boundaries have been slightly adjusted, as necessary, to reflect the DPW's most current Geographic Information System (GIS) aerial layers.

Frequencies included in these prescriptions are minimum recommended frequencies for maintenance. Frequencies were identified based on current and foreseeable mission needs. Any mitigation for tree removal, as identified in Federal Consistency Determination, will be required one time only, provided that recommended maintenance frequency is followed. Maintenance that does not meet these minimum recommended timelines may require future mitigation. Maintenance will be tracked by year (not month) of execution, allowing for flexibility in conducting vegetation management on active, operational test ranges.

The ranges are divided into areas based on vegetation maintenance prescriptions, with areas represented by individual polygons. Common area designations are:

- **Berm**  
Engineered soil berm, typically grass covered with potential for encroaching woody vegetation
- **Encroachment – Trees to Clear**  
Trees that are encroaching on range operations that need to be cut down to the ground (no grubbing or stump removal)
- **Gravel Stands, Pads**  
Gravel stands, pads, and/or impervious surfaces; maintain (at least annually) 15-foot clearance on each side; potential for vegetative growth in gravel; potential for overhanging or dead tree limbs that encroach on clearance
- **Magazine**  
Storage magazine or bunker; maintain (at least annually) 50-foot clearance around perimeter in accordance with security regulations; potential for vegetative growth along fence; potential for overhanging tree limbs that encroach on clearance
- **Natural Area**  
Consolidated trees, forest, and/or wetlands that are monitored for encroachment; potential for overhanging tree limbs that encroach on adjacent areas and/or imbedded road and utility right of ways (right of ways need to be maintained)

- **Natural Area – Mitigation**  
Natural areas that are enhanced or planted to offset permitted impacts; monitored for encroachment; potential for overhanging tree limbs that encroach on adjacent areas
- **Open**  
Grass lawns and fields that may include roads, trails, pads, buildings, and some trees; maintained through mowing (at least twice per year); potential for overhanging or dead tree limbs that encroach on adjacent areas; potential for vegetative growth along fences and building perimeters
- **Shoreline, Beach, Riprap**  
Shoreline areas that may include beach and/or stabilized areas of riprap that are monitored for erosion; potential for vegetative growth in riprap that impacts integrity of stabilized shoreline
- **Stormwater Management**  
Engineered retention pond, drainage inlet, swale and/or other stormwater management structure with potential for encroaching woody vegetation
- **Support Area**  
Fields, roads, and/or pads that may also include some trees and/or small wetlands; maintained less frequently than “open” areas; potential for vegetative growth along fences and building perimeters and in gravel roads and pads

Range roads, magazines, buildings, storage yards, and temperature control unit pads not otherwise addressed in this plan have standard vegetation maintenance prescriptions, as outlined below.

- **Range Roads**  
Range roads not otherwise identified in this plan are to have 15-foot shoulders on both sides that are mechanically managed at least every 10 years to keep the roads open. Many range roads act as fire breaks, and more frequently maintained vegetated shoulders can serve as fuel breaks. Both fuel breaks and fire breaks are critical to executing successful controlled burns. Trees may need to be trimmed along road shoulders to maintain safe clearance, but all tree trimming or cutting must be coordinated in advance with the DPW Forester.
- **Magazines**  
Magazines not otherwise identified in this plan are to have 50 feet of open area around the perimeter in accordance with security regulations. These areas will be mechanically managed at least annually. Herbicide may be applied (by permitted applicators only, with volumes reported to the DPW Integrated Pest Management Coordinator using form DD 1532-1) around fences where mechanical maintenance is less effective. Trees that border the open areas may need to be trimmed to maintain security clearance, but all tree trimming or cutting must be coordinated in advance with the DPW Forester.

- **Buildings, Pads, Fences, and Stored Equipment**  
Buildings not otherwise identified in this plan are generally surrounded by turf grasses and herbaceous weeds. Building yards will be mechanically managed at least annually. Herbicide may be applied (by permitted applicators only, with volumes reported to the DPW Integrated Pest Management Coordinator using form DD 1532-1) around buildings, pads, fences, and stored equipment, where mechanical maintenance is less effective. Trees may need to be trimmed around building perimeters, pads, and along fences to maintain safe clearance, but all tree trimming or cutting must be coordinated in advance with the DPW Forester.
- **Swales**  
Swales not otherwise identified in this plan will be mechanically managed at least every 5 years, or as recommended in the APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded).
- **Temperature Control Unit Pads**  
Temperature control unit pads not otherwise identified in this plan are to have a 50-foot fuel break around the pad. The fuel breaks will be kept clear of all readily combustible materials such as dry grass, dead wood, or brush. Live vegetation is acceptable, with grass as the preferred vegetation. The fuel breaks will be mechanically managed at least annually.

This plan addresses 89 range areas within APG, broken down into 19 ARL ranges, 63 ATC ranges, 6 CBC ranges, and 1 CARA range. This plan may be amended in the future to include additional ranges. The ranges currently included in this plan are:

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#### CARA

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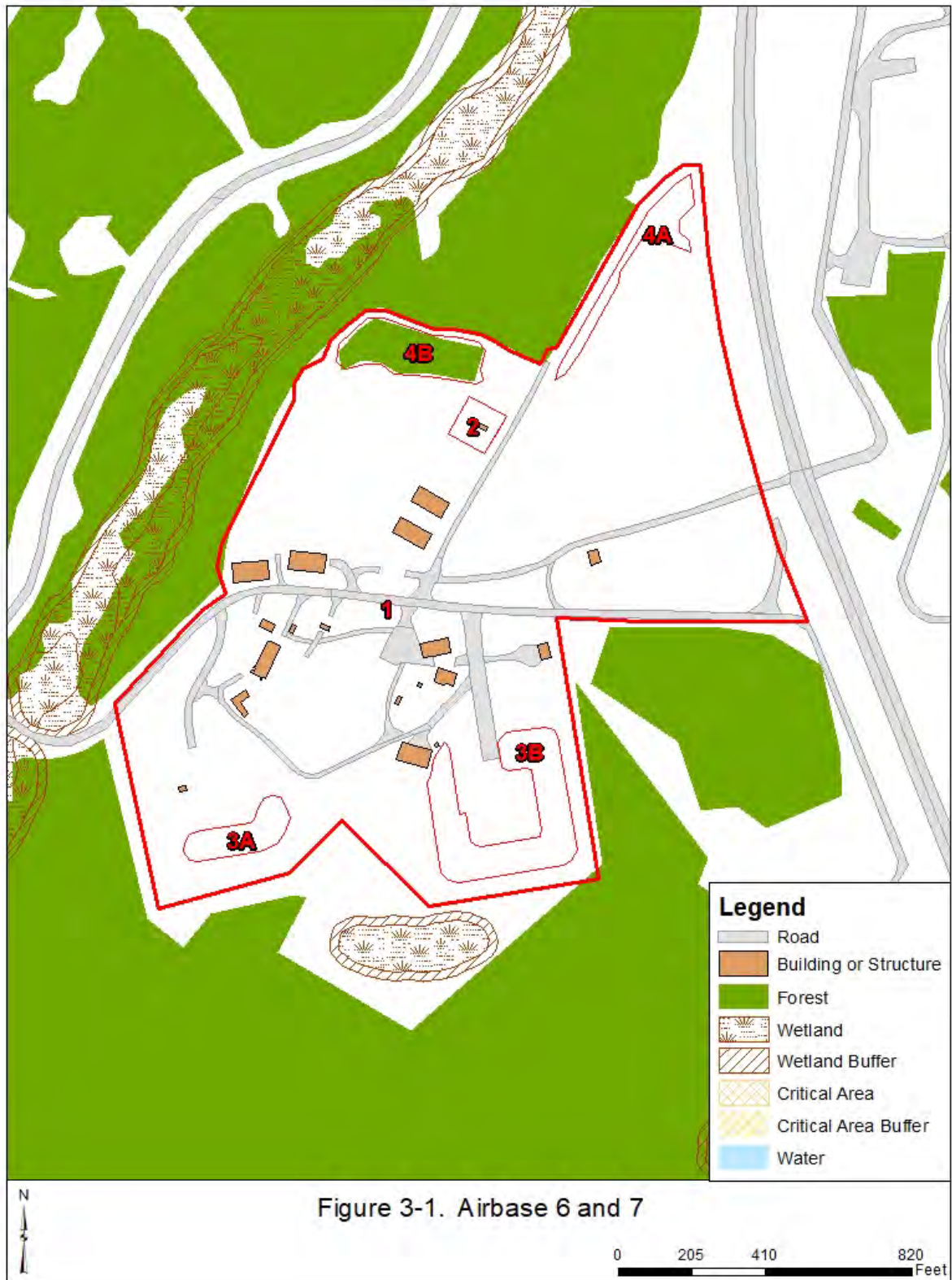
### 3.1 ARL RANGES

#### 3.1.1 Airbase 6 and 7

The Airbase 6 and 7 ranges are located in the Aberdeen Area. The ranges encompass approximately 49 acres.

The Airbase 6 and 7 ranges are delineated into 4 areas (Figure 3-1) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	44
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3
3	Berm	Mechanical, with or without herbicide spraying	Every 2 years	0.6 (A) 2.1 (B)
4	Natural Area	Conservation	Monitor for encroachment	0.7 (A) 1.1 (B)



### 3.1.2 Brier Point

The Brier Point range is located in the Aberdeen Area. The range encompasses approximately 13 acres.

The Brier Point range is delineated into 2 areas (Figure 3-2) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	13
2	Natural Area	Conservation	Monitor for encroachment	0.6



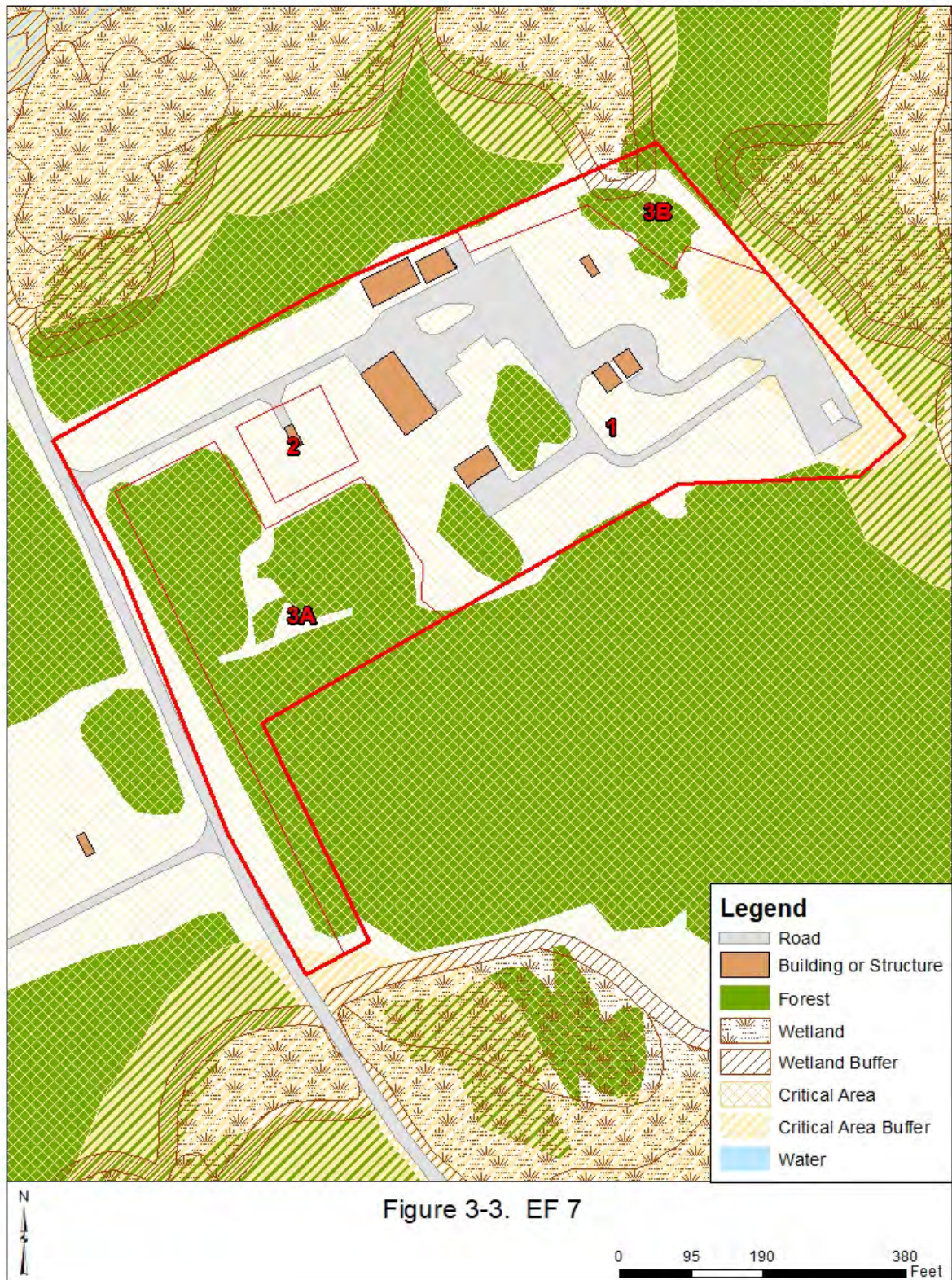
### 3.1.3 EF 7

The EF 7 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 11 acres.

The EF 7 range is delineated into 2 areas (Figure 3-3) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	7.6
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3
3	Natural Area	Conservation	Monitor for encroachment	2.3 (A) 0.6 (B)





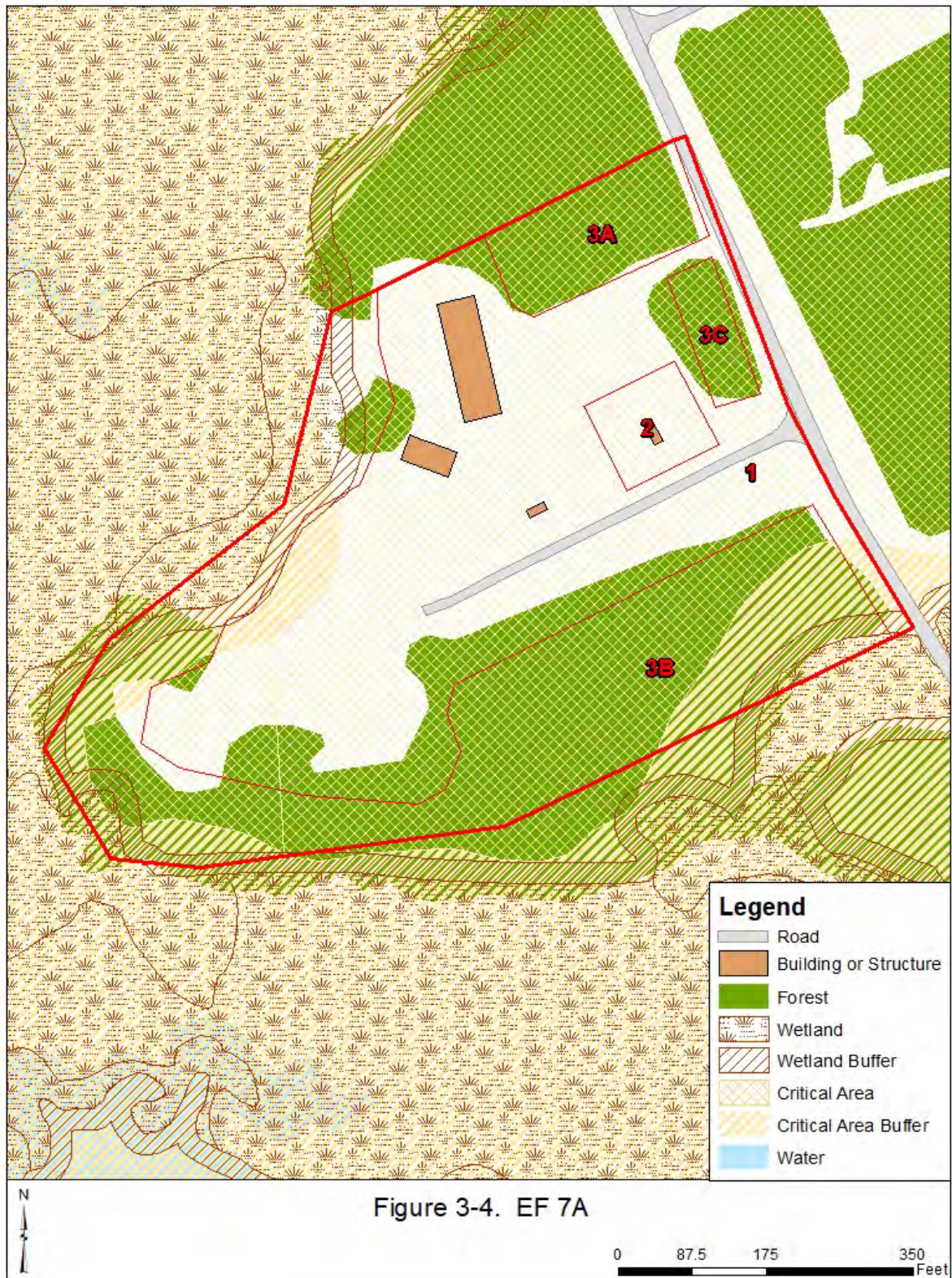
### 3.1.4 EF 7A

The EF 7A range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 11 acres.

The EF 7A range is delineated into 2 areas (Figure 3-4) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	5.9
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3
3	Natural Area	Conservation	Monitor for encroachment	0.7 (A) 4.2 (B) 0.2 (C)





### 3.1.5 EF 8

The EF 8 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 14 acres.

The EF 8 range is delineated into 4 areas (Figure 3-5) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	9.4
2	Natural Area – Mitigation	Conservation	Monitor for encroachment	3.1
3	Natural Area	Conservation	Monitor for encroachment	1.7
4	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.3





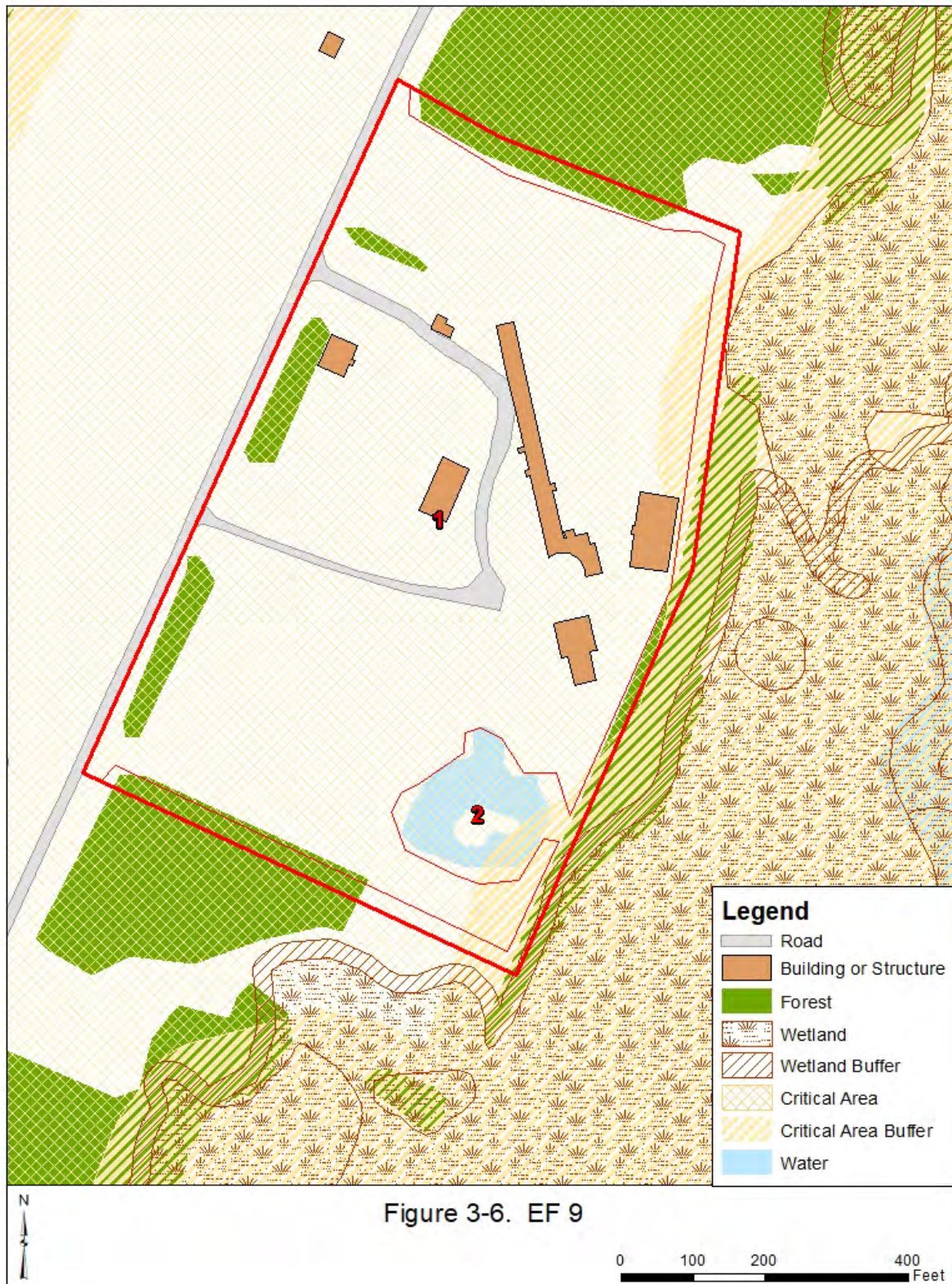
### 3.1.6 EF 9

The EF 9 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 15 acres.

The EF 9 range is delineated into 2 areas (Figure 3-6) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	13
2	Natural Area	Conservation	Monitor for encroachment	2.1





### 3.1.7 EF 10

The EF 10 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 12 acres.

The EF 10 range is delineated into 3 areas (Figure 3-7) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	10
2	Natural Area	Conservation	Monitor for encroachment	0.2 (A) 0.05 (B) 0.07 (C) 0.4 (D) 1.1 (E)
3	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.2





### 3.1.8 EF 11

The EF 11 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 18 acres.

The EF 11 range is delineated into 3 areas (Figure 3-8) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	14
2	Natural Area	Conservation	Monitor for encroachment	0.2 (A) 2.4 (B) 0.4 (C) 1.4 (D)
3	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.5





### 3.1.9 EF 12

The EF 12 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 25 acres.

The EF 12 range is delineated into 2 areas (Figure 3-9) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	13
2	Natural Area	Conservation	Monitor for encroachment	12





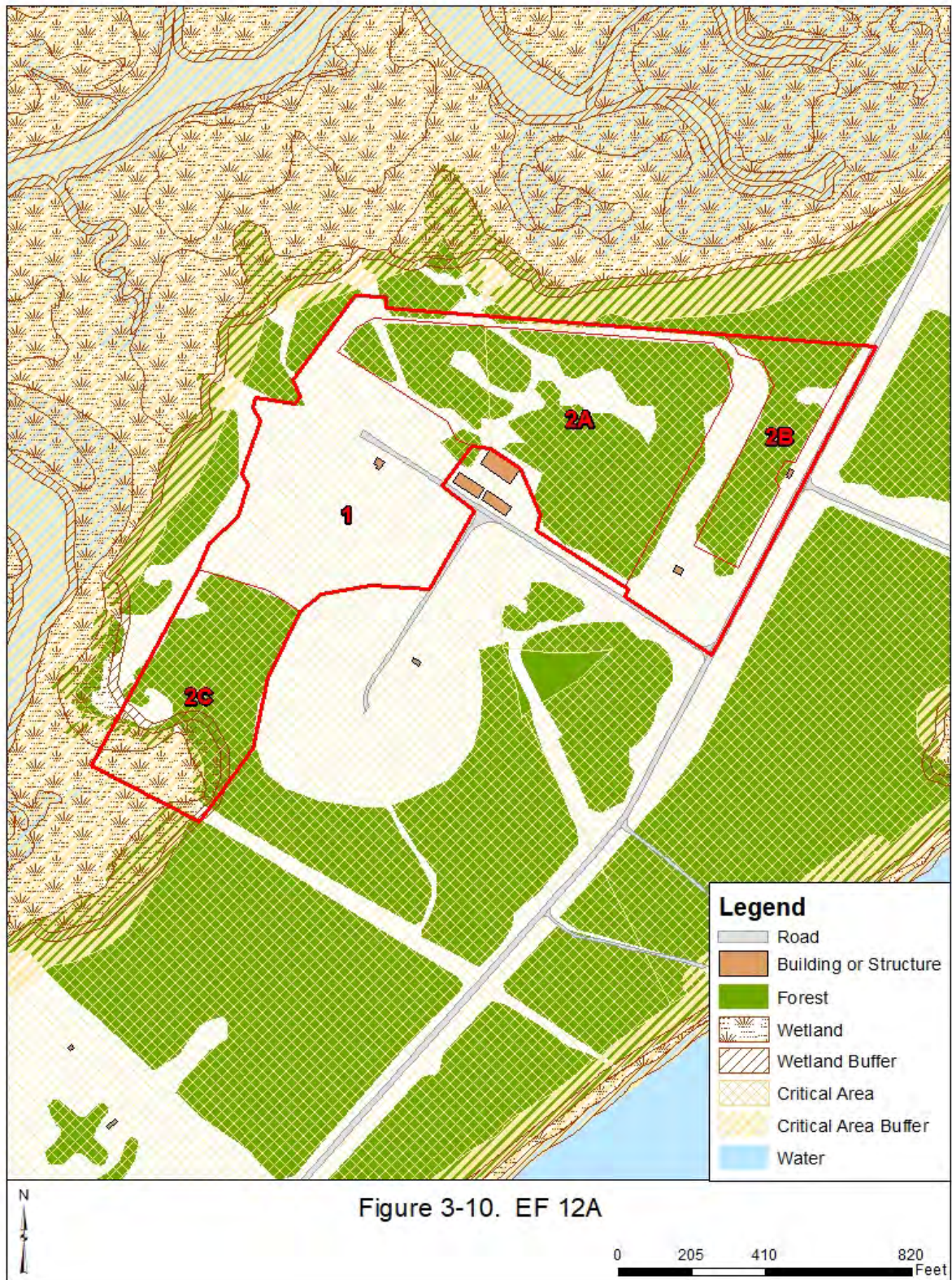
### 3.1.10 EF 12A

The EF 12A range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 30 acres.

The EF 12A range is delineated into 2 areas (Figure 3-10) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	13
2	Natural Area	Conservation	Monitor for encroachment	9.6 (A) 2.5 (B) 5 (C)





### 3.1.11 EF 14

The EF 14 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 29 acres.

The EF 14 range is delineated into a single area (Figure 3-11) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	29
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3





### 3.1.12 EF 15

The EF 15 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 4 acres.

The EF 15 range is delineated into 3 areas (Figure 3-12) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	2.7
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3
3	Natural Area	Conservation	Monitor for encroachment	1.3
4	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.04





### 3.1.13 EF 16

The EF 16 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 17 acres.

The EF 16 range is delineated into 3 areas (Figure 3-13) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	14
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3
3	Natural Area	Conservation	Monitor for encroachment	1.8
4	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.5





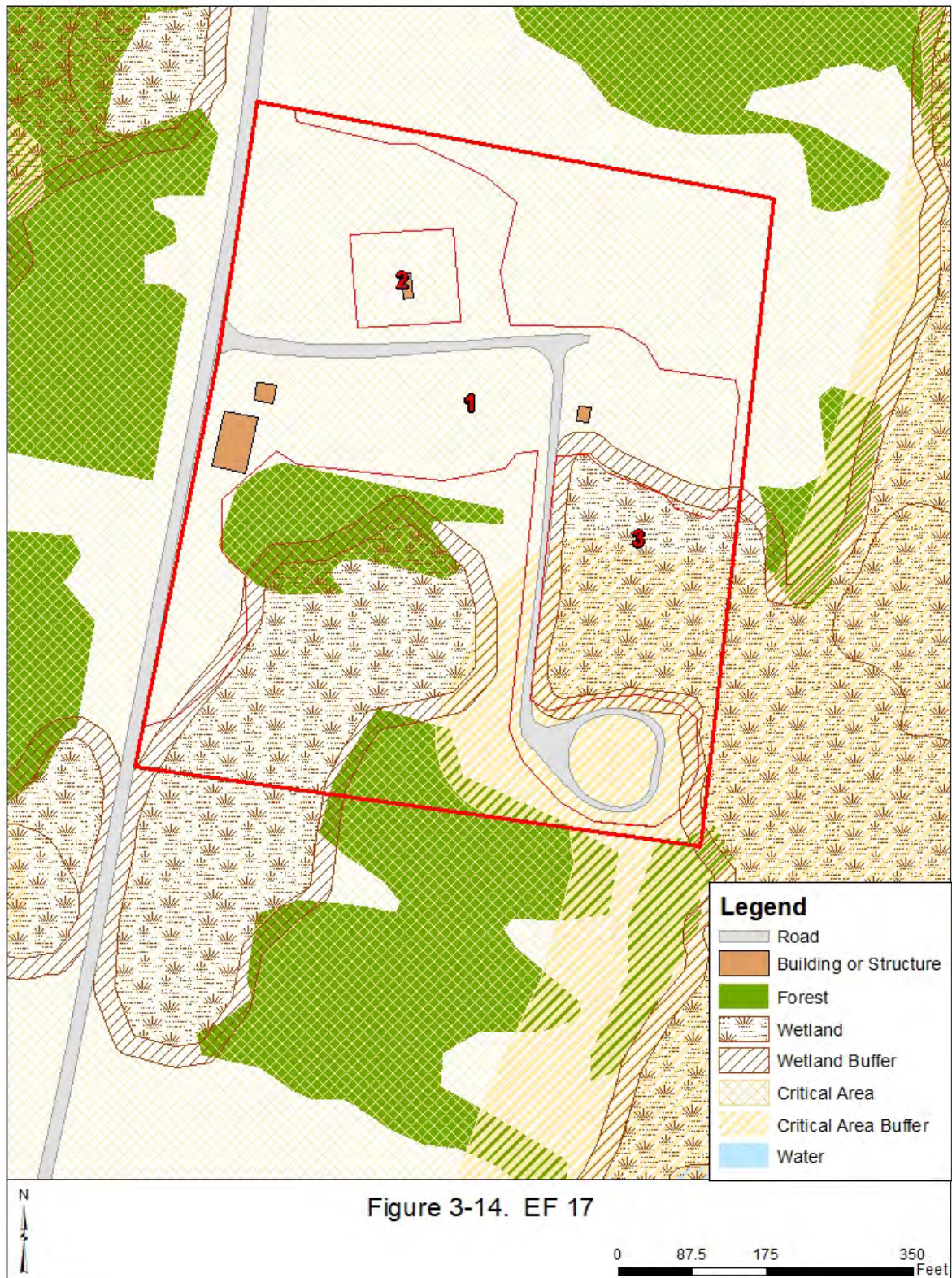
### 3.1.14 EF 17

The EF 17 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 12 acres.

The EF 17 range is delineated into 2 areas (Figure 3-14) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	5
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3
3	Natural Area	Conservation	Monitor for encroachment	6.4





### 3.1.15 EF 20

The EF 20 range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 6 acres.

The EF 20 range is delineated into 3 areas (Figure 3-15) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	5.4
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3
3	Natural Area	Conservation	Monitor for encroachment	0.1





### 3.1.16 Fuze Range

The Fuze Range is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 20 acres.

The Fuze Range is delineated into 2 areas (Figure 3-16) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	14
2	Natural Area	Conservation	Monitor for encroachment	0.2 (A) 0.3 (B) 0.07 (C) 6.1 (D)





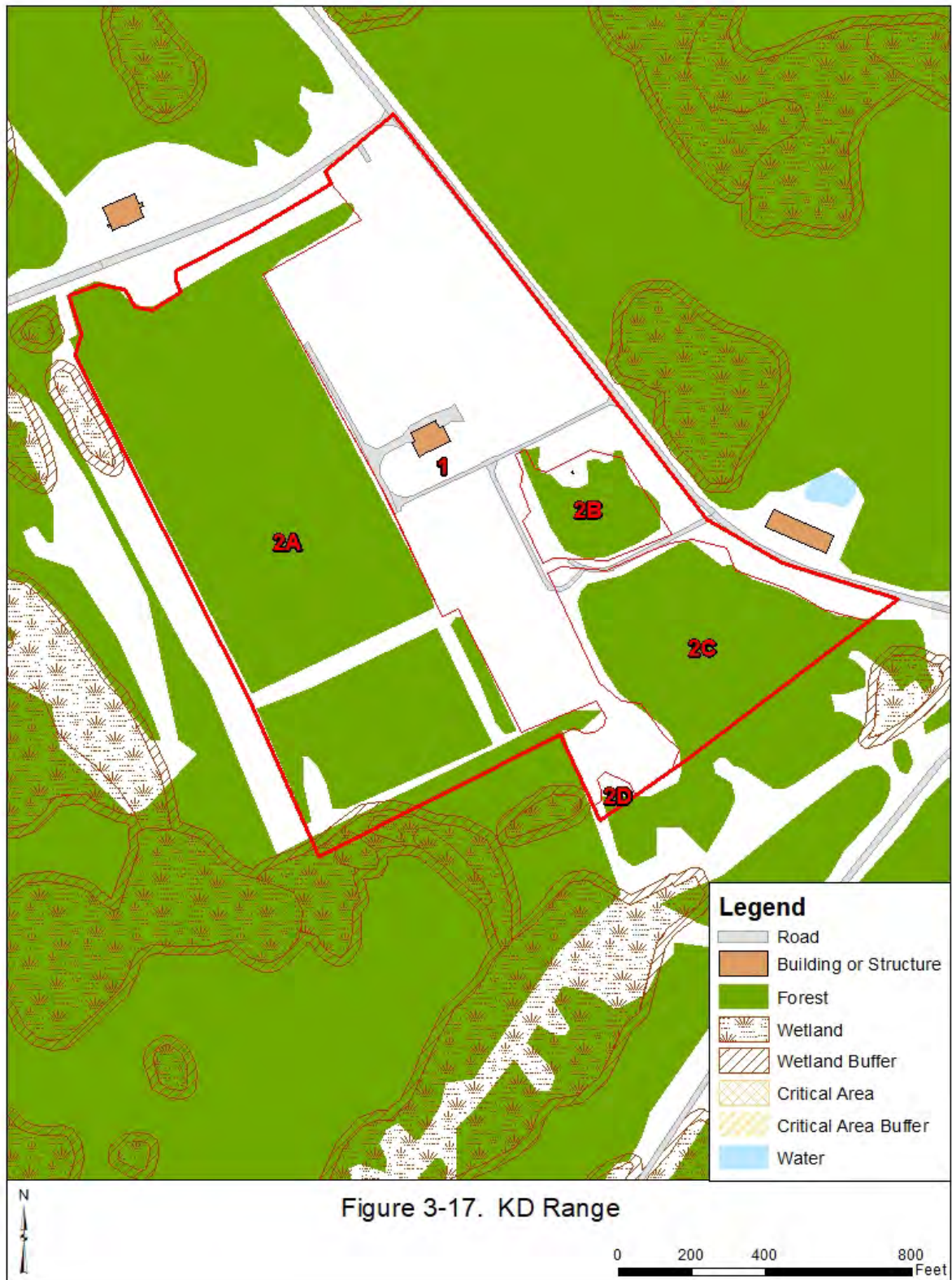
### 3.1.17 KD Range

The KD Range is located in the Aberdeen Area. The range encompasses approximately 51 acres.

The KD Range is delineated into 2 areas (Figure 3-17) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	20
2	Natural Area	Conservation	Monitor for encroachment	23 (A) 2 (B) 6.3 (C) 0.2 (D)





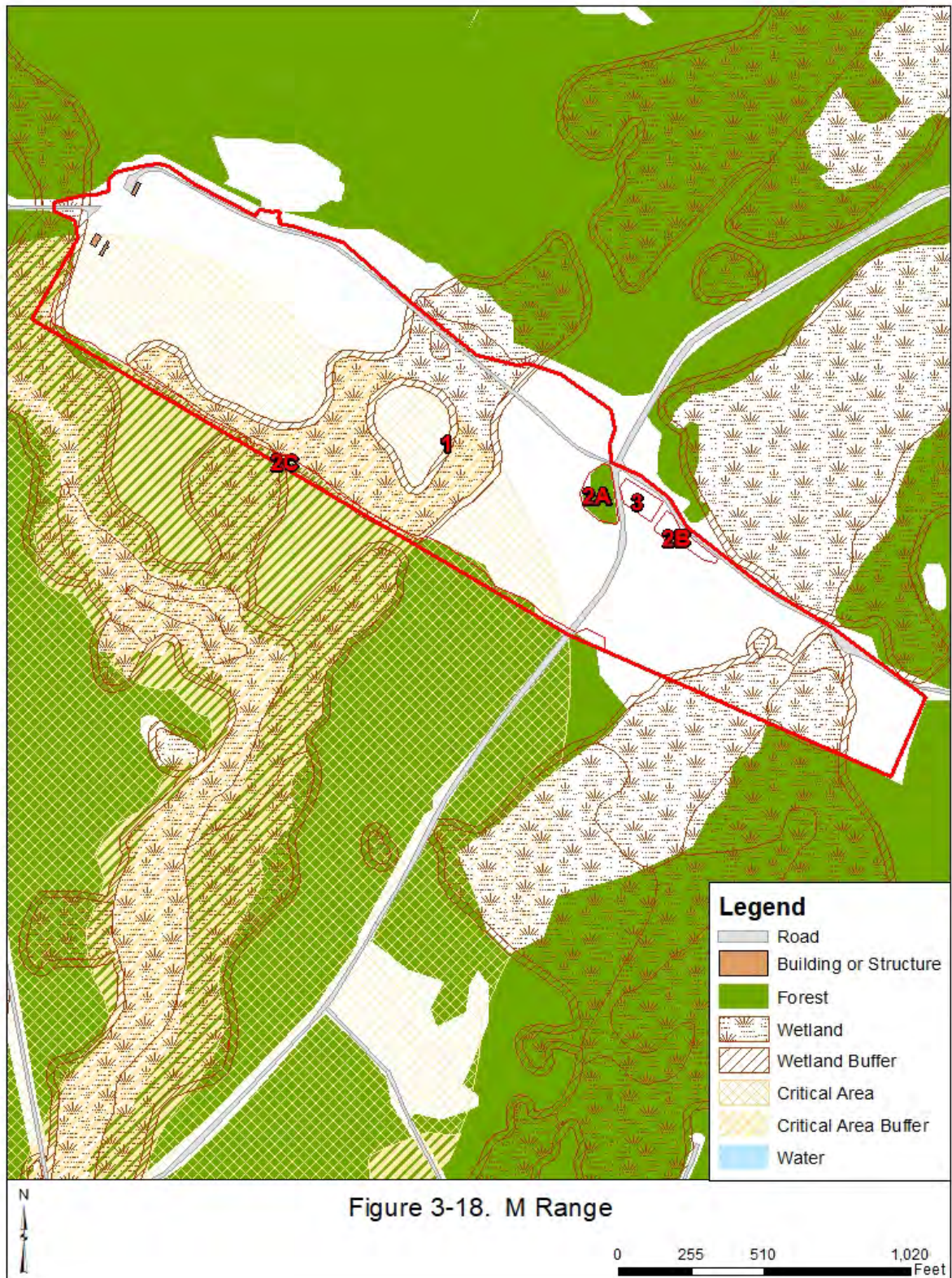
### 3.1.18 M Range

The M Range is located in the Aberdeen Area. The range encompasses approximately 48 acres.

The M Range is delineated into 3 areas (Figure 3-18) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	45
2	Natural Area	Conservation	Monitor for encroachment	0.5 (A) 0.3 (B) 1.6 (C)
3	Cemetery	Cemetery	Not applicable	0.3





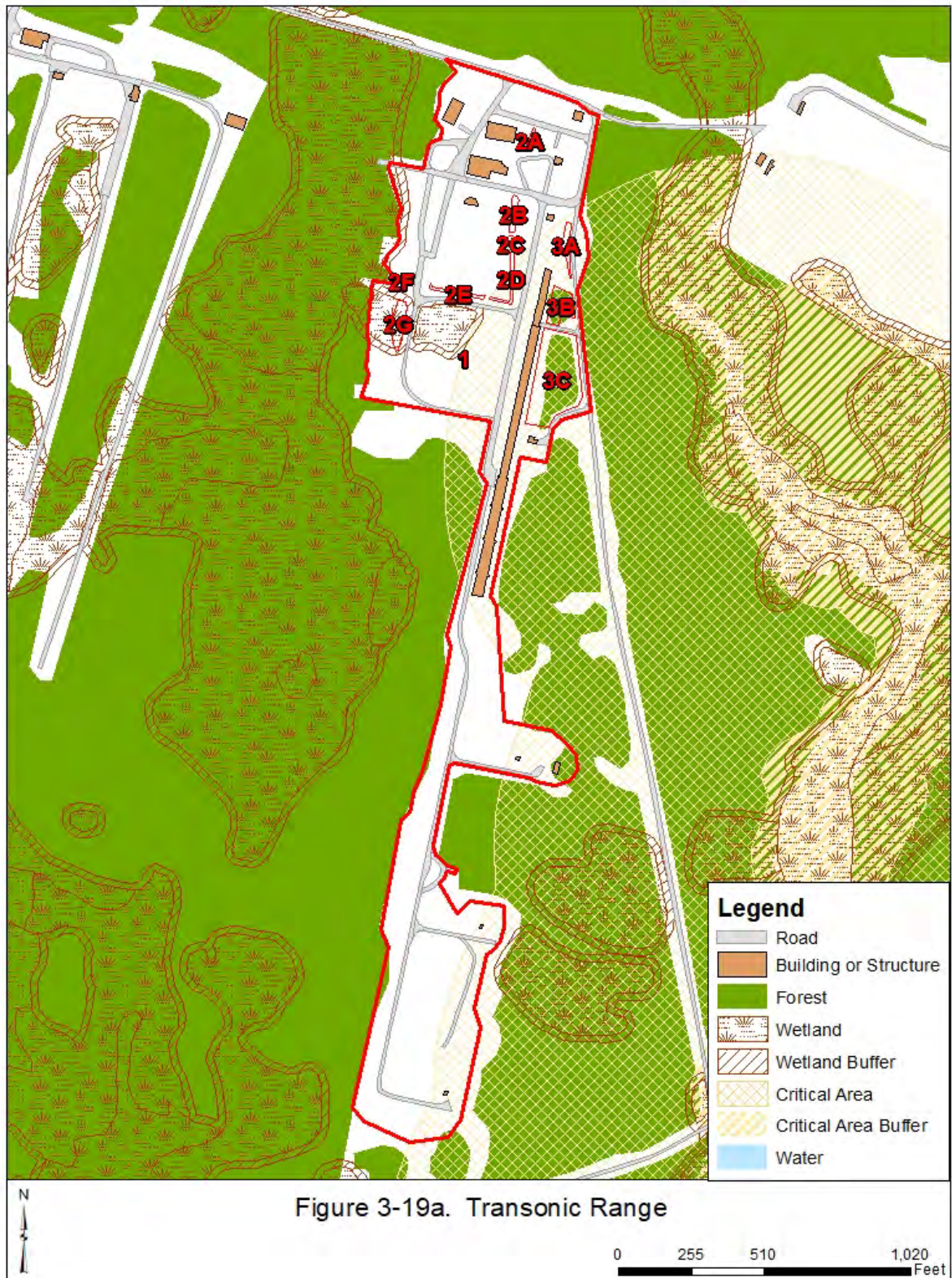
### 3.1.19 Transonic Range

The Transonic Range is located in the Aberdeen Area. The range encompasses approximately 32 acres.

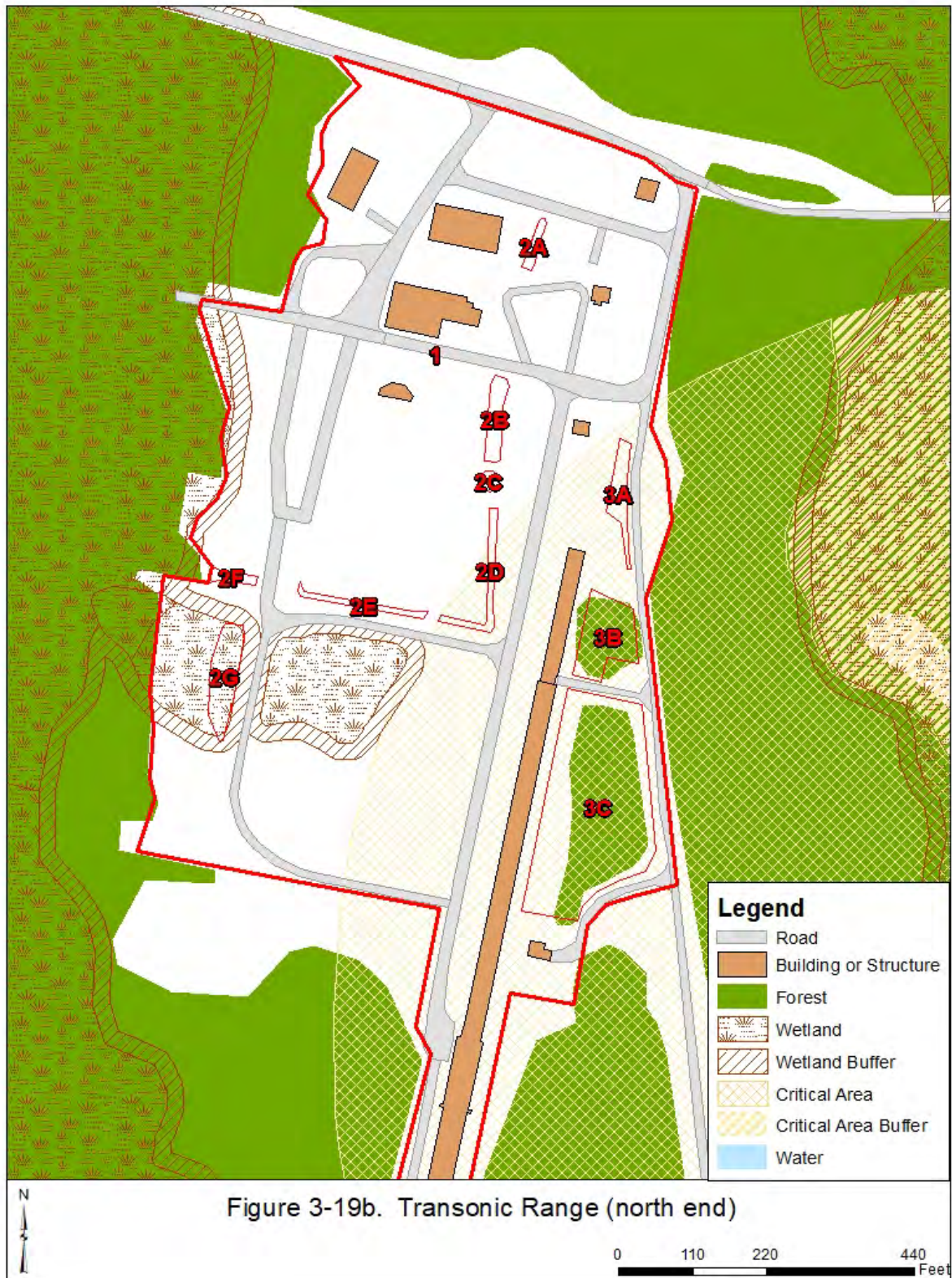
The Transonic Range is delineated into 3 areas (Figures 3-19a and 3-19b) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	30
2	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	0.02 (A) 0.07 (B) 0.02 (C) 0.06 (D) 0.04 (E) 0.02 (F) 0.1 (G)
3	Natural Area	Conservation	Monitor for encroachment	0.08 (A) 0.2 (B) 1.1 (C)











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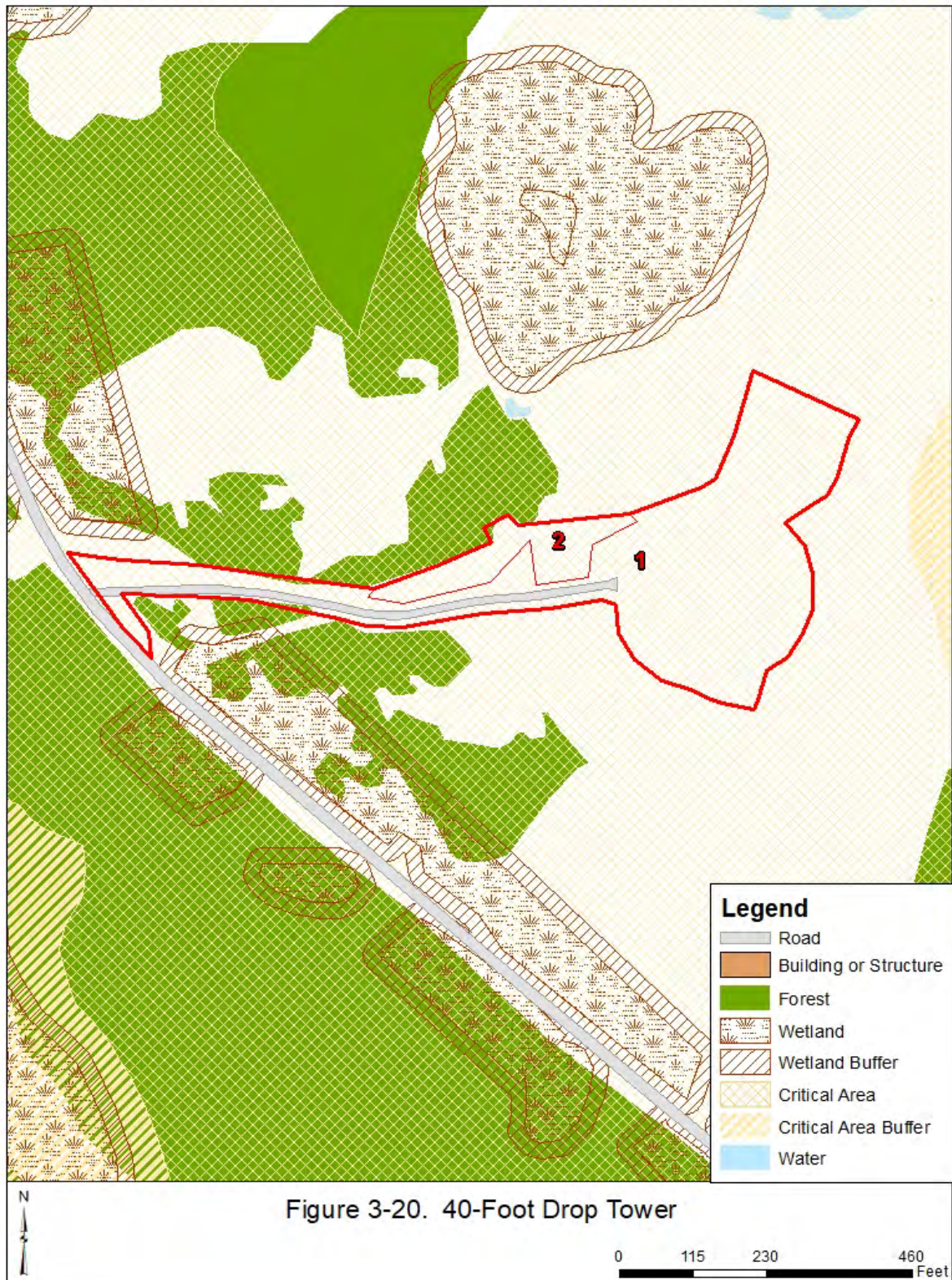
## 3.2 ATC RANGES

### 3.2.1 40-Foot Drop Tower

The 40-Foot Drop Tower range is located in the Aberdeen Area. The range encompasses approximately 4 acres.

The 40-Foot Drop Tower range is delineated into 2 areas (Figure 3-20) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	4.2
2	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Once, then maintain as open (Area 1)	0.5



### 3.2.2 7600 Recovery Field

The 7600 Recovery Field is located in the Aberdeen Area. The range encompasses approximately 70 acres.

The 7600 Recovery Field is delineated into 2 areas (Figure 3-21) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Encroachment – Trees to Clear (primary impact area)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 20 years	25
2	Encroachment – Trees to Clear (expanded impact area)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 20 years	45





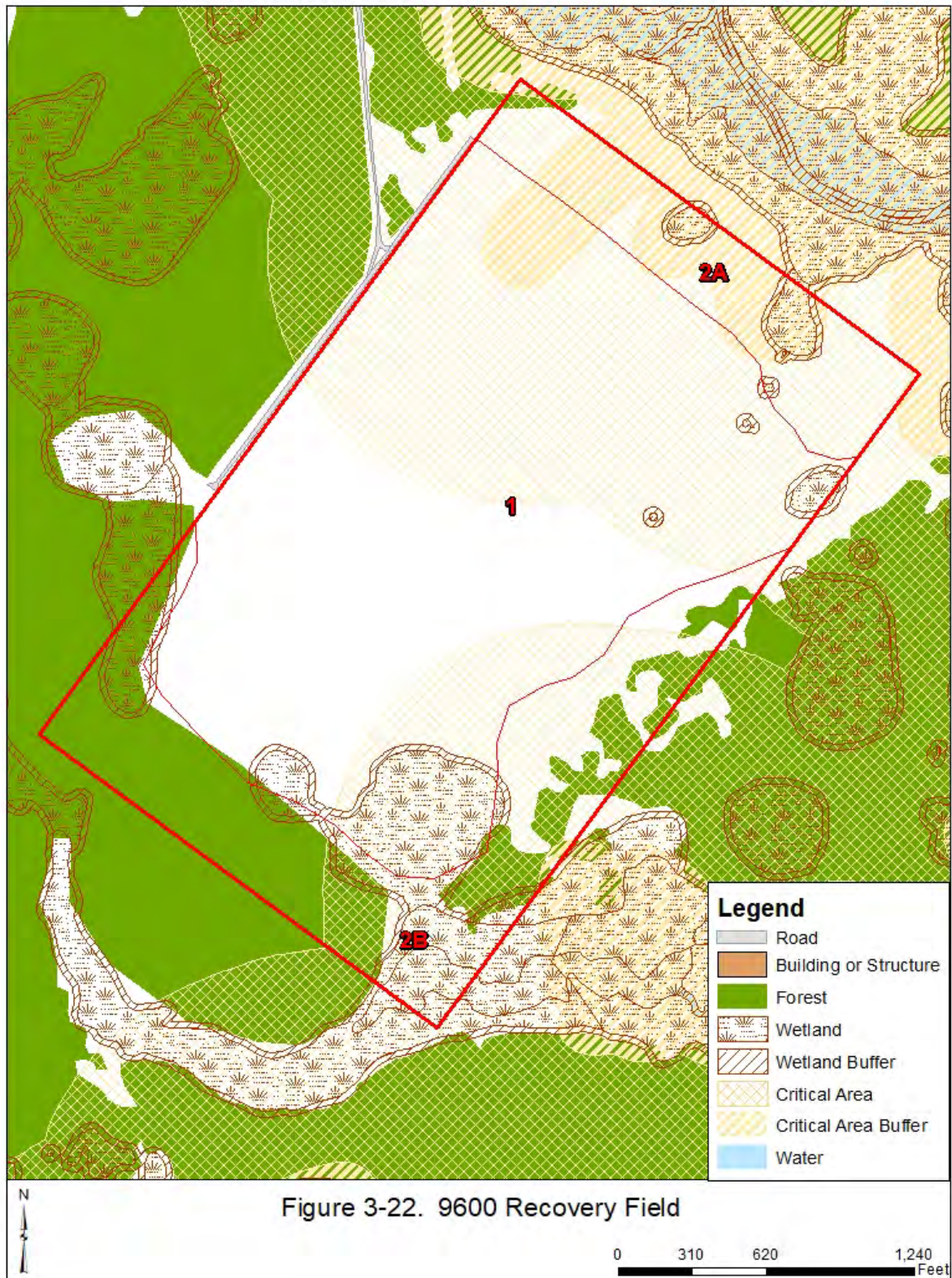
### 3.2.3 9600 Recovery Field

The 9600 Recovery Field is located in the Aberdeen Area. The range encompasses approximately 162 acres.

The 9600 Recovery Field is delineated into 2 areas (Figure 3-22) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Encroachment – Trees to Clear	Mechanical and/or controlled burn, with or without herbicide spraying	Every 20 years	107
2	Natural Area	Conservation	Monitor for encroachment	17 (A) 38 (B)





### 3.2.4 AA3

The AA3 range is located in the Aberdeen Area. The range encompasses approximately 7.5 acres.

The AA3 range is delineated into 3 areas (Figure 3-23) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	2.6
2	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 2 years	0.4 (A) 0.7 (B)
3	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 5 years	3.8





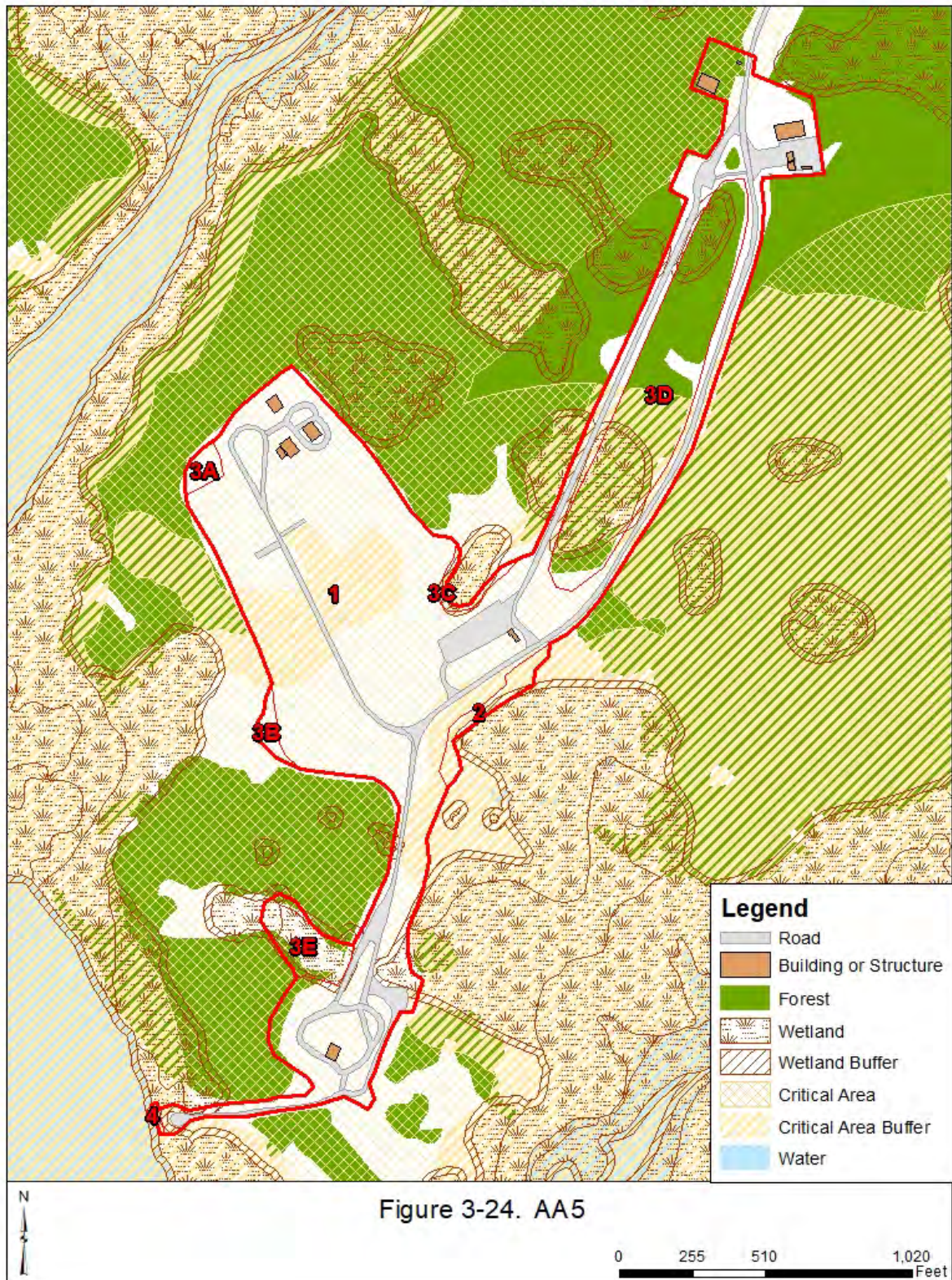
### 3.2.5 AA5

The AA5 range is located in the Aberdeen Area. The range encompasses approximately 47 acres.

The AA5 range is delineated into 4 areas (Figure 3-24) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	37
2	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	0.7
3	Natural Area	Conservation	Monitor for encroachment	0.3 (A) 0.3 (B) 0.3 (C) 7.1 (D) 1.2 (E)
4	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.07





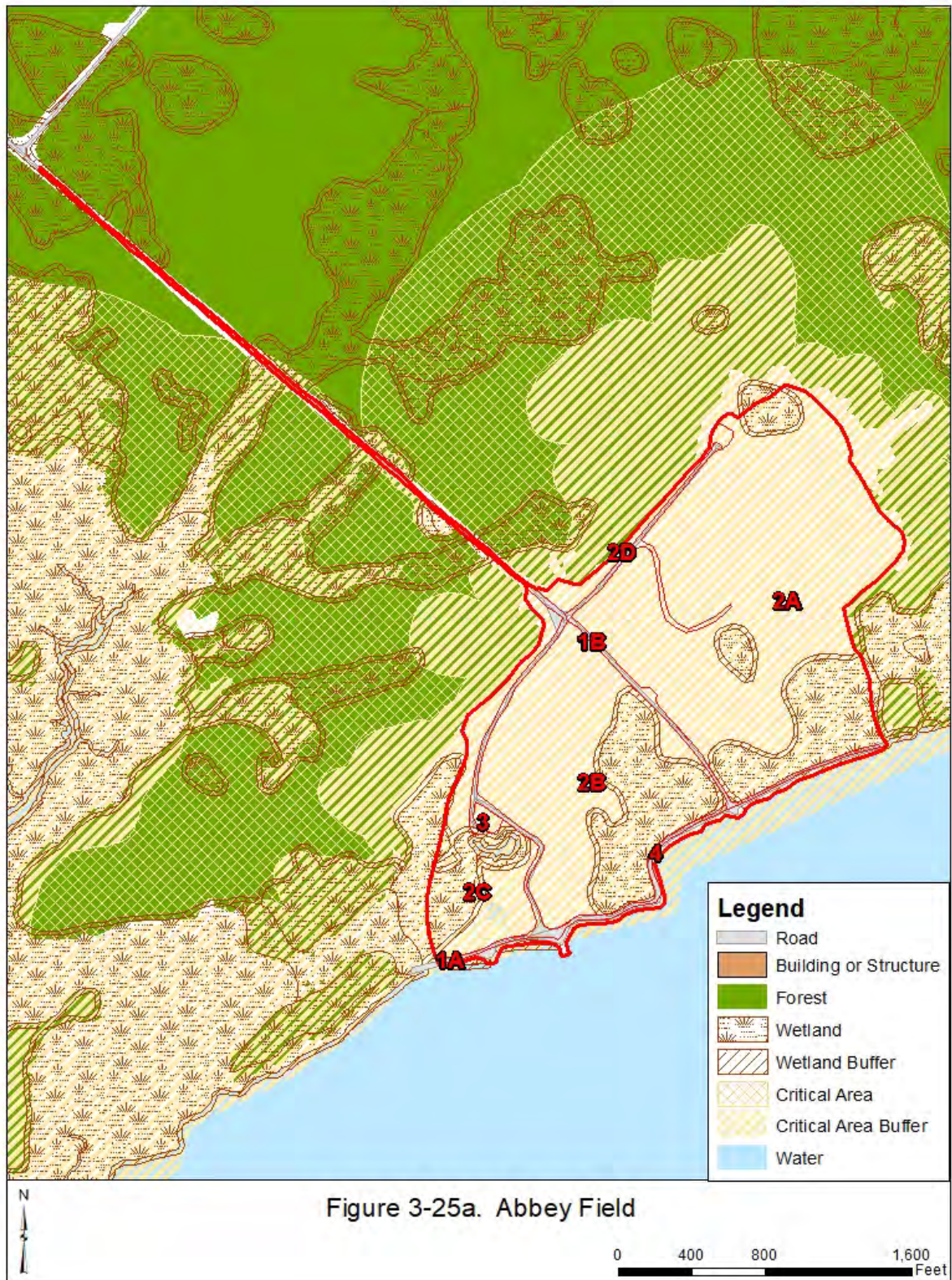
### 3.2.6 Abbey Field

The Abbey Field is located in the Aberdeen Area. The range encompasses approximately 102 acres.

The Abbey Field is delineated into 4 areas (Figures 3-25a and 3-25b) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Support Area (access roads)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	4 (A) 2.2 (B)
2	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	53 (A) 28 (B) 11 (C) 1.7 (D)
3	Encroachment – Trees to Clear	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	0.4
4	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	2.1









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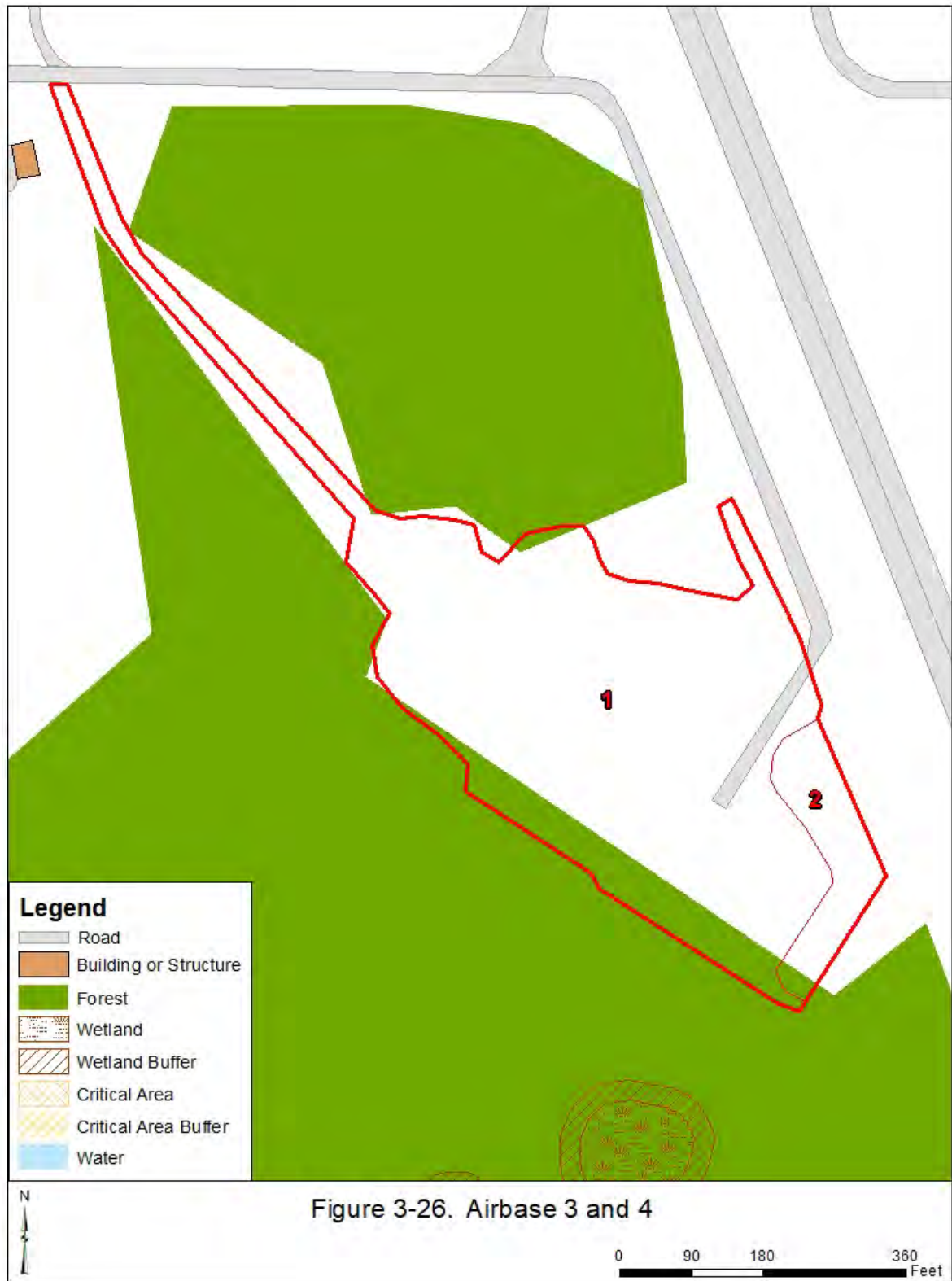
### 3.2.7 Airbase 3 and 4

The Airbase 3 and 4 range is located in the Aberdeen Area. The range encompasses approximately 5.8 acres.

The Airbase 3 and 4 range is delineated into 2 areas (Figure 3-26) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	5.3
2	Berm	Mechanical, with or without herbicide spraying	Every 2 years	0.5





### 3.2.8 Airbase 5

The Airbase 5 range is located in the Aberdeen Area. The range encompasses approximately 15 acres.

The Airbase 5 range is delineated into 4 areas (Figure 3-27) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	13
2	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Once, then maintain as open (Area 1)	0.2
3	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	0.1
4	Natural Area	Conservation	Monitor for encroachment	2.4

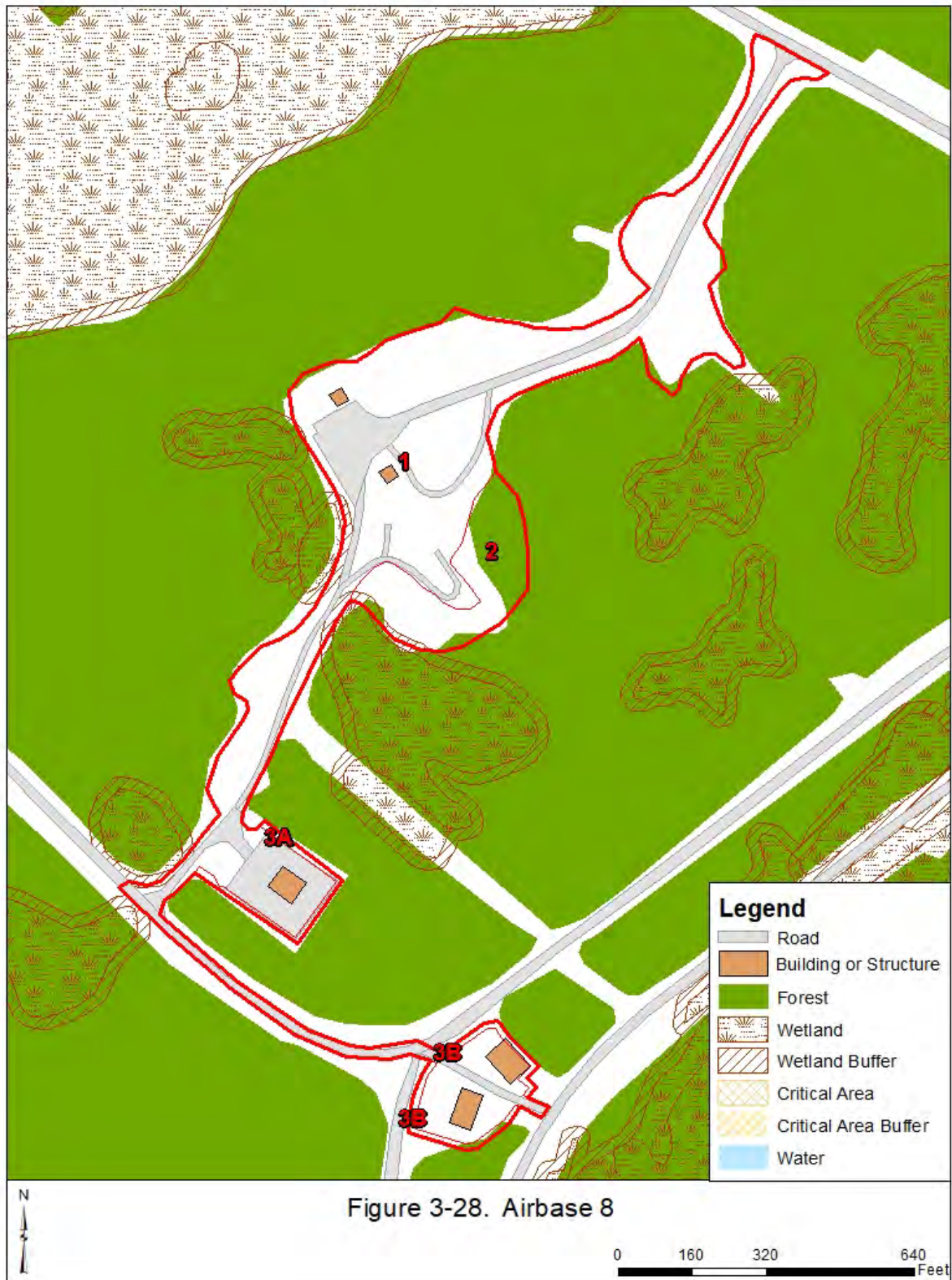


### 3.2.9 Airbase 8

The Airbase 8 range is located in the Aberdeen Area. The range encompasses approximately 13 acres.

The Airbase 8 range is delineated into 3 areas (Figure 3-28) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	11
2	Support Area (fence lines)	Mechanical, with or without herbicide spraying	Every 2 years	0.2 (A) 0.2 (B)
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	1.5





### 3.2.10 Airbase 9

The Airbase 9 range is located in the Aberdeen Area. The range encompasses approximately 6 acres.

The Airbase 9 range is delineated into 4 areas (Figure 3-29) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	1.6
2	Support Area	Mechanical, with or without herbicide spraying	Once per year	3.5
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.7
4	Natural Area	Conservation	Monitor for encroachment	0.1 (A) 0.2 (B)



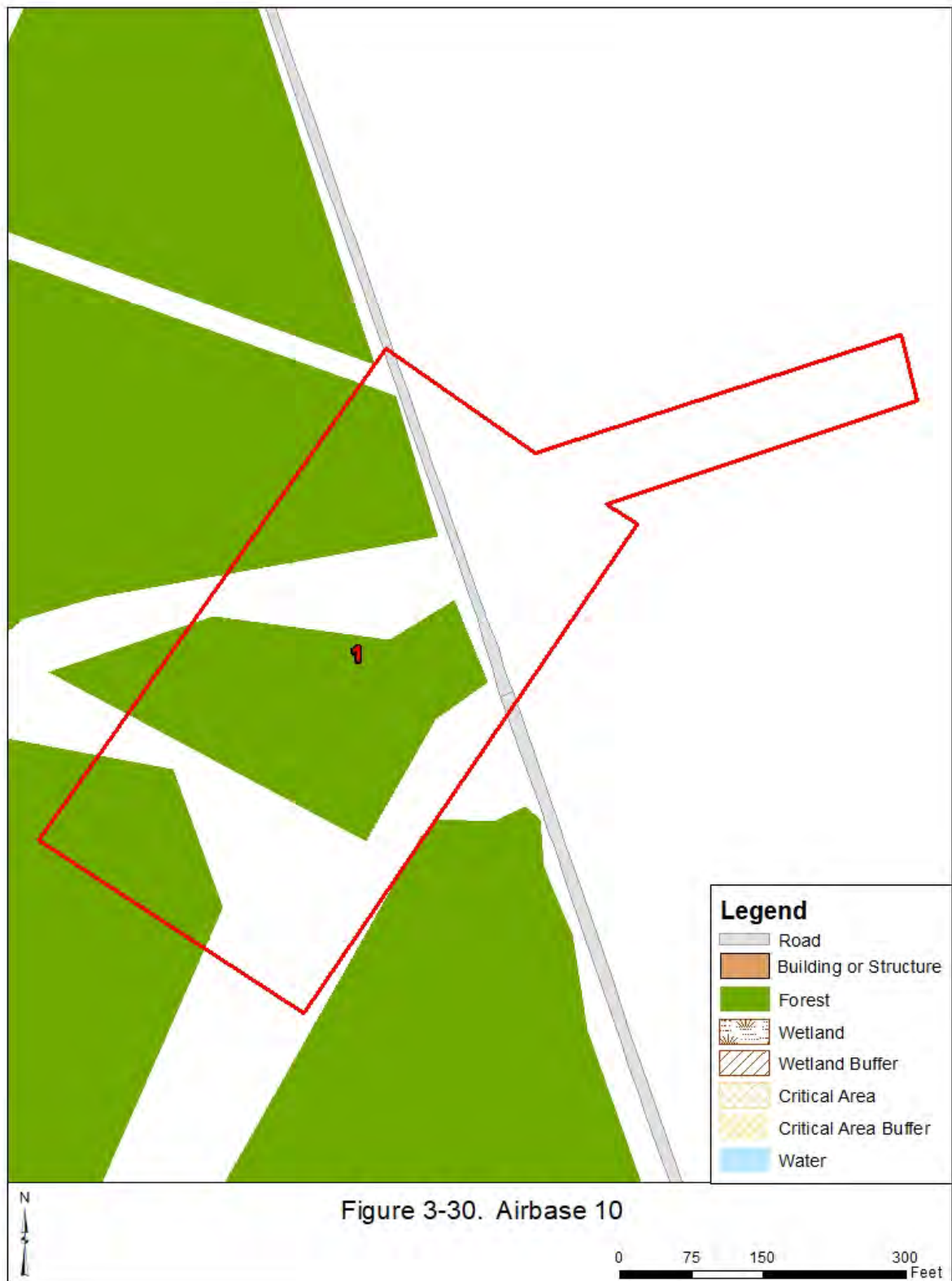
### 3.2.11 Airbase 10

The Airbase 10 range is located in the Aberdeen Area. The range encompasses approximately 5 acres.

The Airbase 10 range is delineated into a single area (Figure 3-30) with associated vegetation maintenance prescription.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	5.3



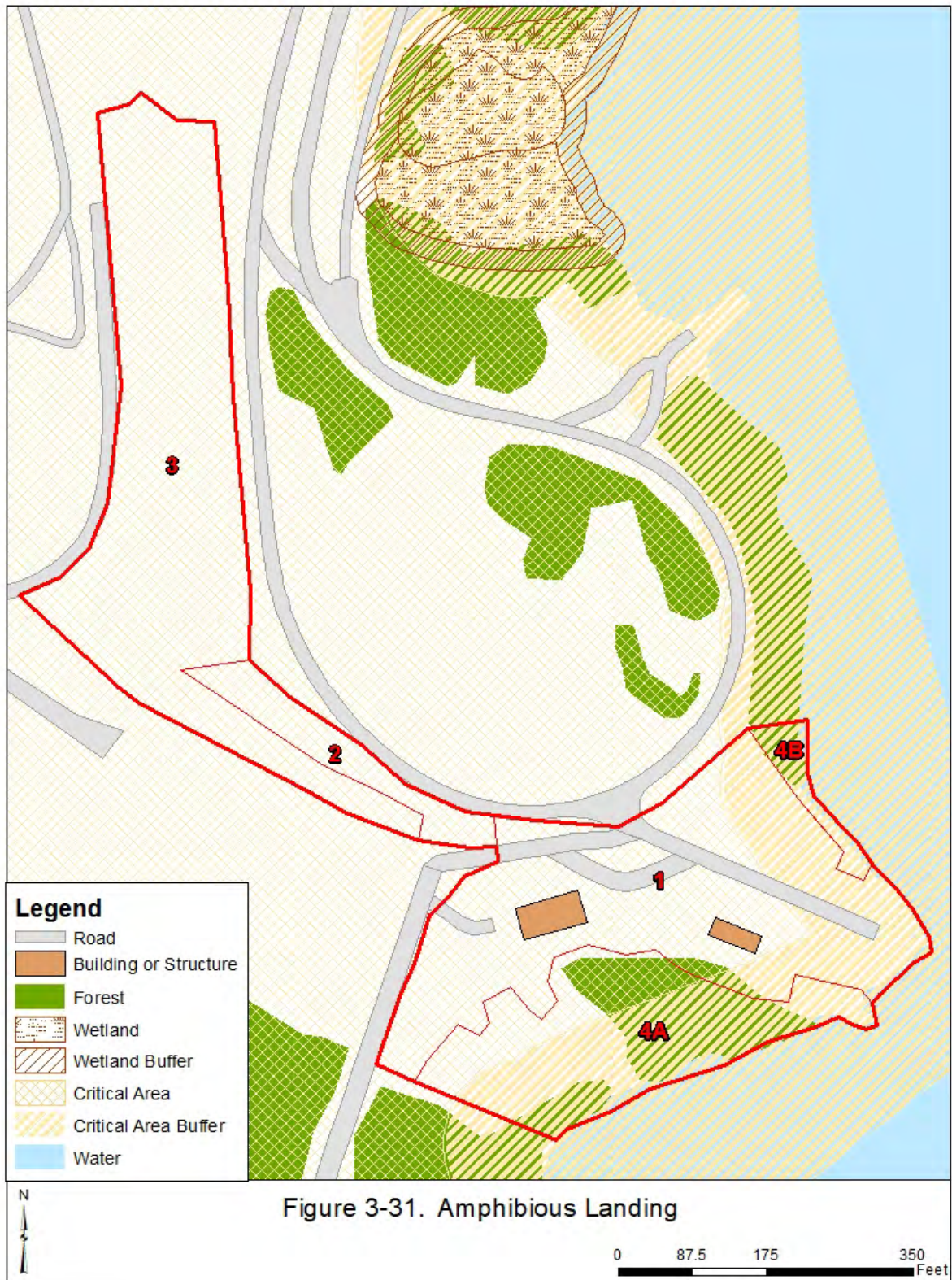


### 3.2.12 Amphibious Landing

The Amphibious Landing is located in the Aberdeen Area. The range encompasses approximately 7 acres.

The Amphibious Landing is delineated into 4 areas (Figure 3-31) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	2.7
2	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	2.8
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.4
4	Natural Area	Conservation	Monitor for encroachment	1.4 (A) 0.1 (B)



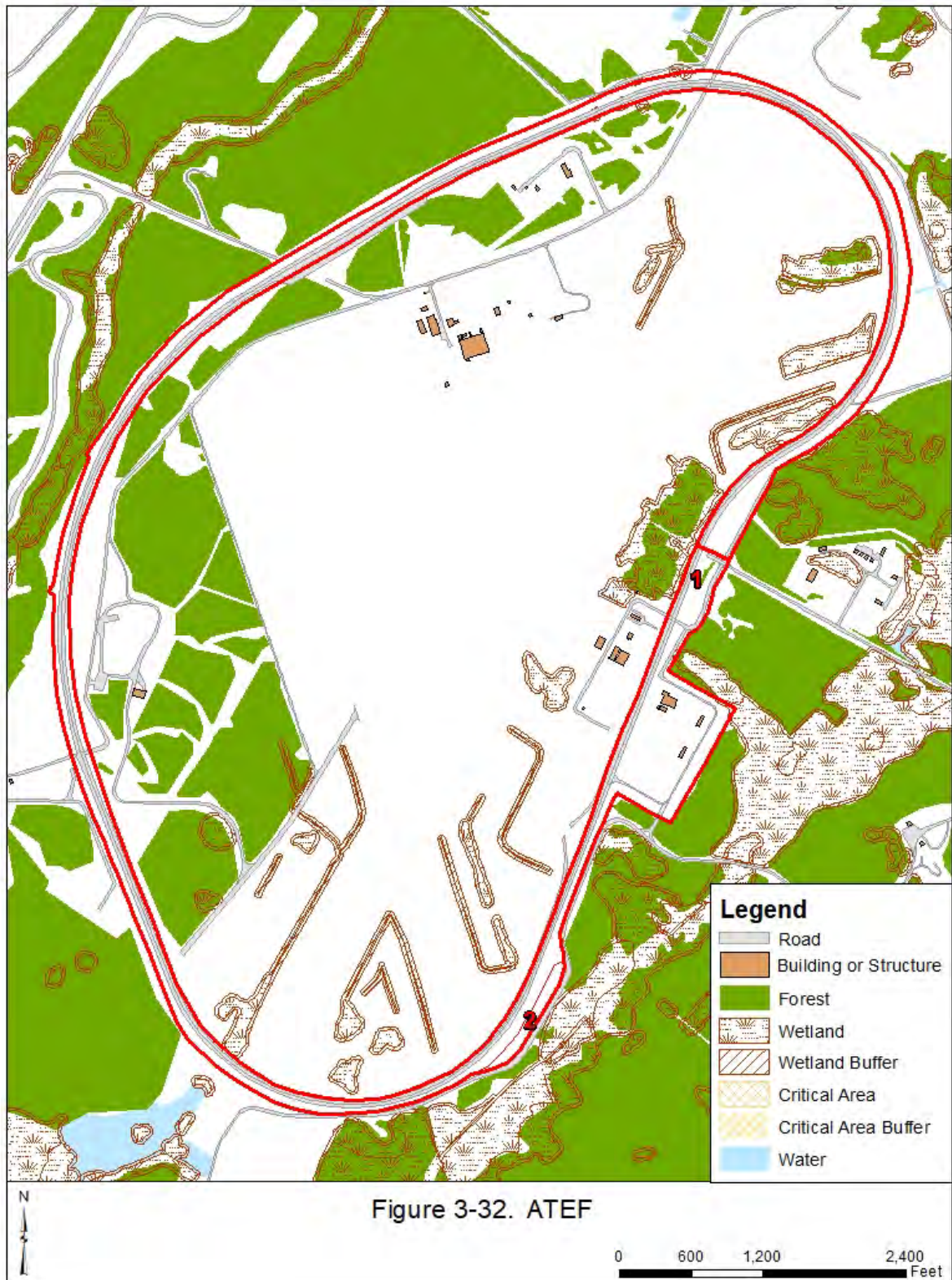
### 3.2.13 Automotive Technology Evaluation Facility (ATEF)

The ATEF is located in the Aberdeen Area. The range encompasses approximately 101 acres.

The ATEF is delineated into 2 areas (Figure 3-32) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	99
2	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	2.4





### 3.2.14 Ballistic Range and New Barricade

The Ballistic Range and New Barricade range are located adjacent to one another in the Aberdeen Area. The ranges encompass approximately 17 acres.

The Ballistic Range and New Barricade ranges are delineated into 5 areas (Figure 3-33) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	6.9
2	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 2 years	5.3
3	Encroachment – Trees to Clear	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	2.5
4	Natural Area	Conservation	Monitor for encroachment	0.4 (A) 0.3 (B) 1.1 (C)
5	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.6





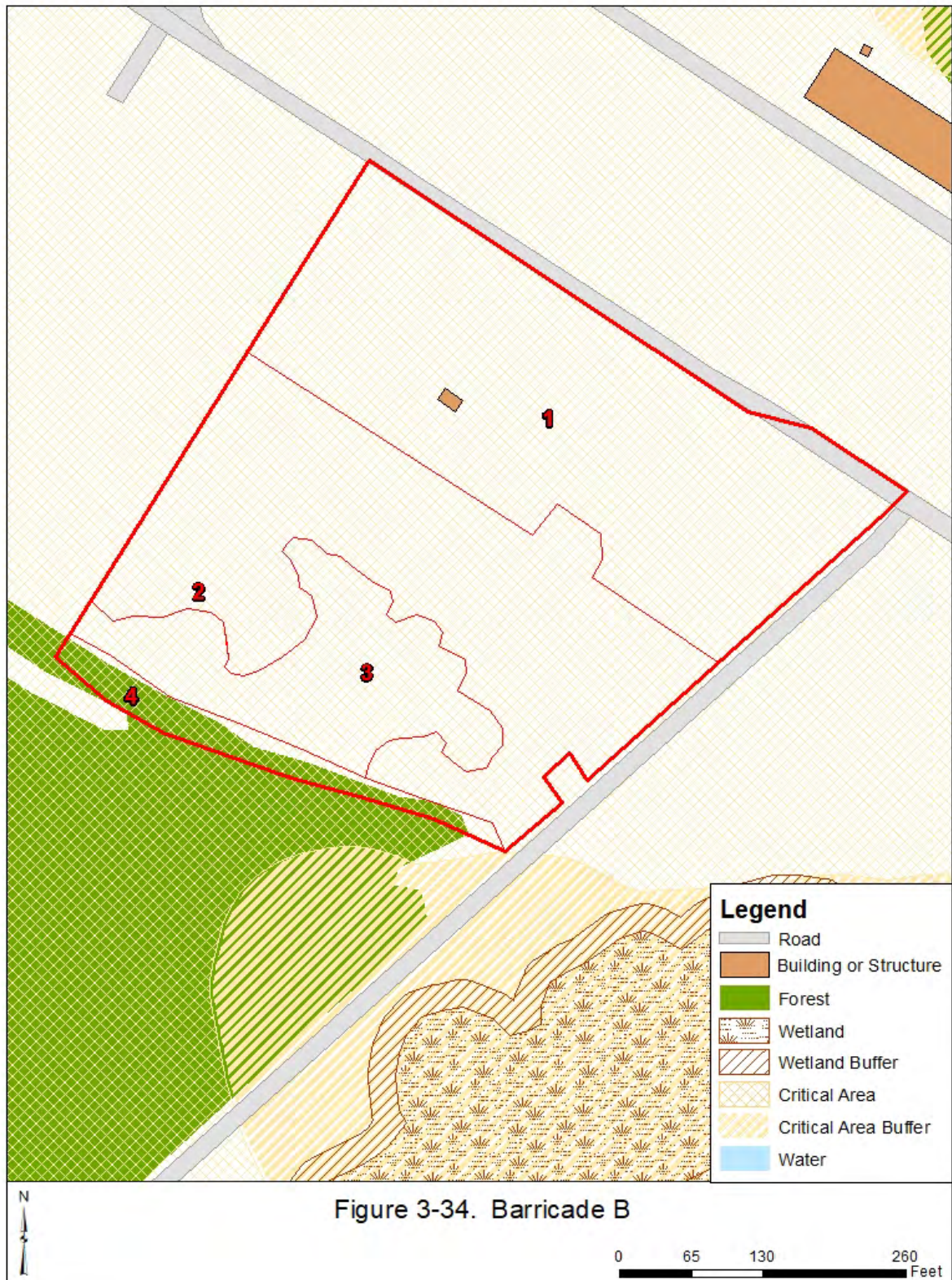
### 3.2.15 Barricade B

The Barricade B range is located in the Aberdeen Area. The range encompasses approximately 6 acres.

The Barricade B range is delineated into 4 areas (Figure 3-34) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	2.5
2	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	2.2
3	Encroachment – Trees to Clear	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	0.8
4	Natural Area	Conservation	Monitor for encroachment	0.3





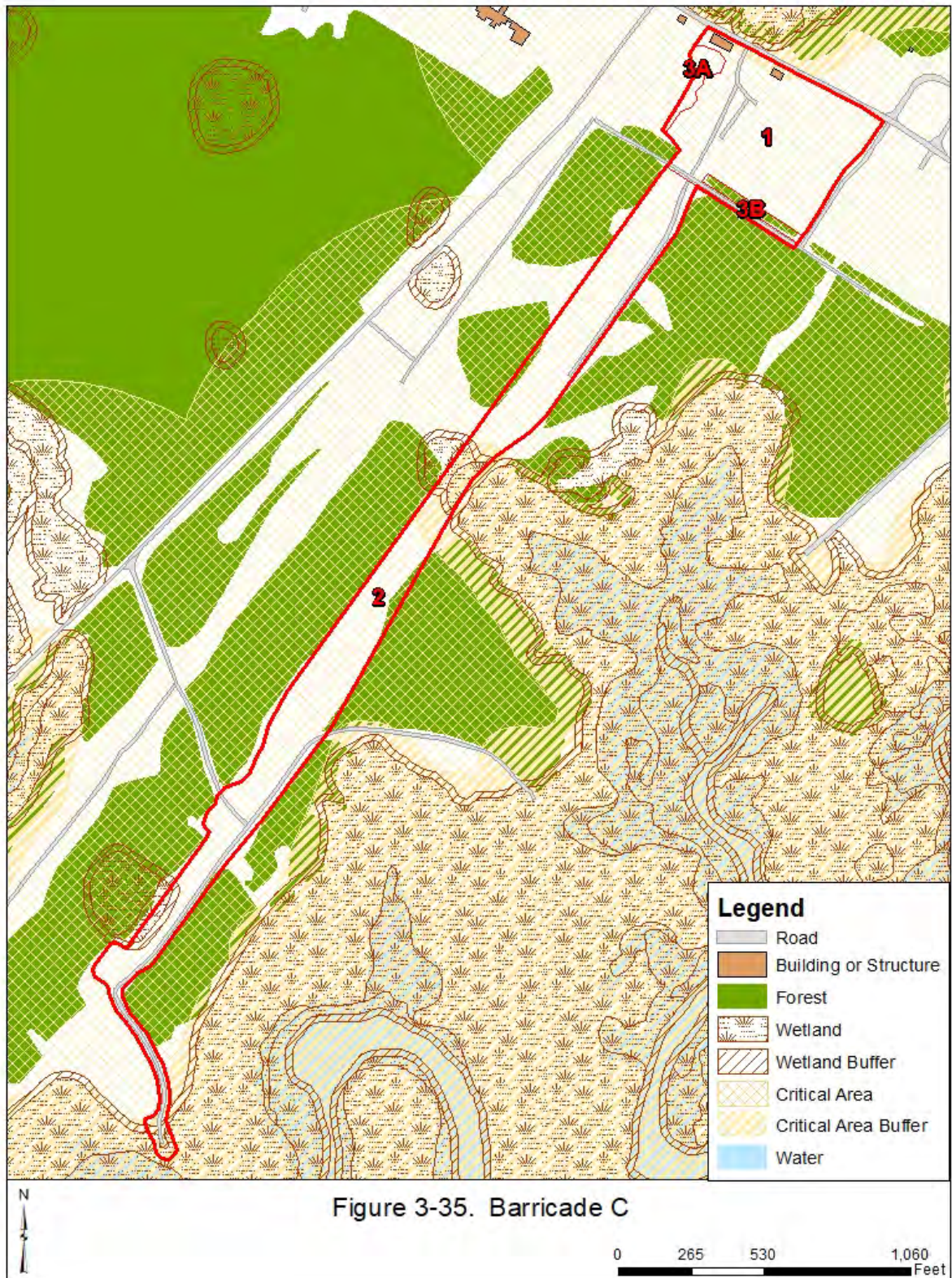
### 3.2.16 Barricade C

The Barricade C range is located in the Aberdeen Area. The range encompasses approximately 21 acres.

The Barricade C range is delineated into 3 areas (Figure 3-35) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	7.3
2	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	13.2
3	Natural Area	Conservation	Monitor for encroachment	0.4 (A) 0.3 (B)





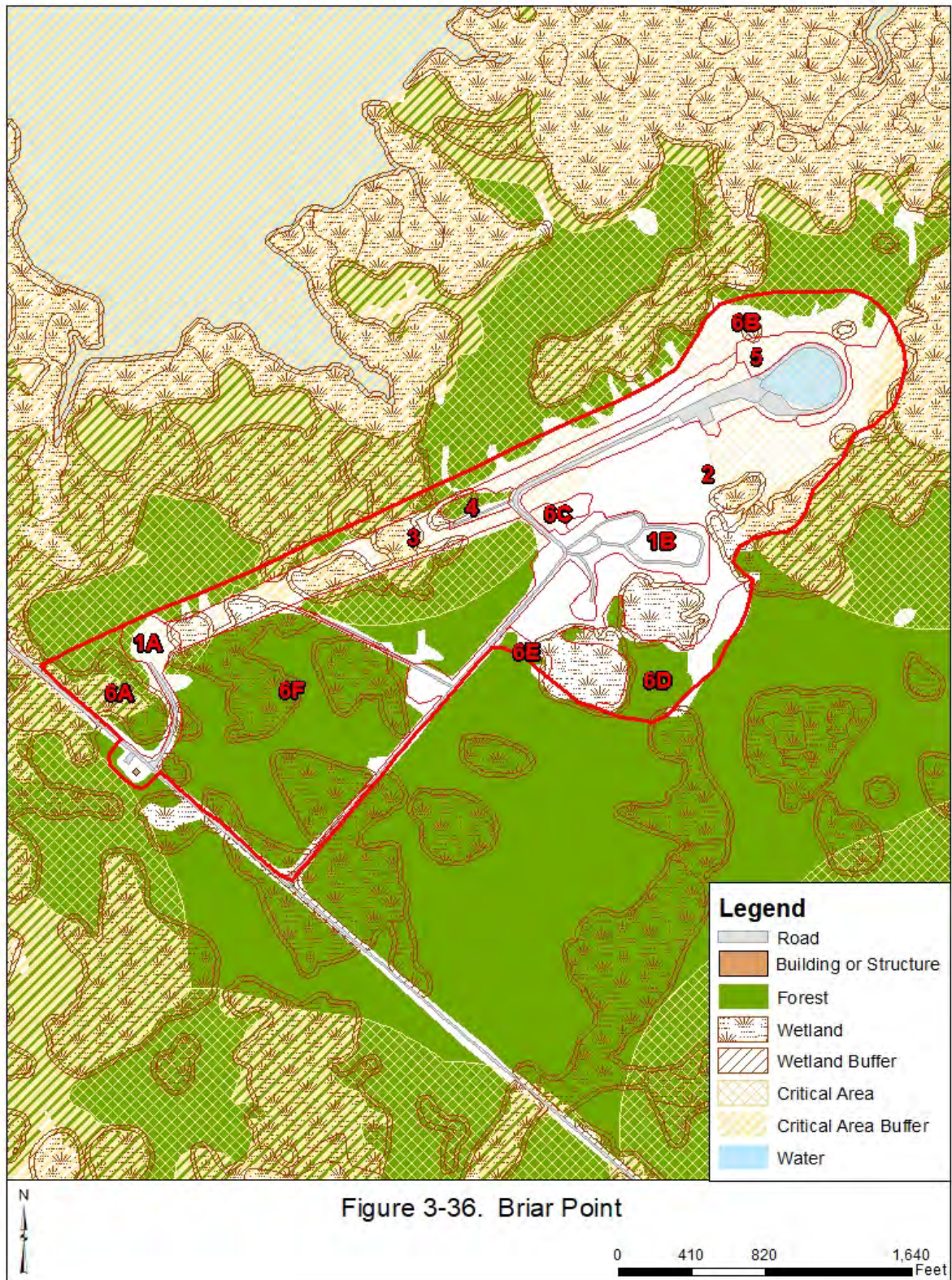
### 3.2.17 Briar Point

The Briar Point range is located in the Aberdeen Area. The range encompasses approximately 142 acres.

The Briar Point range is delineated into 6 areas (Figure 3-36) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	3.4 (A) 18 (B)
2	Support Area	Mechanical, with or without herbicide spraying	Every 2 years	33
3	Support Area	Mechanical, with or without herbicide spraying	Every 10 years	11
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 10 years	1.2
5	Berm	Mechanical, with or without herbicide spraying	Every 10 years	2.2
6	Natural Area	Conservation	Monitor for encroachment	6.1 (A) 13 (B) 1 (C) 6.7 (D) 0.8 (E) 46 (F)





### 3.2.18 BTD Complex

The BTD Complex is located in the Aberdeen Area. The range encompasses approximately 14 acres.

The BTD Complex is delineated into 4 areas (Figure 3-37) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	12.8
2	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Once, then maintain as open (Area 1)	0.04 (A) 0.08 (B) 0.05 (C)
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Once per year	0.5
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 2 years	0.3





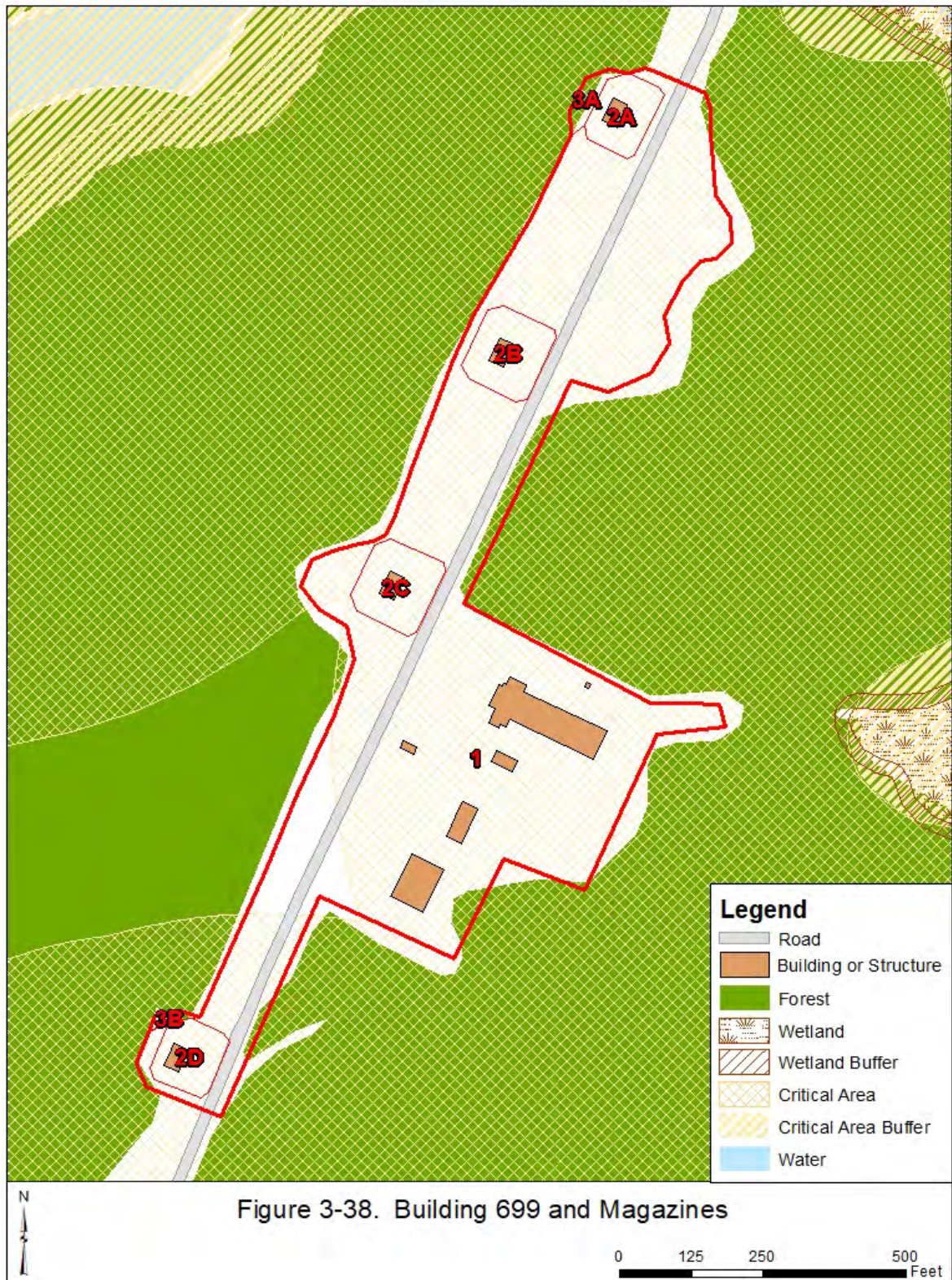
### 3.2.19 Building 699 and Magazines

The Building 699 and Magazines are located in the Aberdeen Area. The range encompasses approximately 13 acres.

The Building 699 and Magazines are delineated into 3 areas (Figure 3-38) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Support Area	Mechanical, with or without herbicide spraying	Once per year	12
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3 (A) 0.4 (B) 0.4 (C) 0.3 (D)
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 2 years	0.09 (A) 0.03 (B)





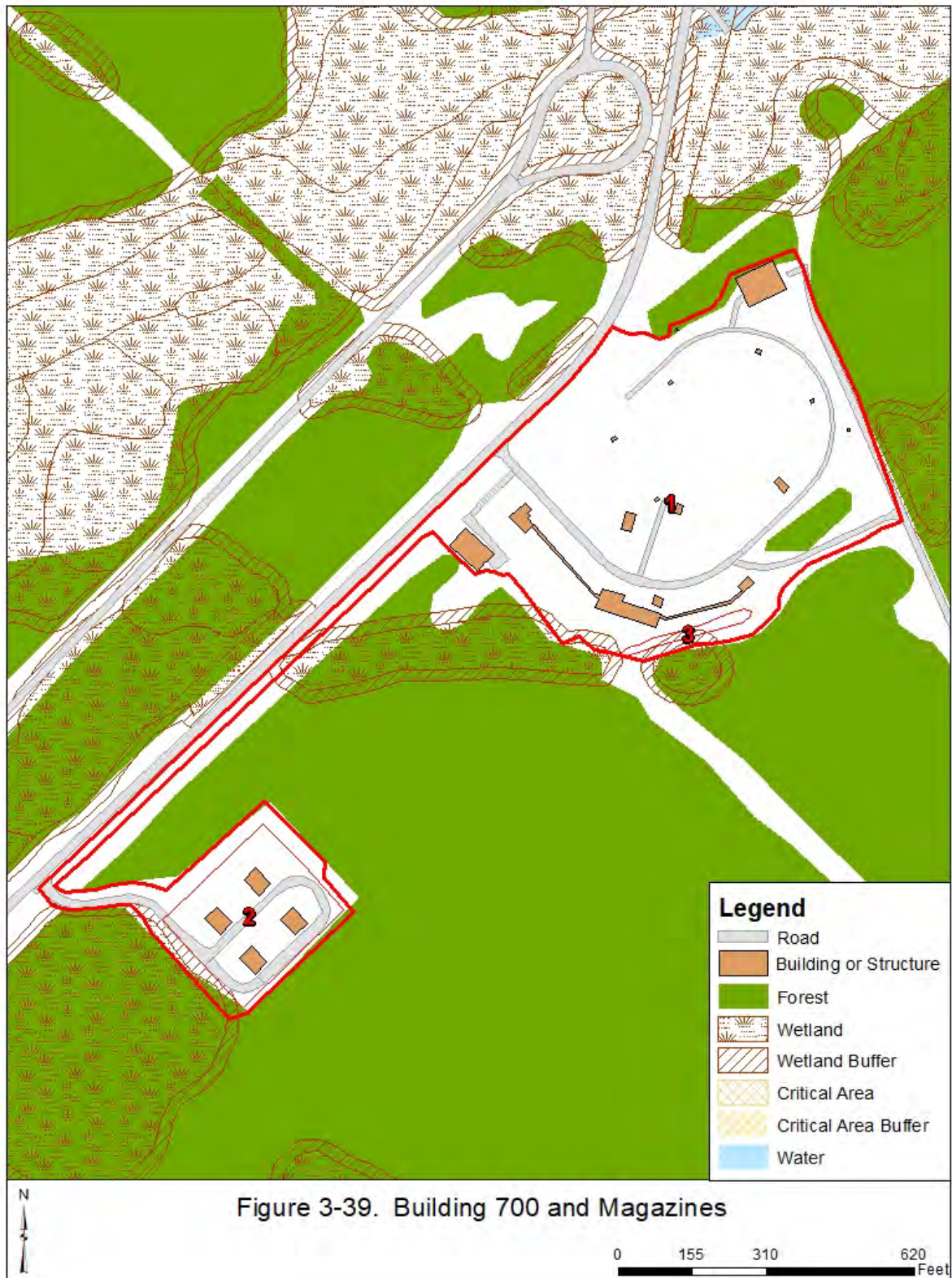
### 3.2.20 Building 700 and Magazines

The Building 700 and Magazines are located in the Aberdeen Area. The range encompasses approximately 14 acres.

The Building 700 and Magazines are delineated into 3 areas (Figure 3-39) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Support Area	Mechanical, with or without herbicide spraying	Once per year	13
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	1.7
3	Natural Area	Conservation	Monitor for encroachment	0.1



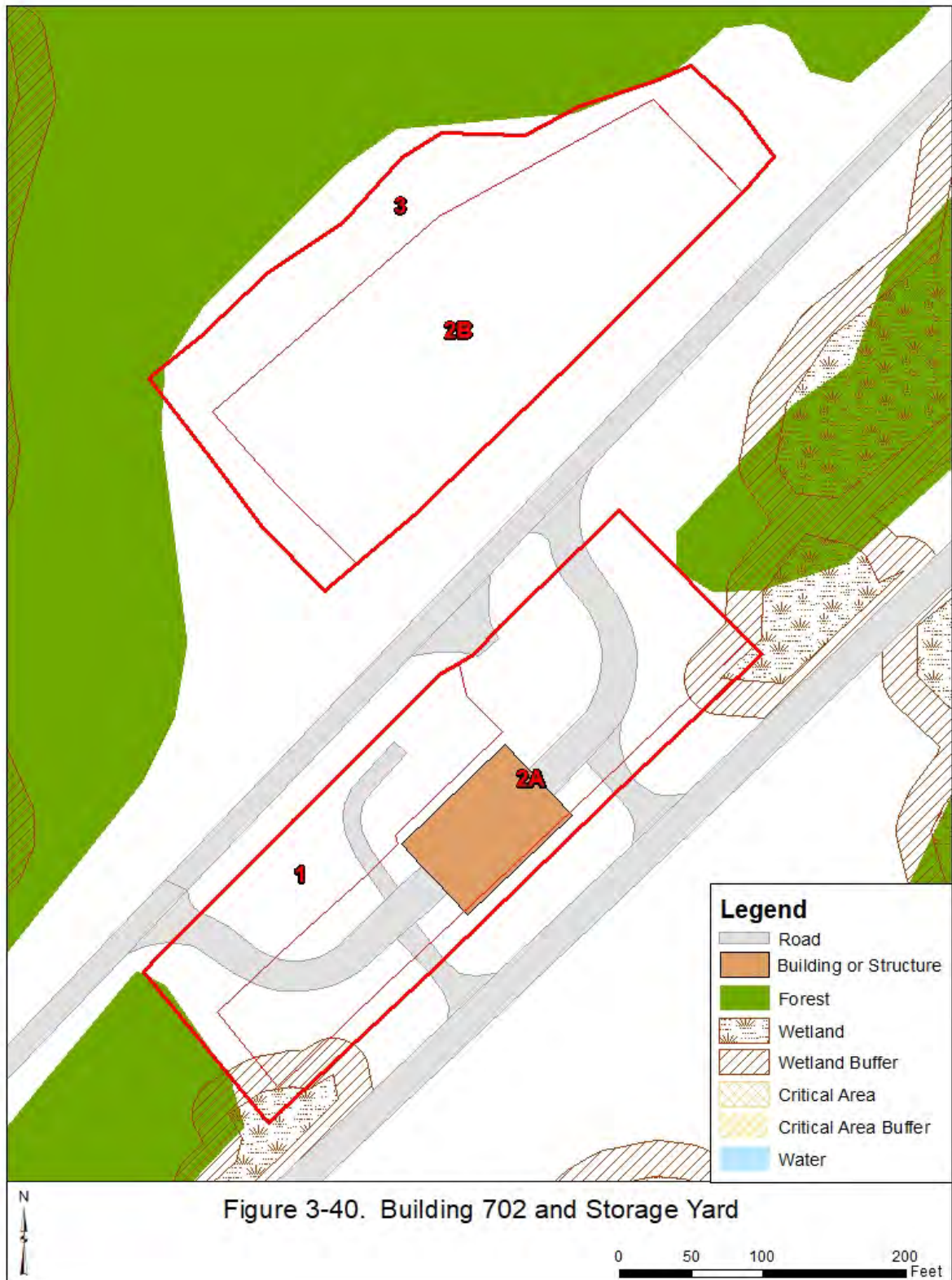


### 3.2.21 Building 702 and Storage Yard

The Building 702 and Storage Yard are located in the Aberdeen Area. The range encompasses approximately 3 acres.

The Building 702 and Storage Yard are delineated into 3 areas (Figure 3-40) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	0.6
2	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	0.9 (A) 1.1 (B)
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	0.5



### 3.2.22 C Field

The C Field range is located in the Edgewood Area. The range encompasses approximately 95 acres.

The C Field range is delineated into 7 areas (Figure 3-41) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	88
2	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	0.2 (A) 2.1 (B)
3	Berm	Mechanical, with or without herbicide spraying	Every 2 years	3.1
4	Natural Area	Conservation	Monitor for encroachment	0.5 (A) 0.5 (B) 1.2 (C) 0.6 (D)
5	Natural Area – Mitigation	Conservation	Monitor for encroachment	1.5
6	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	1.2





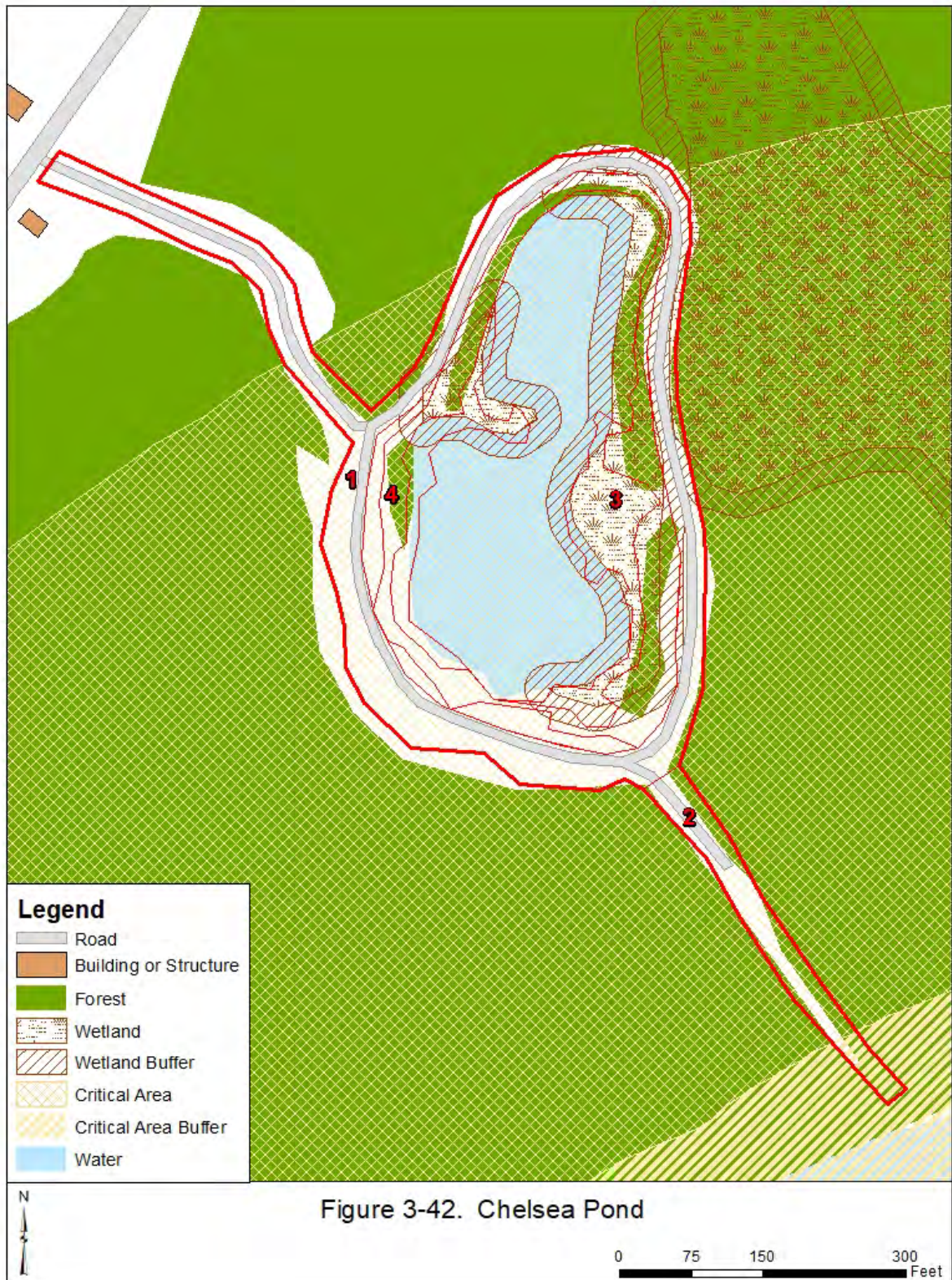
### 3.2.23 Chelsea Pond

The Chelsea Pond is located in the Aberdeen Area. The range encompasses approximately 5 acres.

The Chelsea Pond range is delineated into 4 areas (Figure 3-42) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Support Area	Mechanical, with or without herbicide spraying	Every 2 years	1.6
2	Support Area (access trail to creek)	Mechanical, with or without herbicide spraying	Every 10 years	0.3
3	Support Area	Mechanical, with or without herbicide spraying	Every 10 years	1.5
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 10 years	0.8





### 3.2.24 Churchville Test Area

The Churchville Test Area is located in the Aberdeen Area. The range encompasses approximately 218 acres. The range is bordered to the north by Deer Creek.

The Churchville Test Area is delineated into 4 areas (Figure 3-43) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	79
2	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	2.1
3	Natural Area	Conservation	Monitor for encroachment	132
4	Shoreline, Beach, Riprap	Shoreline protection (Deer Creek)	Monitor, keep riprap clear	5



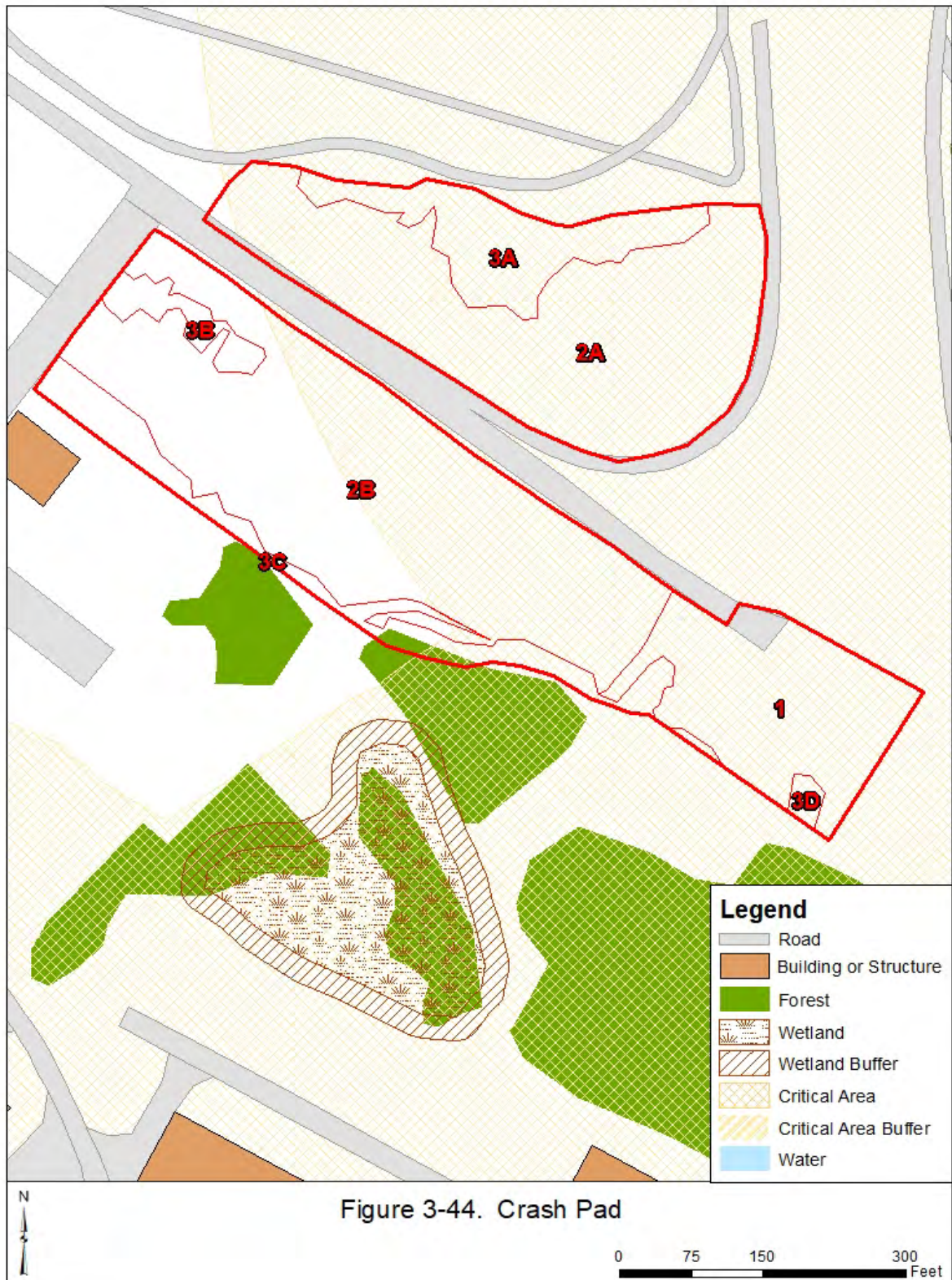


### 3.2.25 Crash Pad (Rail Impact)

The Crash Pad (Rail Impact) range is located in the Aberdeen Area. The range encompasses approximately 7 acres.

The Crash Pad (Rail Impact) range is delineated into 3 areas (Figure 3-44) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	0.9
2	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	1.9 (A) 2.6 (B)
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.5 (A) 0.1 (B) 0.5 (C) 0.03 (D)



### 3.2.26 D Field

The D Field range is located in the Edgewood Area. The range encompasses approximately 132 acres.

The D Field range is delineated into 3 areas (Figure 3-45) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Support Area (access roads)	Mechanical	Once per year	6.8
2	Natural Area	Conservation	Monitor for encroachment	6 (A) 83 (B) 32 (C) 0.9 (D)
3	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.6 (A) 2.6 (B)





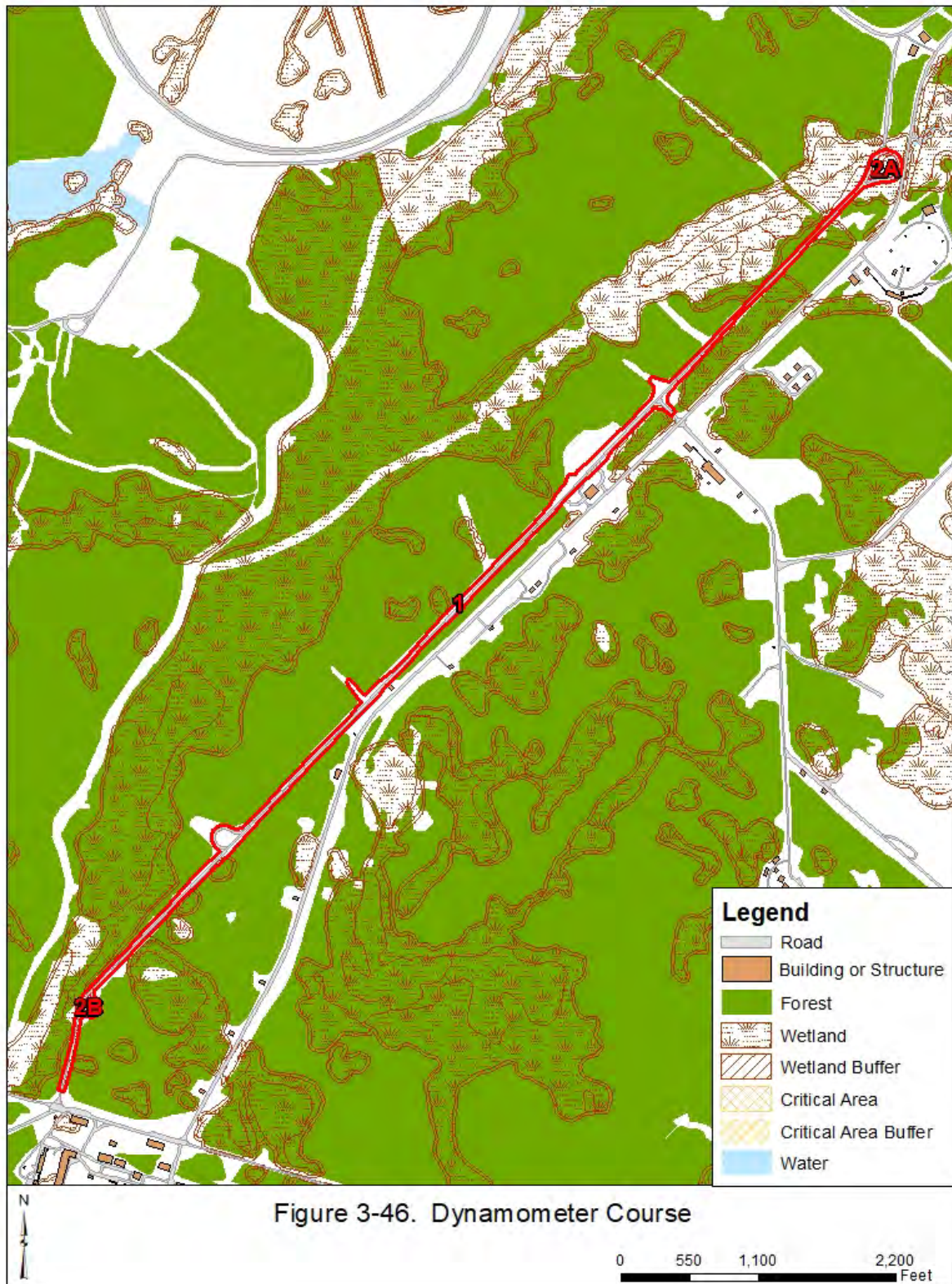
### 3.2.27 Dynamometer Course

The Dynamometer Course is located in the Aberdeen Area. The range encompasses approximately 16 acres.

The Dynamometer Course is delineated into 2 areas (Figure 3-46) with associated vegetation maintenance prescriptions. Areas 2A and 2B are two small vegetated areas within the turning loops at the north and south end of the course.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	15
2	Natural Area	Conservation	Monitor for encroachment	0.8 (A) 0.3 (B)





### 3.2.28 Edgewood Ammo Plant

The Edgewood Ammo Plant is located in the Edgewood Area. The range encompasses approximately 7 acres.

The Edgewood Ammo Plant is delineated into 2 areas (Figure 3-47) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	3.8
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	1.9 (A) 0.9 (B)





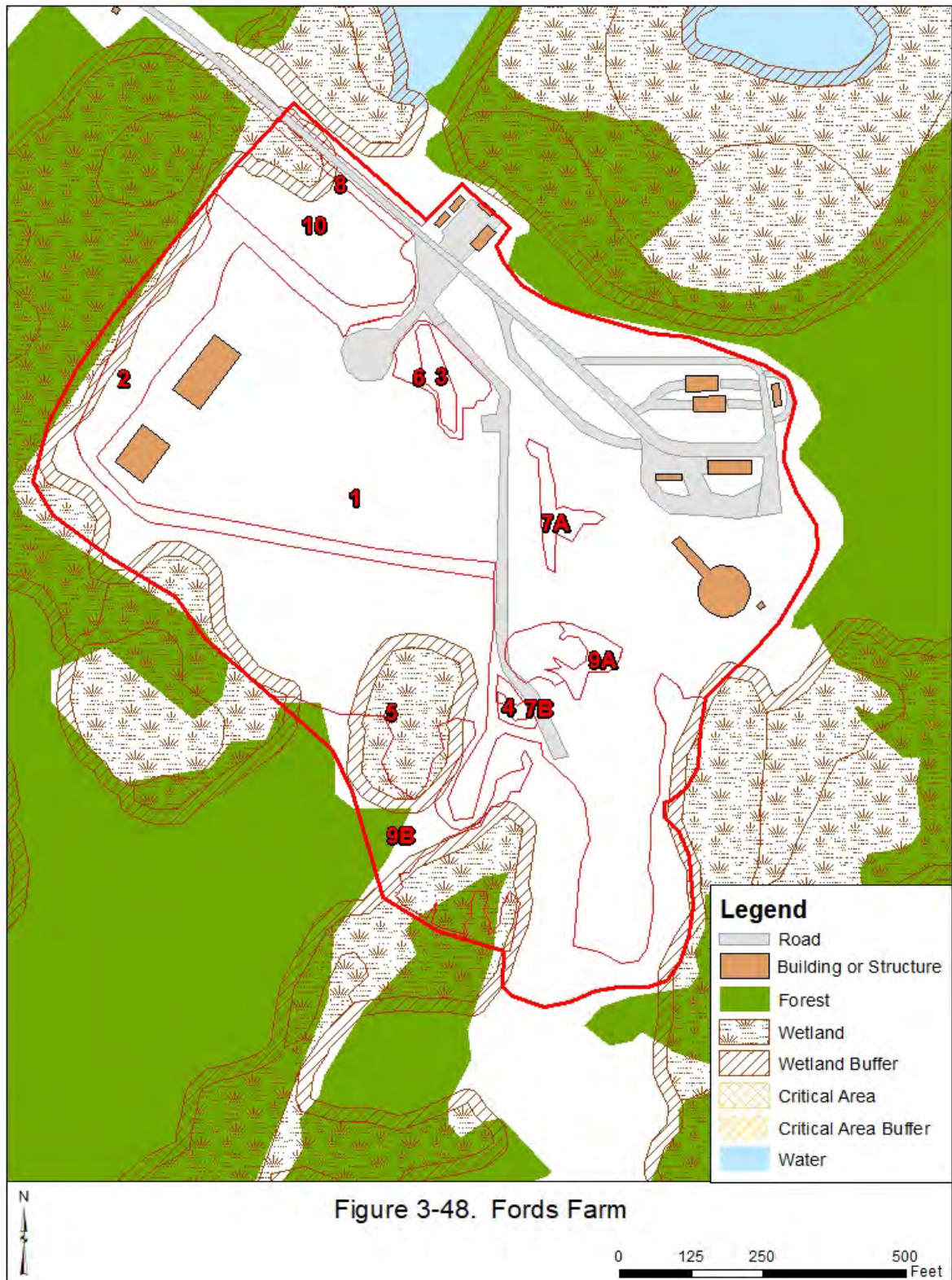
### 3.2.29 Fords Farm

The Fords Farm range is located in the Aberdeen Area. The range encompasses approximately 27 acres.

The Fords Farm range is delineated into 10 areas (Figure 3-48) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	15
2	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	1.6
3	Support Area	Mechanical	Once per year	0.4
4	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	0.08
5	Support Area	Mechanical, with or without herbicide spraying	Every 10 years	8.8
6	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Once per year	0.1
7	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.2 (A) 0.02 (B)
8	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	0.1
9	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 10 years	0.2 (A) 1.2 (B)
10	Natural Area	Conservation	Monitor for encroachment	1.2





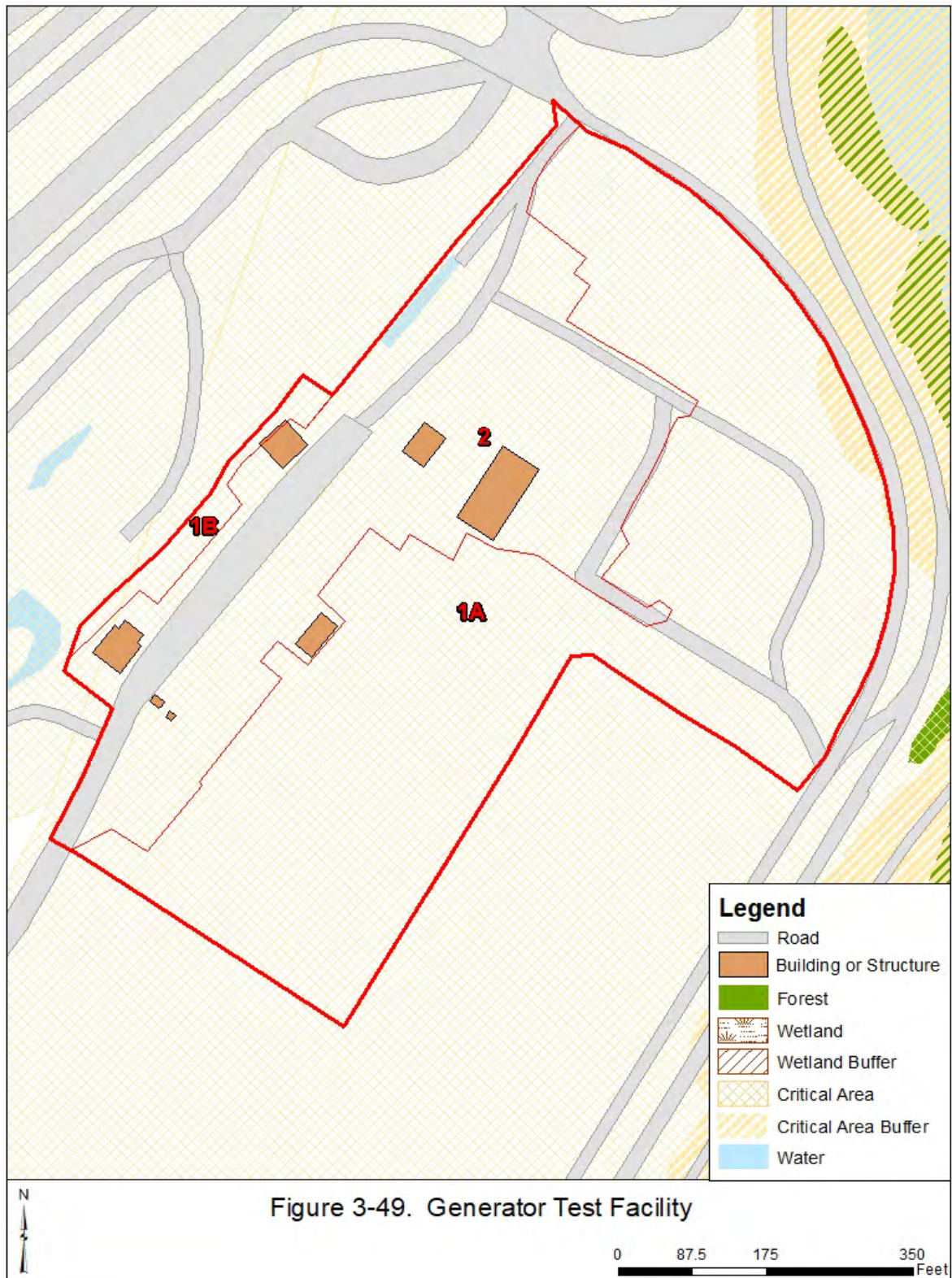
### 3.2.30 Generator Test Facility

The Generator Test Facility is located in the Aberdeen Area. The range encompasses approximately 13 acres.

The Generator Test Facility is delineated into 2 areas (Figure 3-49) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	8 (A) 0.3 (B)
2	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	4.8





### 3.2.31 Grenade Range

The Grenade Range is located in the Aberdeen Area. The range encompasses approximately 2 acres.

The Grenade Range is delineated into 2 areas (Figure 3-50) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Support Area	Mechanical, with or without herbicide spraying	Once per year	0.7
2	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	1.3





### 3.2.32 Henry Field (H Field)

The Henry Field (H Field) range is located in the Aberdeen Area. The range encompasses approximately 857 acres.

The Henry Field (H Field) range is delineated into 6 areas (Figure 3-51) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	214
2	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 2 years	55
3	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 5 years	62 (A) 172 (B) 28 (C) 60 (D) 25 (E) 195 (F) 33 (G)
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	2.2
5	Natural Area	Conservation	Monitor for encroachment	1.6 (A) 2.5 (B)
6	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	7.1





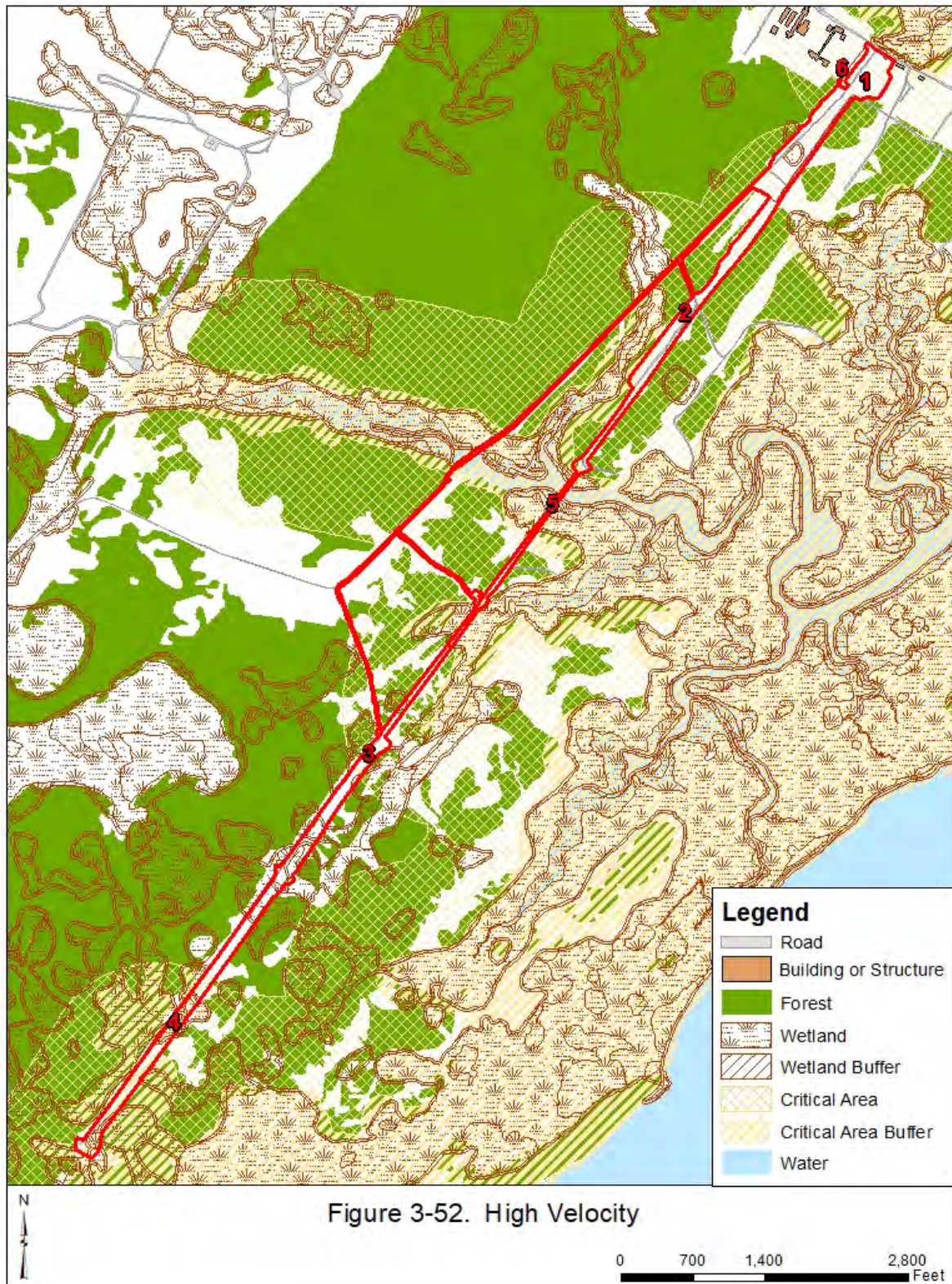
### 3.2.33 High Velocity

The High Velocity range is located in the Aberdeen Area. The range encompasses approximately 41 acres.

The High Velocity range is delineated into 6 areas (Figure 3-52) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open (includes access roads)	Mowing	Twice per year	15
2	Support Area (0M to 1500M)	Mechanical, with or without herbicide spraying	Every 3 years	8.9
3	Support Area (creek to 3000M)	Mechanical, with or without herbicide spraying	Every 10 years	8.3
4	Support Area (3000M to 4000M)	Mechanical, with or without herbicide spraying	Every 20 years	8.5
5	Support Area (creek crossing)	Mechanical and/or controlled burn	Monitor for encroachment	0.5
6	Natural Area	Conservation	Monitor for encroachment	0.5





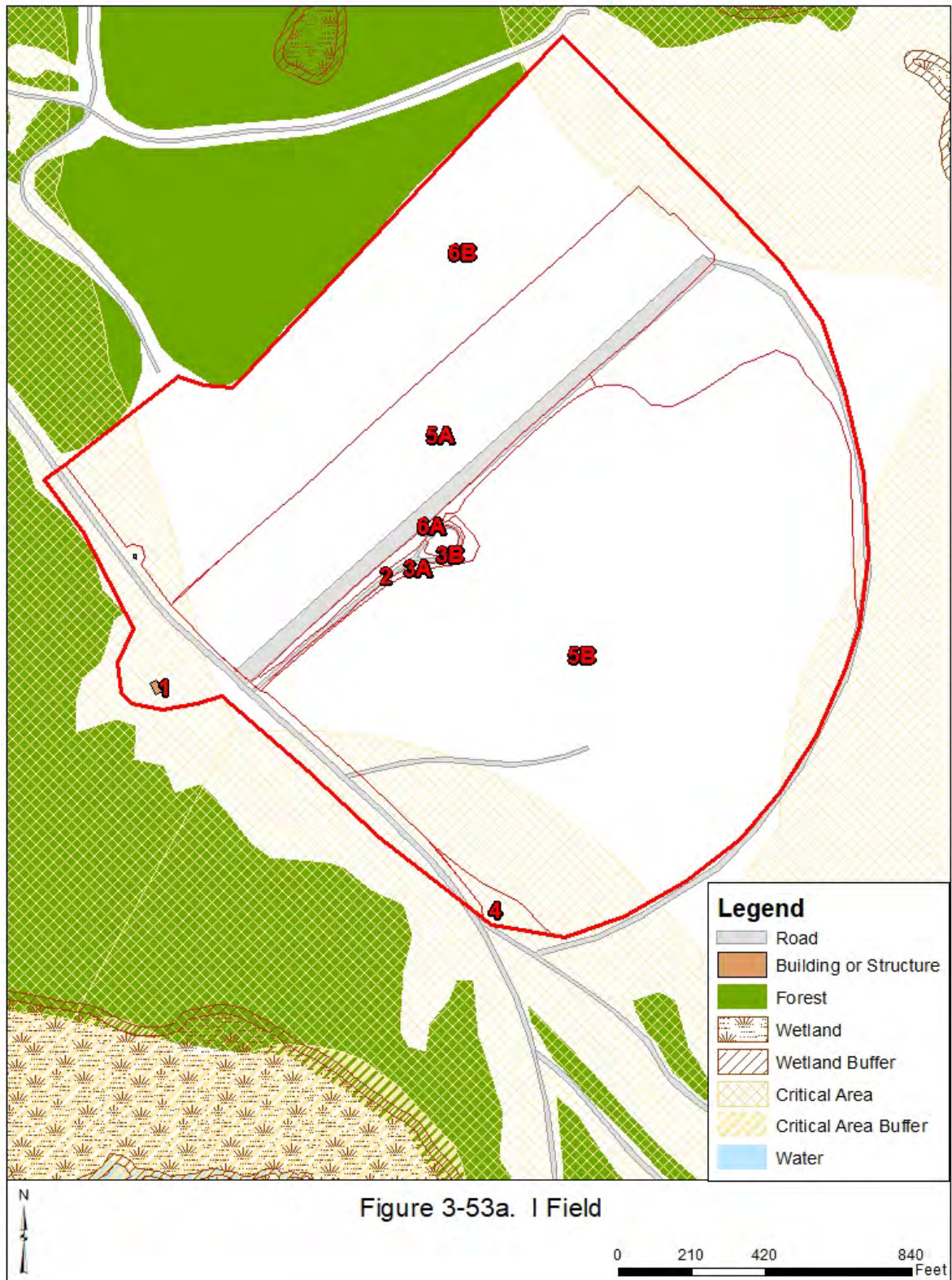
### 3.2.34 I Field

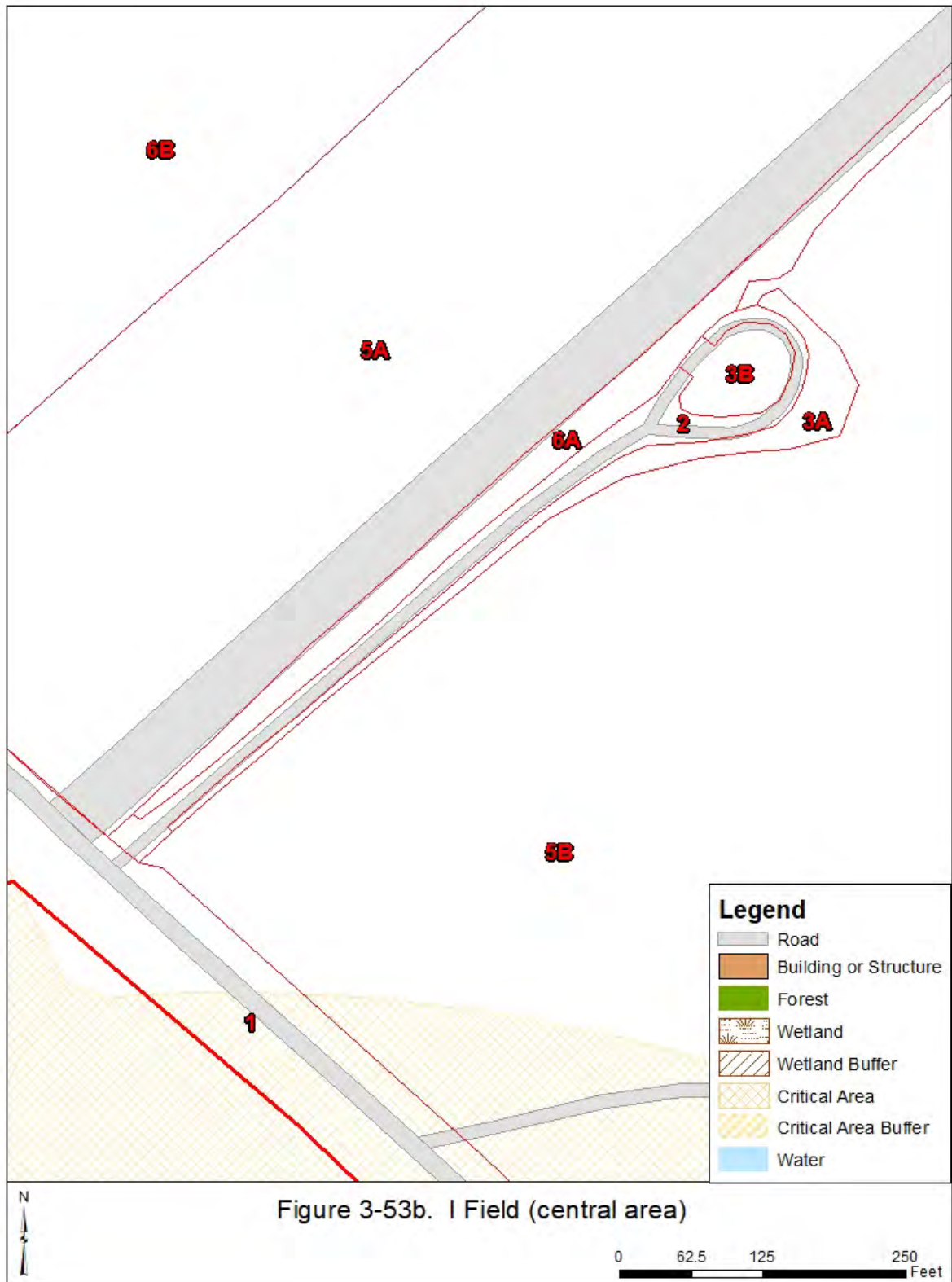
The I Field range is located in the Edgewood Area. The range encompasses approximately 83 acres.

The I Field range is delineated into 6 areas (Figures 3-53a and 3-53b) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	4.4
2	Support Area	Mechanical, with or without herbicide spraying	Once per year	0.5
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.3 (A) 0.1 (B)
4	Encroachment – Trees to Clear	Mechanical	Every 10 years	0.4
5	Bare Ground	Mechanical	As needed for testing and to keep clear of potential encroaching vegetation	13 (A) 40 (B)
6	Natural Area	Conservation	Monitor for encroachment	0.7 (A) 24 (B)









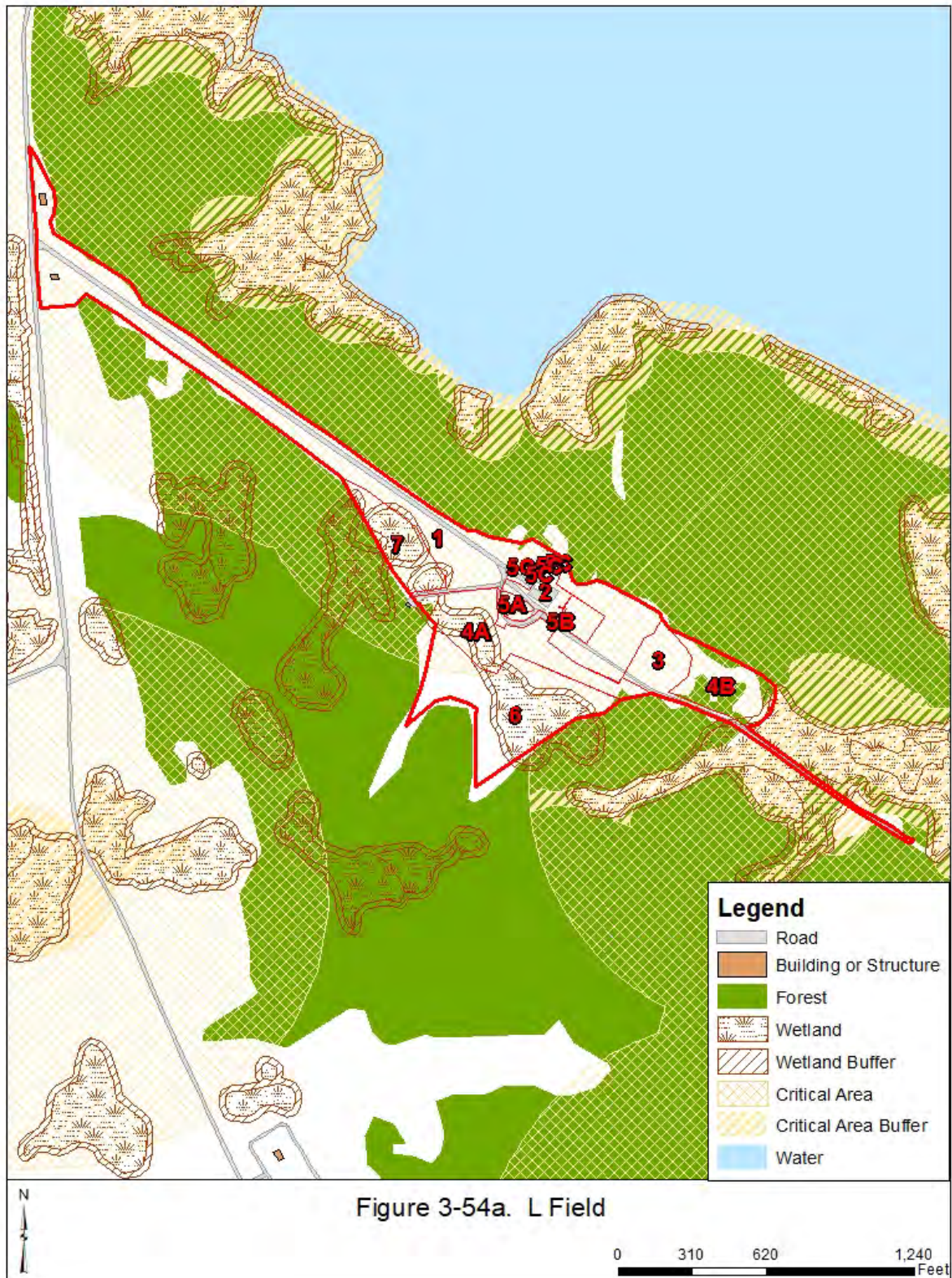
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### 3.2.35 L Field

The L Field range is located in the Edgewood Area. The range encompasses approximately 27 acres.

The L Field range is delineated into 7 areas (Figures 3-54a and 3-54b) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	11
2	Support Area	Mechanical, with or without herbicide spraying	Every 2 years	1.2
3	Support Area (includes access trail to creek)	Mechanical, with or without herbicide spraying	Every 5 years	1.9
4	Support Area	Mechanical, with or without herbicide spraying	Every 10 years	3.2 (A) 2 (B)
5	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 2 years	0.2 (A) 0.02 (B) 0.01 (C)
6	Natural Area – Mitigation	Conservation	Monitor for encroachment	5.1
7	Natural Area	Conservation	Monitor for encroachment	1.7







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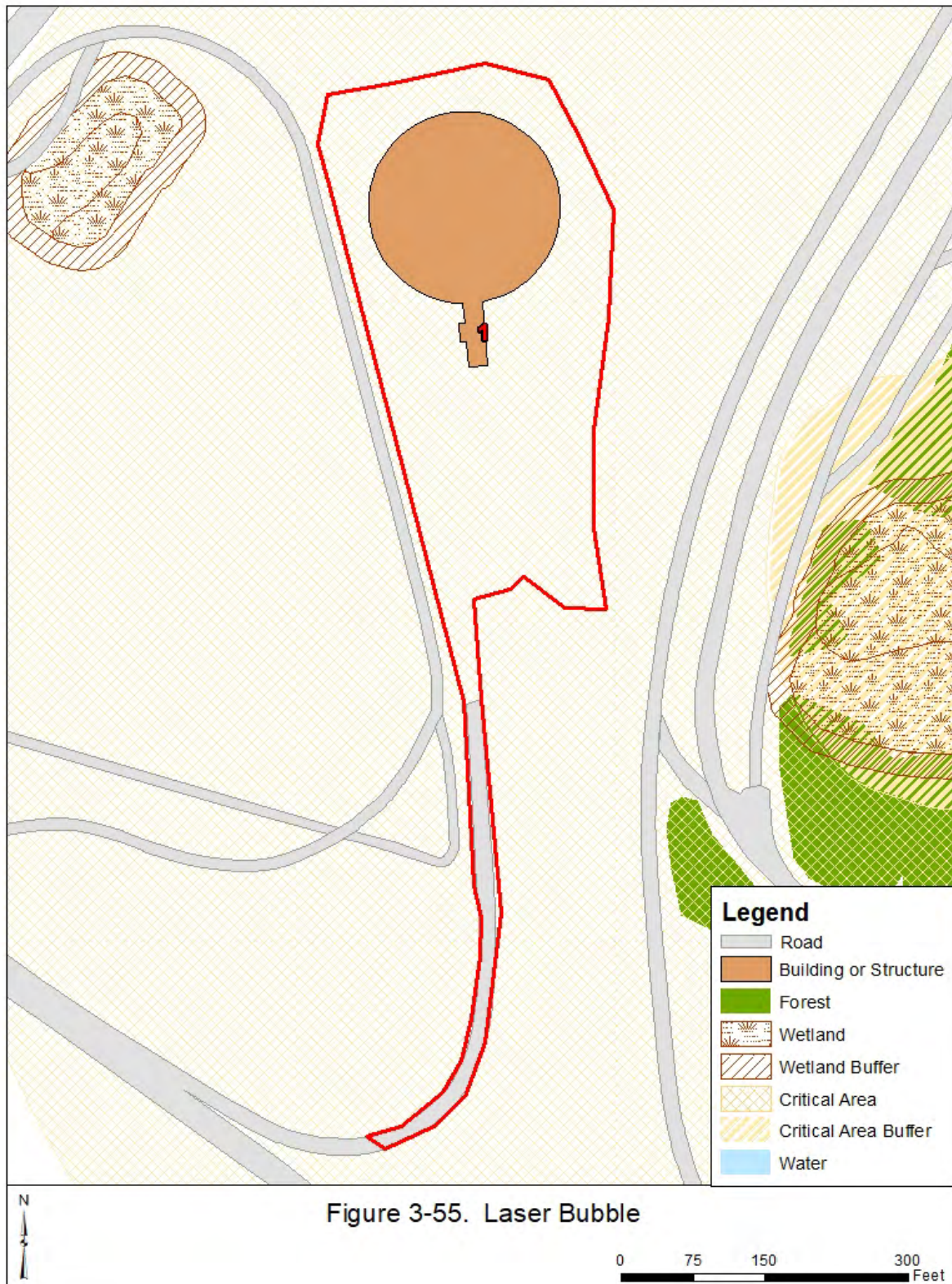
### 3.2.36 Laser Bubble (Moving Target Simulator)

The Laser Bubble (Moving Target Simulator) is located in the Aberdeen Area. The range encompasses approximately 3 acres.

The Laser Bubble (Moving Target Simulator) is delineated into a single area (Figure 3-55) with associated vegetation maintenance prescription.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	3.2





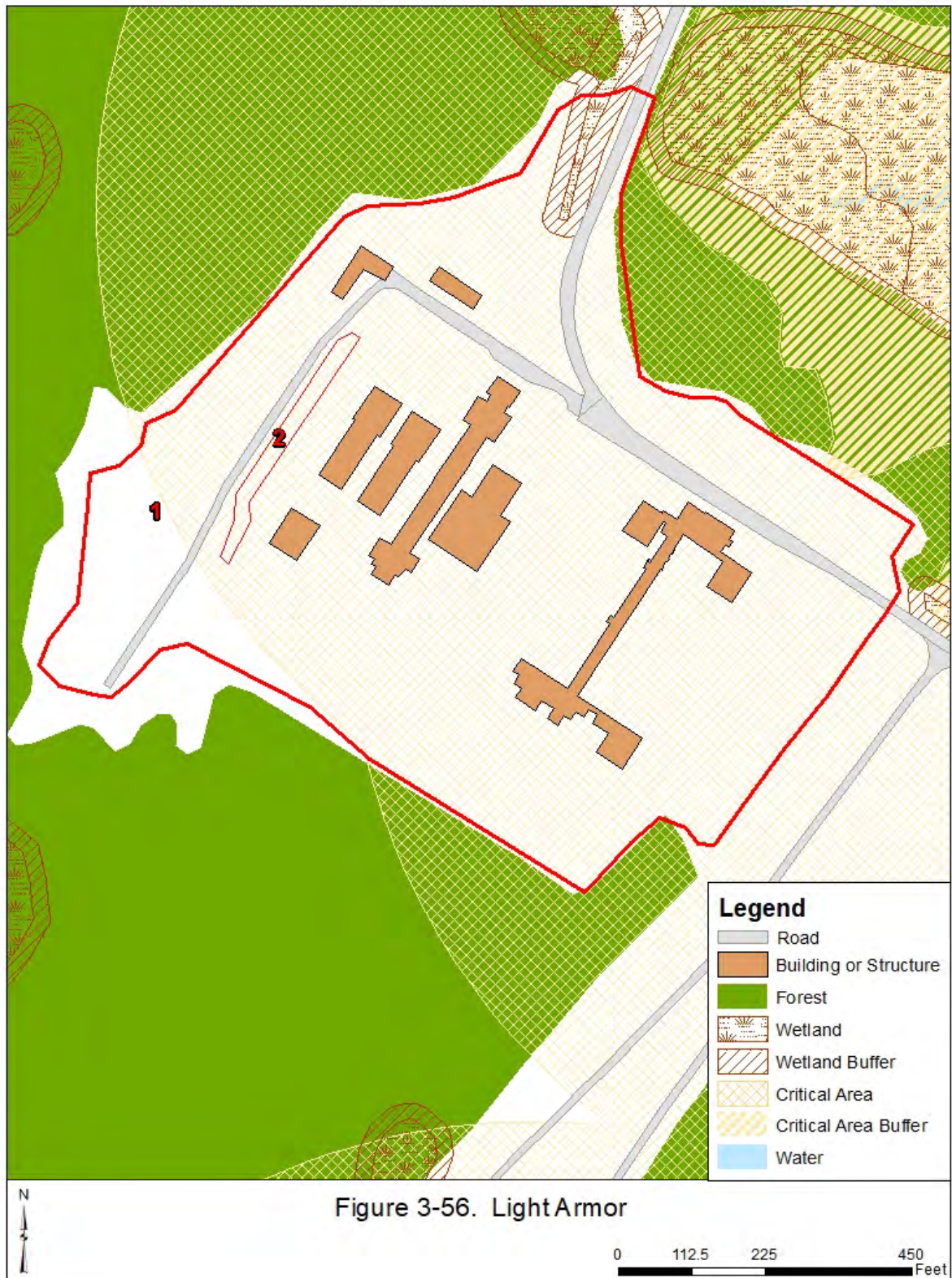


### 3.2.37 Light Armor

The Light Armor range is located in the Aberdeen Area. The range encompasses approximately 20 acres.

The Light Armor range is delineated into 2 areas (Figure 3-56) with associated vegetation maintenance prescription.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	20
2	Berm	Mechanical, with or without herbicide spraying	Every 3 years	0.2



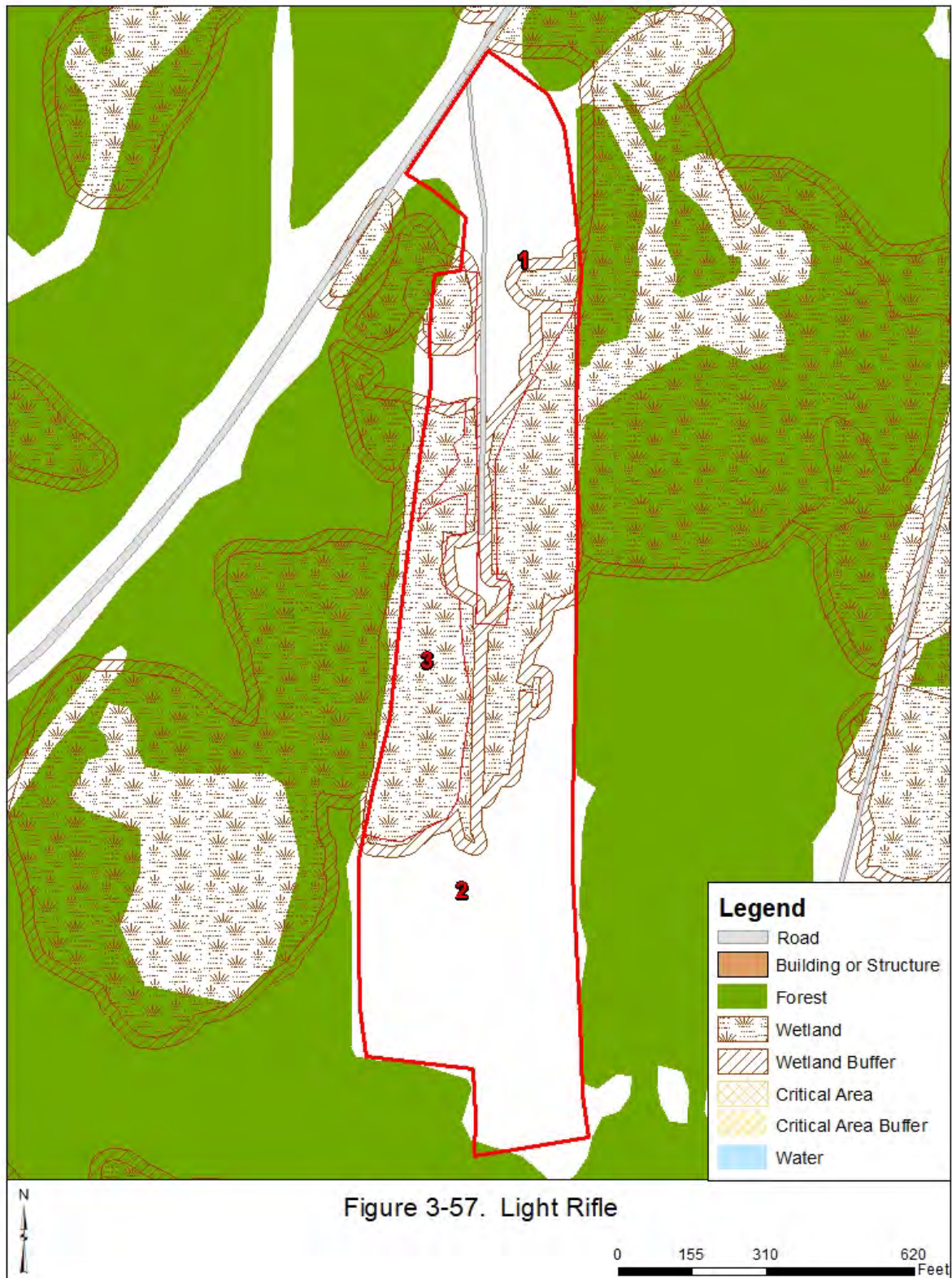
### 3.2.38 Light Rifle

The Light Rifle range is located in the Aberdeen Area. The range encompasses approximately 18 acres.

The Light Rifle range is delineated into 3 areas (Figure 3-57) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	4.1
2	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 2 years	11
3	Encroachment – Trees to Clear	Mechanical and/or controlled burn, with or without herbicide spraying	Every 5 years	2.5



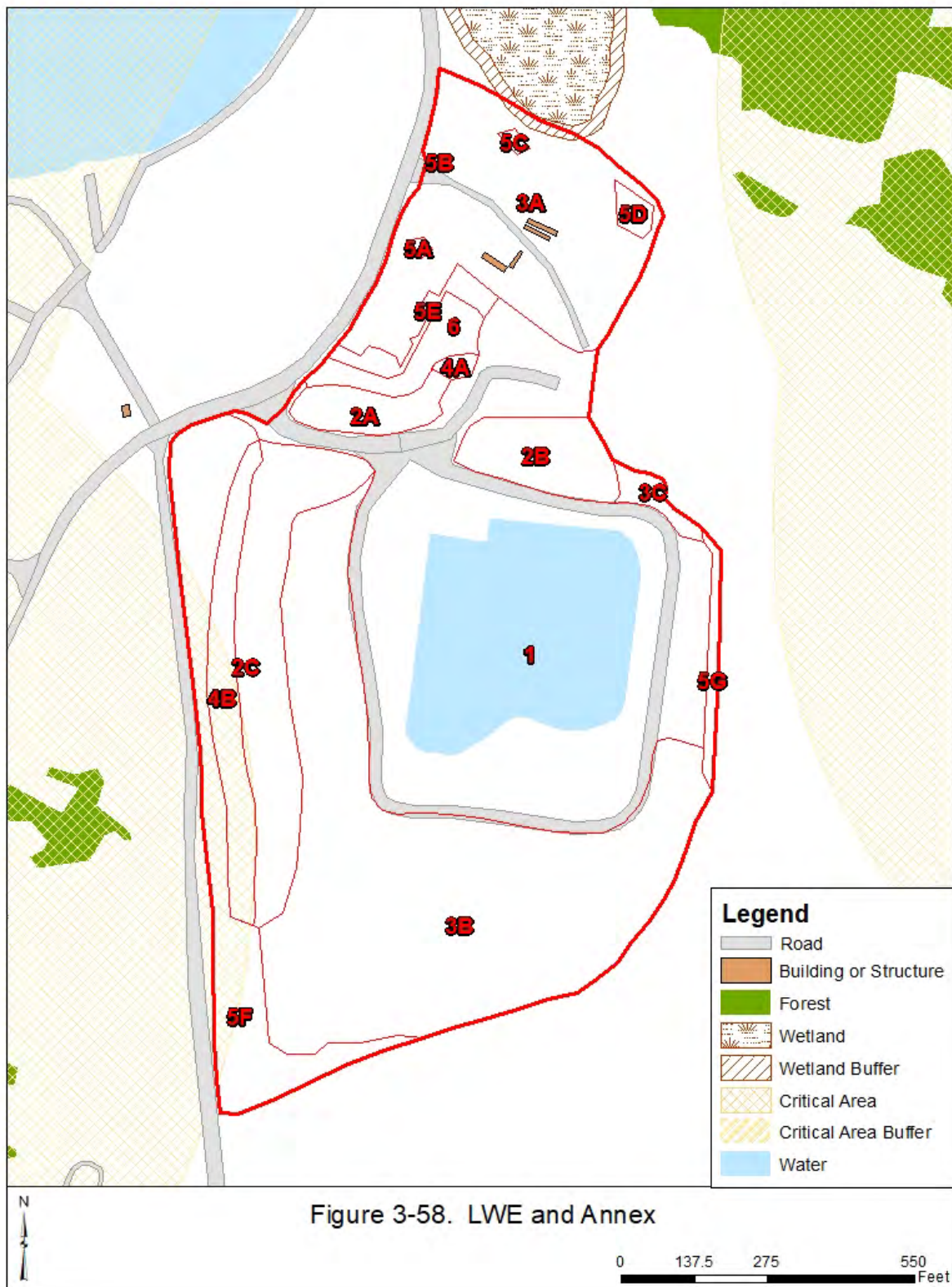


### 3.2.39 Littoral Warfare Environment (LWE) and Annex

The LWE and Annex are located in the Aberdeen Area. The range encompasses approximately 31 acres.

The LWE and Annex are delineated into 6 areas (Figure 3-58) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	10
2	Berm	Mechanical, with or without herbicide spraying	Every 3 years	0.6 (A) 0.8 (B) 3.1 (C)
3	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	4.3 (A) 8.3 (B) 0.2 (C)
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 2 years	0.07 (A) 1 (B)
5	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.03 (A) 0.01 (B) 0.03 (C) 0.1 (D) 0.3 (E) 2.3 (F) 0.2 (G)
6	Natural Area	Conservation	Monitor for encroachment	0.5





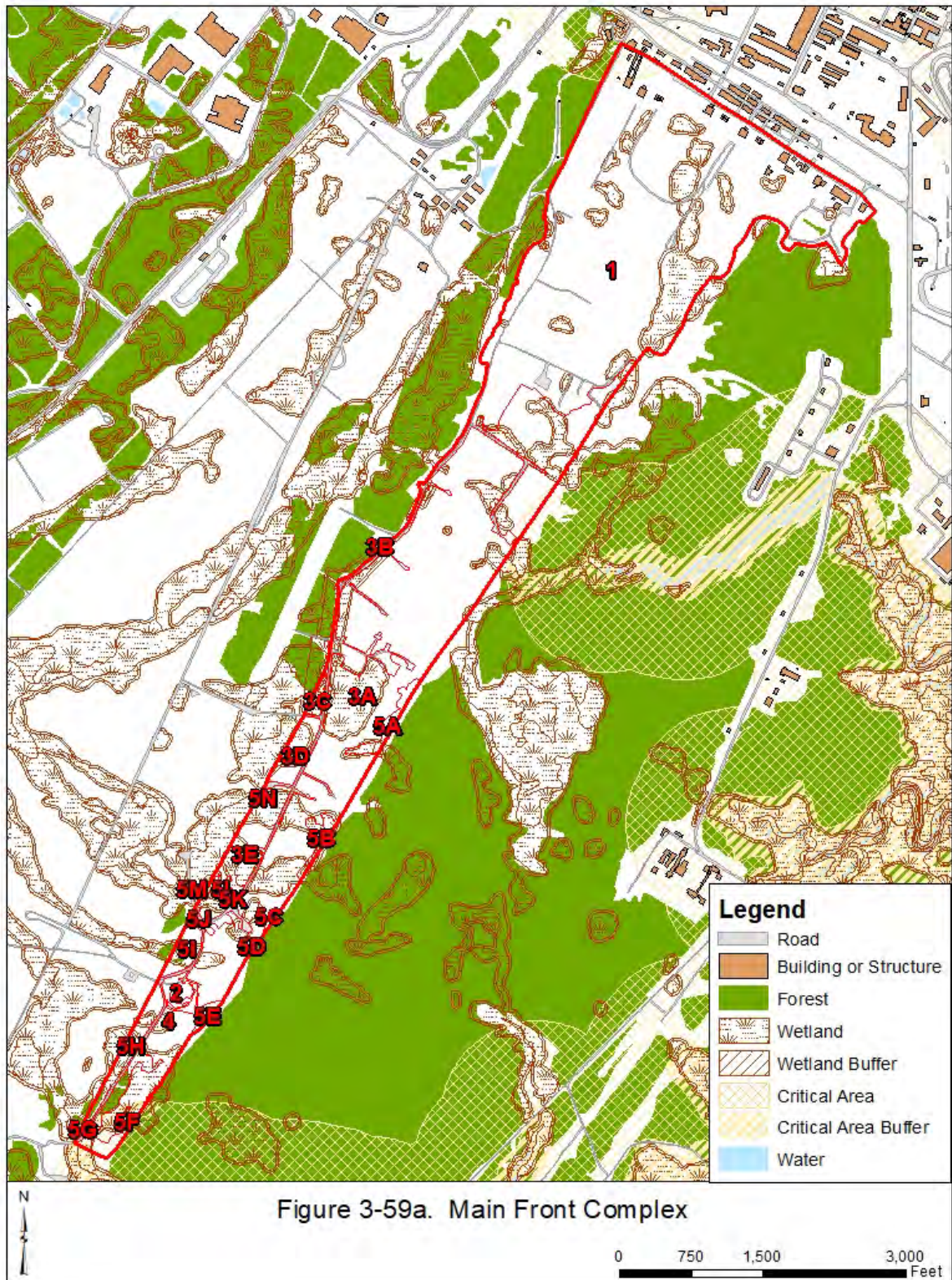
### 3.2.40 Main Front Complex

The Main Front Complex is located in the Aberdeen Area. The range encompasses approximately 355 acres.

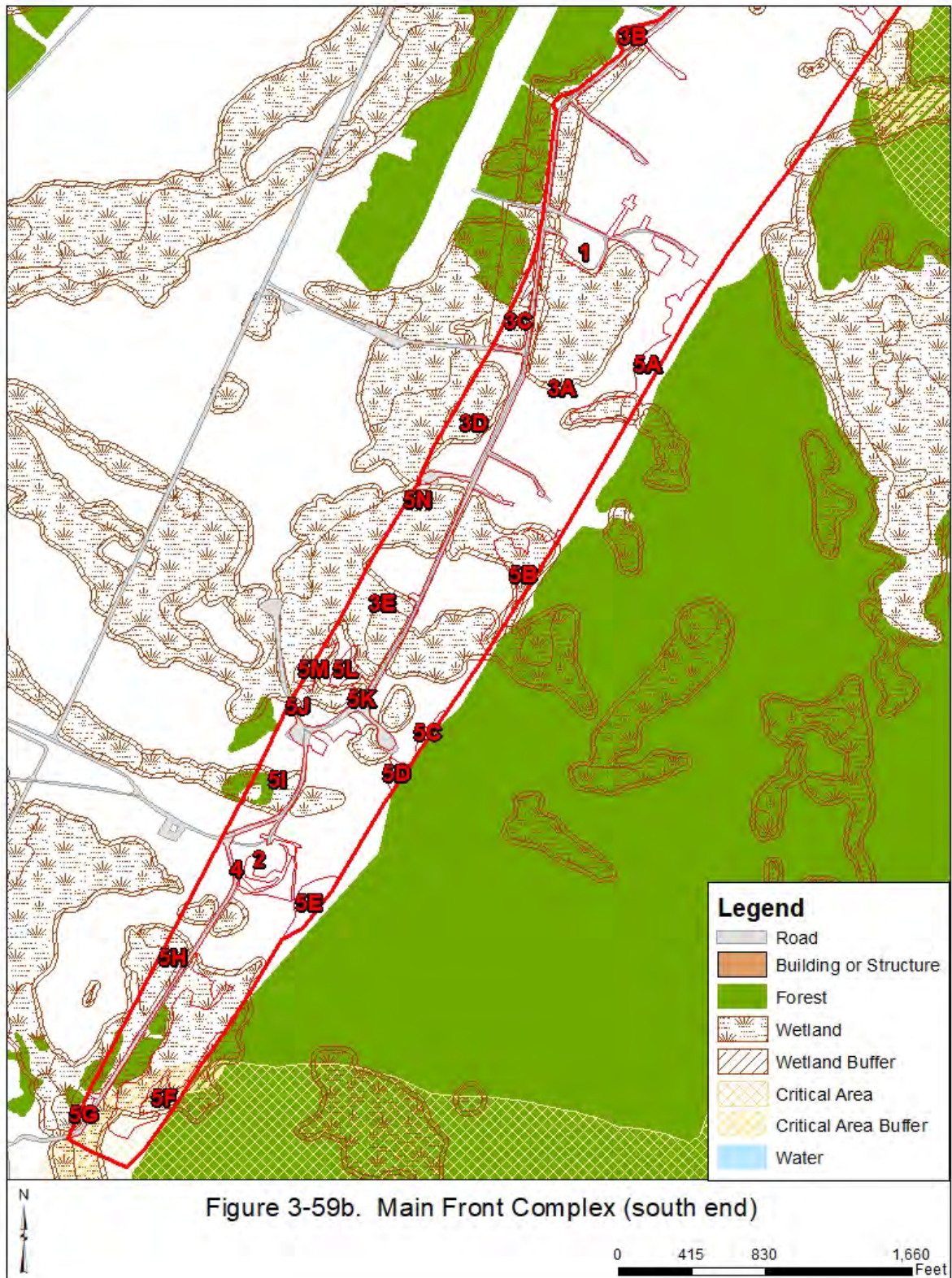
The Main Front Complex is delineated into 5 areas (Figures 3-59a and 3-59b) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open (includes access roads and pads)	Mowing, with or without controlled burn	Twice per year	183
2	Support Area (catch box)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 5 years	2.2
3	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	131 (A) 0.4 (B) 1.2 (C) 4.2 (D) 9.9 (E)
4	Encroachment – Trees to Clear (catch box)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 5 years	0.5
5	Encroachment – Trees to Clear	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	2.4 (A) 1.9 (B) 0.2 (C) 0.2 (D) 1 (E) 5.5 (F) 0.2 (G) 4.3 (H) 3 (I) 0.07 (J) 0.1 (K) 0.5 (L) 0.4 (M) 0.3 (N)









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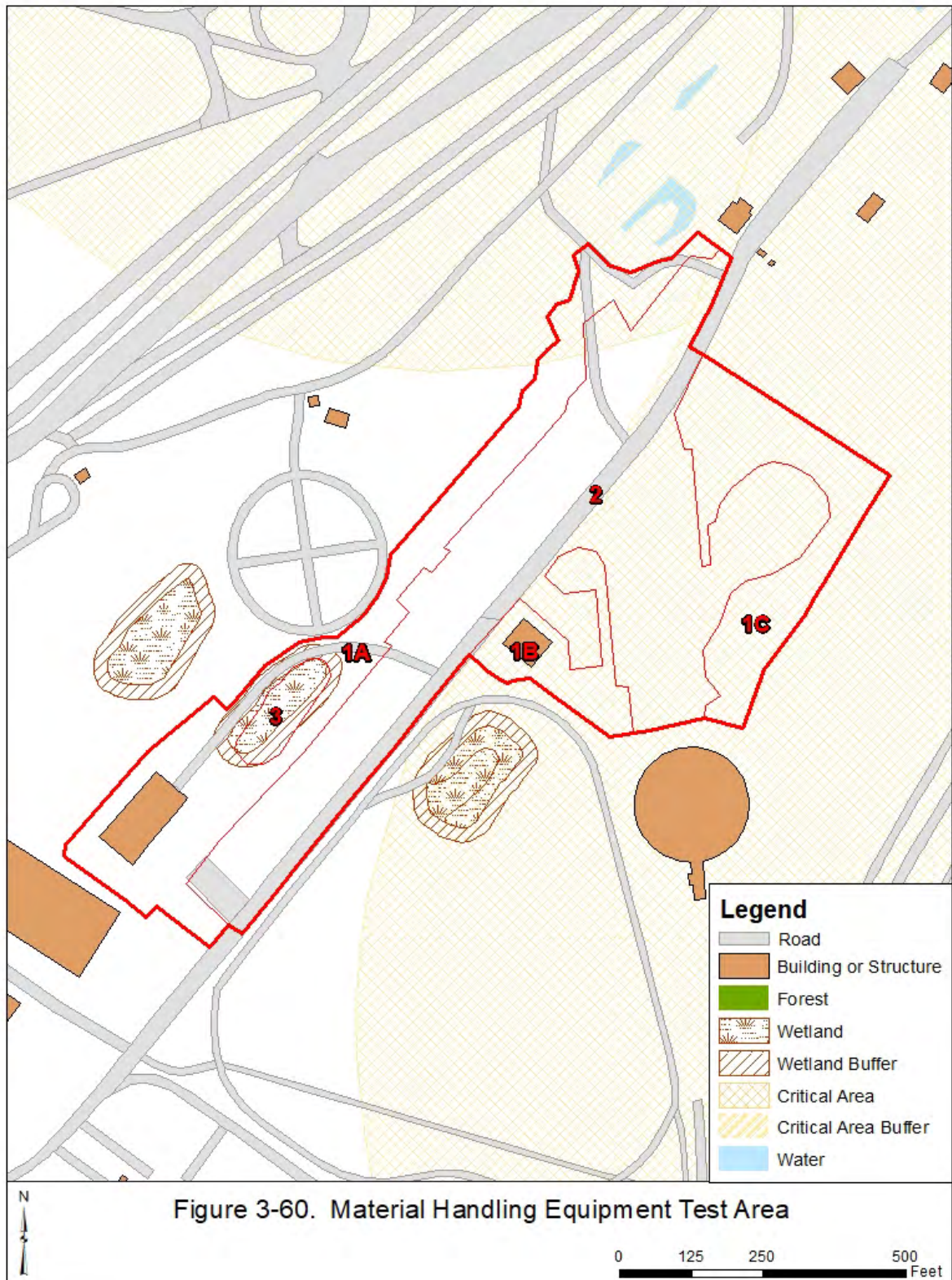
### 3.2.41 Material Handling Equipment Test Area (Heavy Equipment Test Area)

The Material Handling Equipment Test Area (Heavy Equipment Test Area) is located in the Aberdeen Area. The range encompasses approximately 14 acres.

The Material Handling Equipment Test Area (Heavy Equipment Test Area) is delineated into 2 areas (Figure 3-60) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	3.6 (A) 0.8 (B) 2 (C)
2	Gravel Stands, Pads	Mechanical, with or without herbicide spraying	Once per year	7.4
3	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	0.3





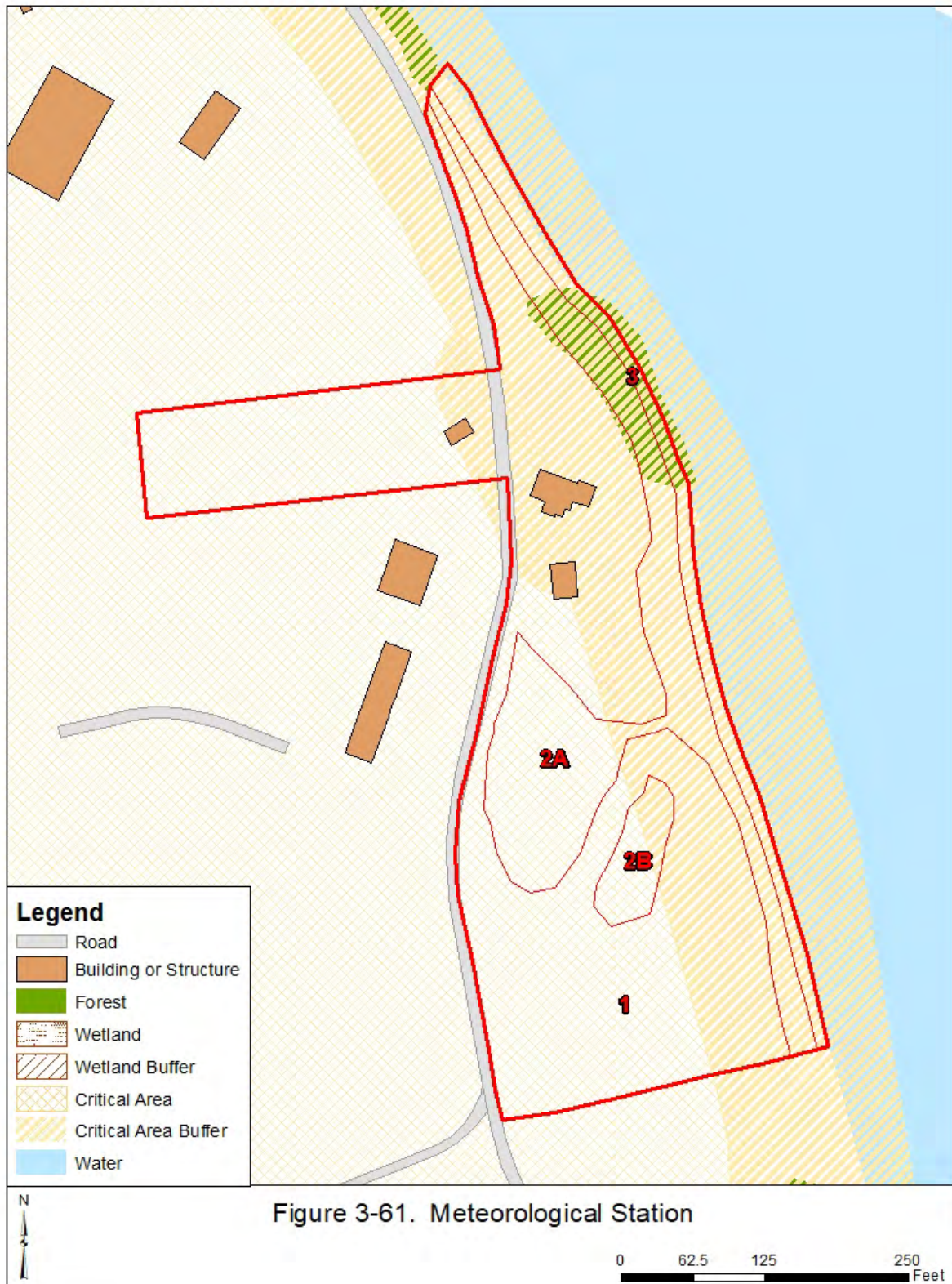
### 3.2.42 Meteorological Station

The Meteorological Station is located in the Aberdeen Area. The range encompasses approximately 4 acres.

The Meteorological Station is delineated into 3 areas (Figure 3-61) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	3
2	Natural Area	Conservation	Monitor for encroachment	0.9 (A) 0.1 (B)
3	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.3





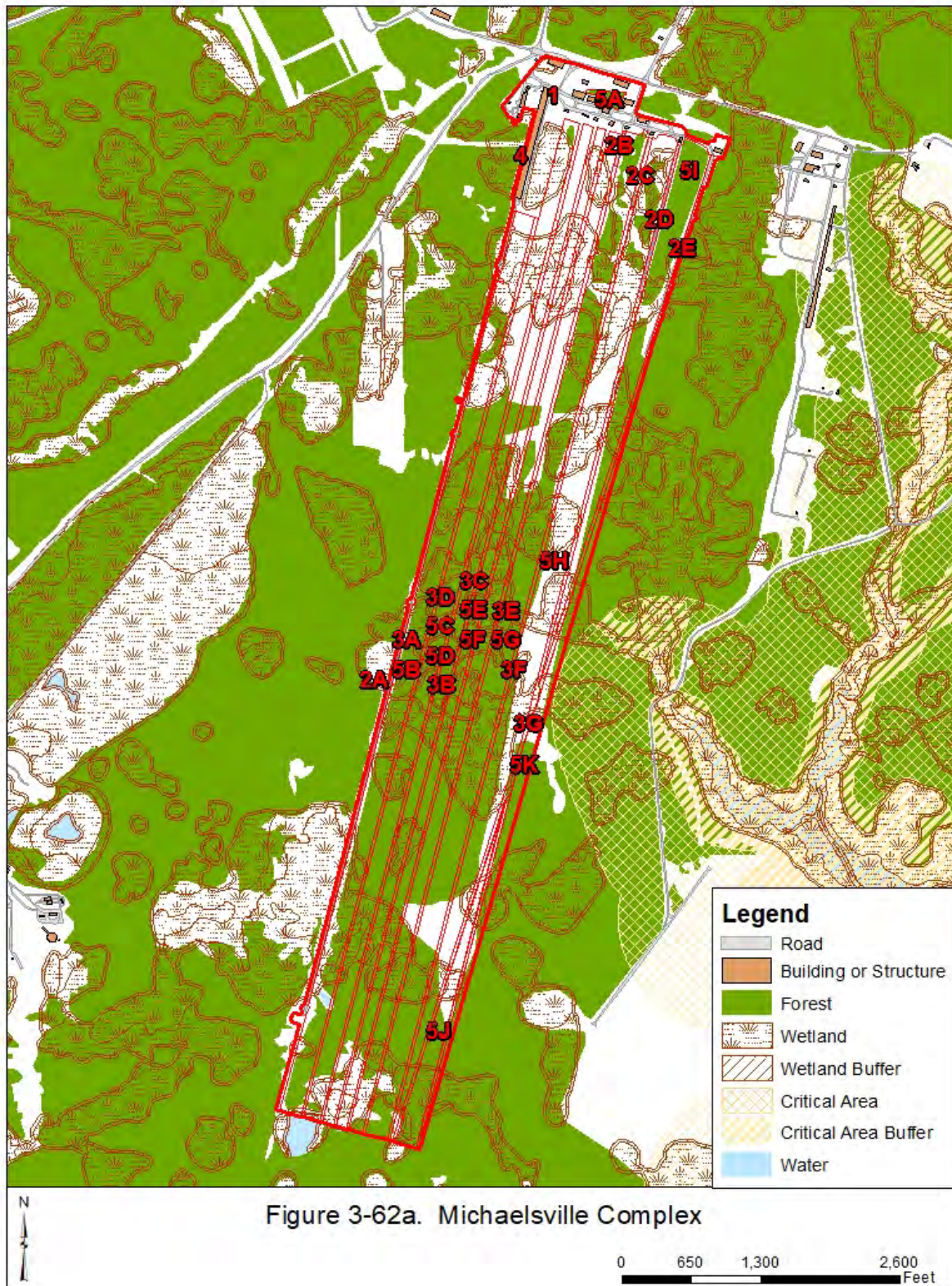


### 3.2.43 Michaelsville Complex

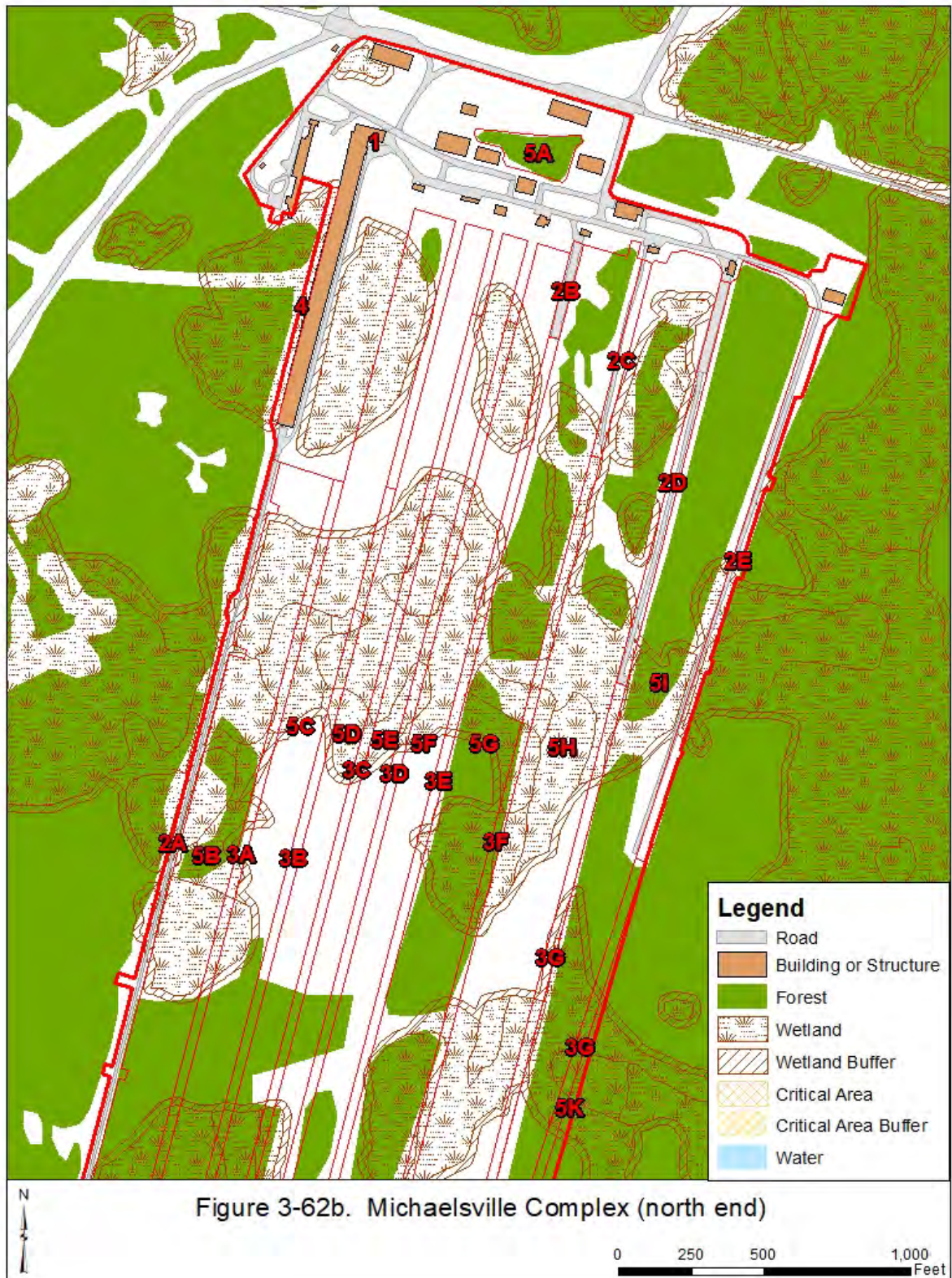
The Michaelsville Complex is located in the Aberdeen Area. The range encompasses approximately 357 acres.

The Michaelsville Complex is delineated into 5 areas (Figures 3-62a, 3-62b, and 3-62c) with associated vegetation maintenance prescriptions.

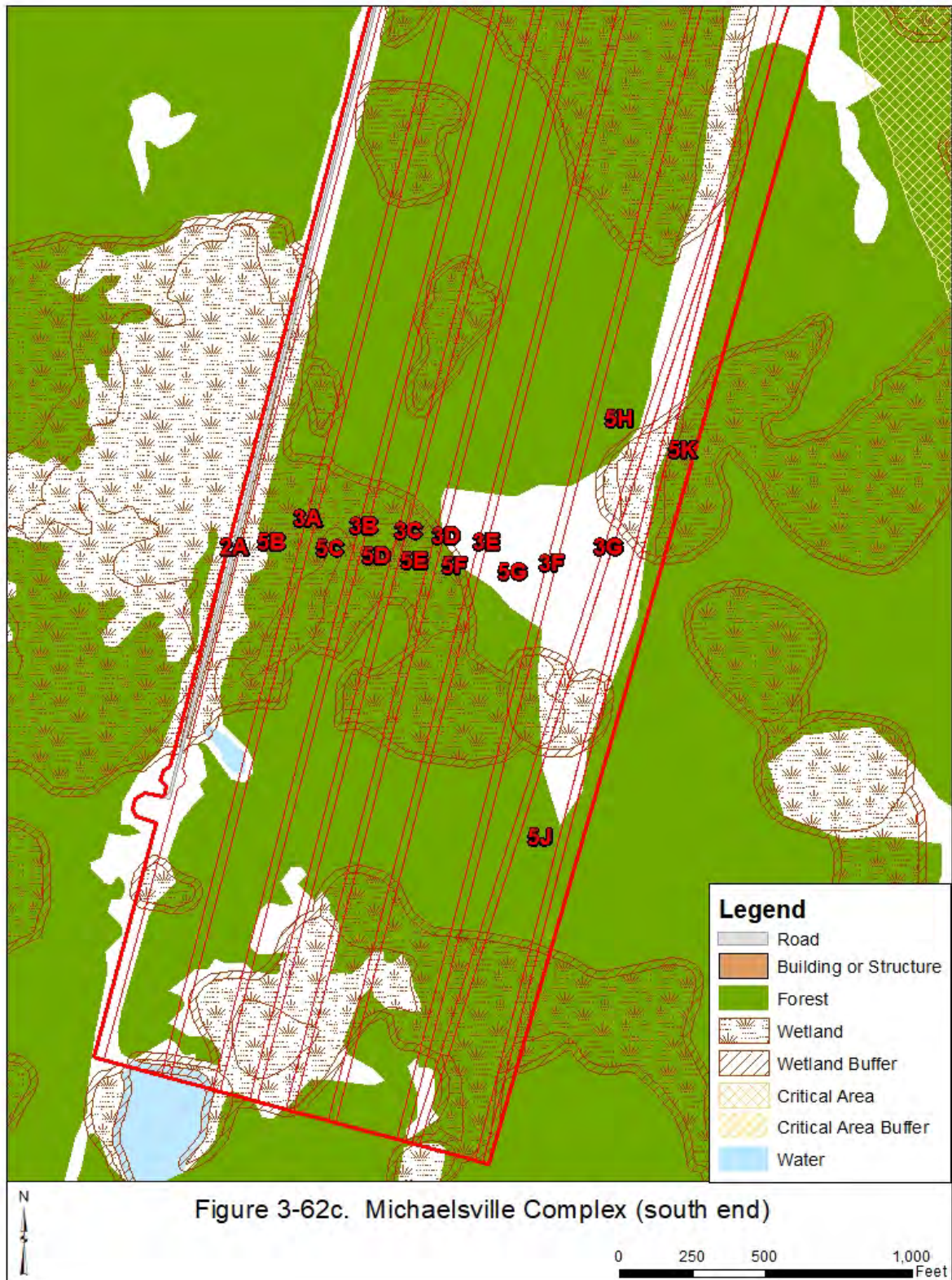
Area	Area Type	Maintenance Type	Frequency	Acres
1	Open (includes MICH5 tunnel, MICH 11 to 300M, MICH16/17 to 300M, MICH18/19 to 100M, Cold Room to 100M and firing pads for MICH20, MICH21, MICH22, MICH23)	Mowing	Twice per year	22
2	Support Area (A – Small Arms Range Road) (B – MICH20 to 100M) (C – MICH21 to 200M) (D – MICH22 to 450M) (E – MICH23 to 600M)	Mechanical, with or without herbicide spraying	Every 3 years	8 (A) 0.3 (B) 0.6 (C) 1.1 (D) 1.8 (E)
3	Support Area (A – MICH11, 300 to 3000M) (B – MICH16/17, 300 to 3000M) (C – MICH18/19, 100 to 3000M) (D – Cold Room, 100 to 3000M) (E – MICH20, 100 to 3000M) (F – MICH21, 200 to 3000M) (G – MICH22, 450 to 3000M and MICH23, 600 to 3000M)	Mechanical, with or without herbicide spraying	Every 20 years	6.2 (A) 6.3 (B) 6.7 (C) 6.8 (D) 6.6 (E) 6.4 (F) 11 (G)
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	0.5
5	Natural Area	Conservation	Monitor for encroachment	0.9 (A) 39 (B) 33 (C) 23 (D) 21 (E) 26 (F) 48 (G) 45 (H) 18 (I) 7.7 (J) 12 (K)











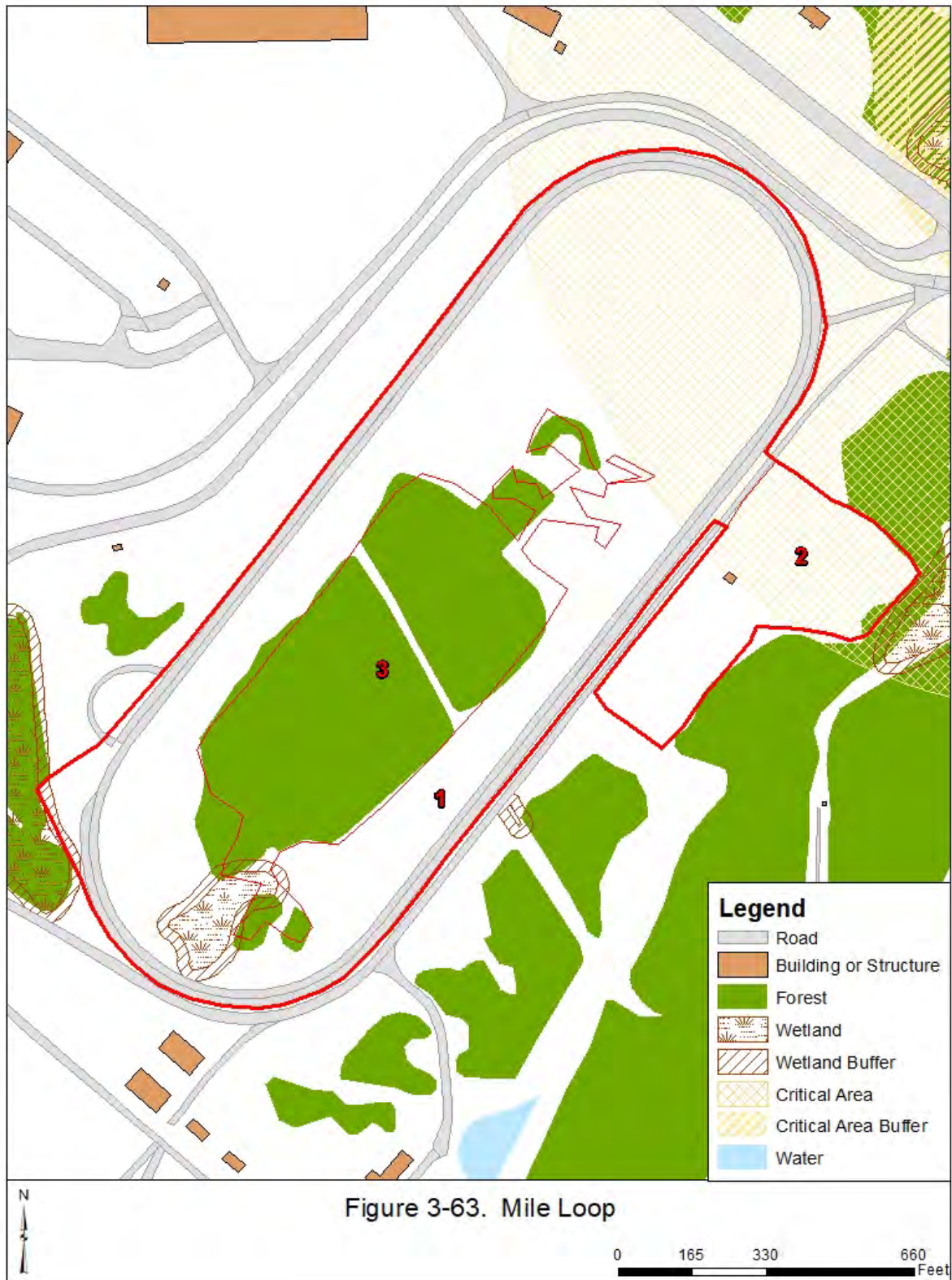
### 3.2.44 Mile Loop

The Mile Loop is located in the Aberdeen Area. The range encompasses approximately 41 acres.

The Mile Loop is delineated into 3 areas (Figure 3-63) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	27
2	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	4.3
3	Natural Area	Conservation	Monitor for encroachment	9.5





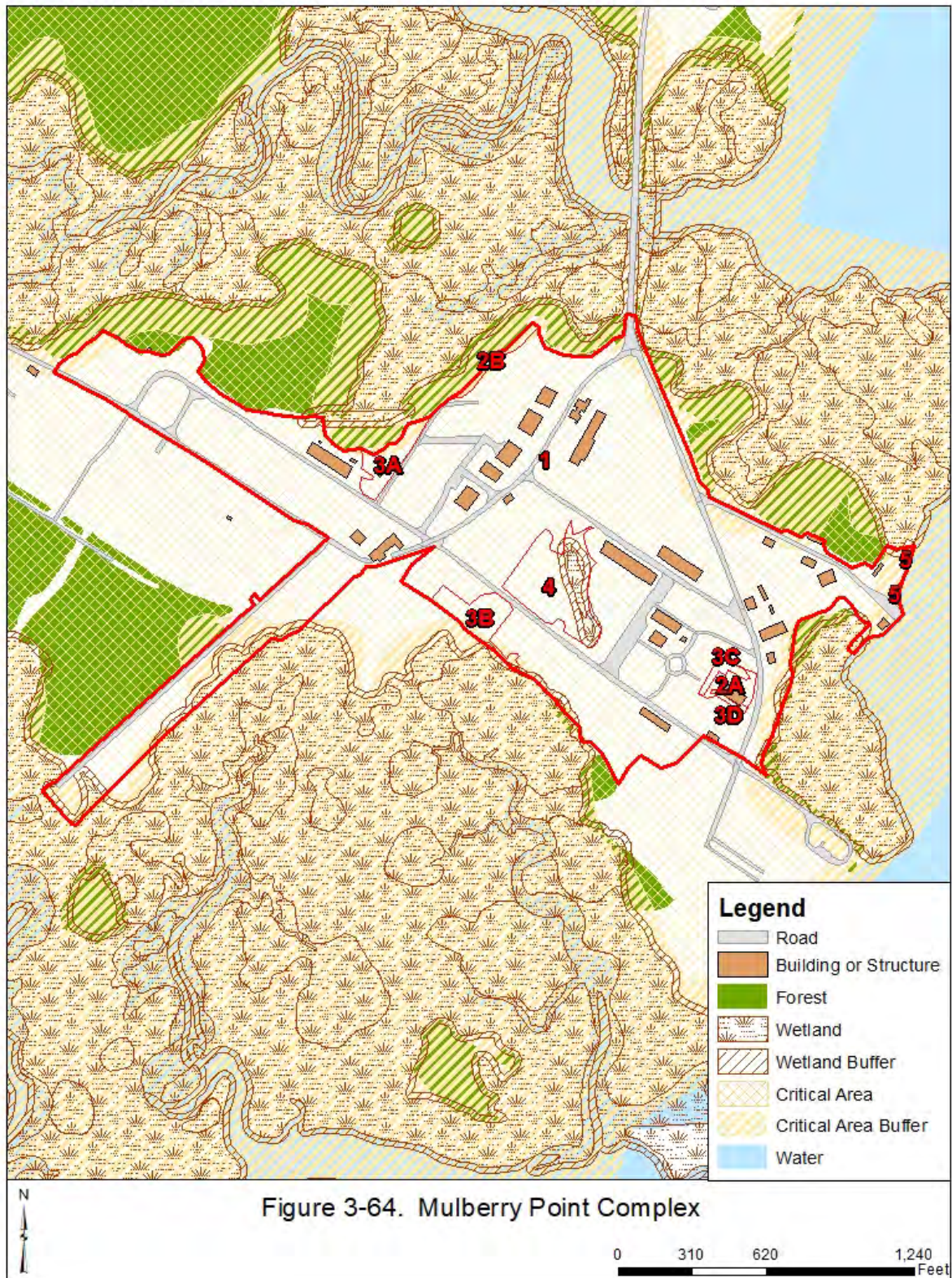
### 3.2.45 Mulberry Point Complex

The Mulberry Point Complex is located in the Aberdeen Area. The range encompasses approximately 69 acres.

The Mulberry Point Complex is delineated into 5 areas (Figure 3-64) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	63
2	Support Area (A – area around B635) (B – area around Arborvitae trees)	Mechanical, with or without herbicide spraying	Every 3 years	0.7 (A) 0.3 (B)
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.8 (A) 1 (B) 0.2 (C) 0.07 (D)
4	Natural Area	Conservation	Monitor for encroachment	2.6
5	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.05





### 3.2.46 Munson Test Area

The Munson Test Area is located in the Aberdeen Area. The range encompasses approximately 150 acres.

The Munson Test Area is delineated into 4 areas (Figure 3-65) with associated vegetation maintenance prescriptions. Area 4 represents a small stand of trees that encroach on a portion of the test course.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	136 (A) 0.6 (B) 1.1 (C)
2	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	3.2 (A) 4.1 (B) 1 (C) 3.1 (D)
3	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	0.02 (A) 0.09 (B) 0.06 (C) 0.03 (D) 0.2 (E) 0.3 (F) 0.09 (G)
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Once, then maintain as open (Area 1)	0.03





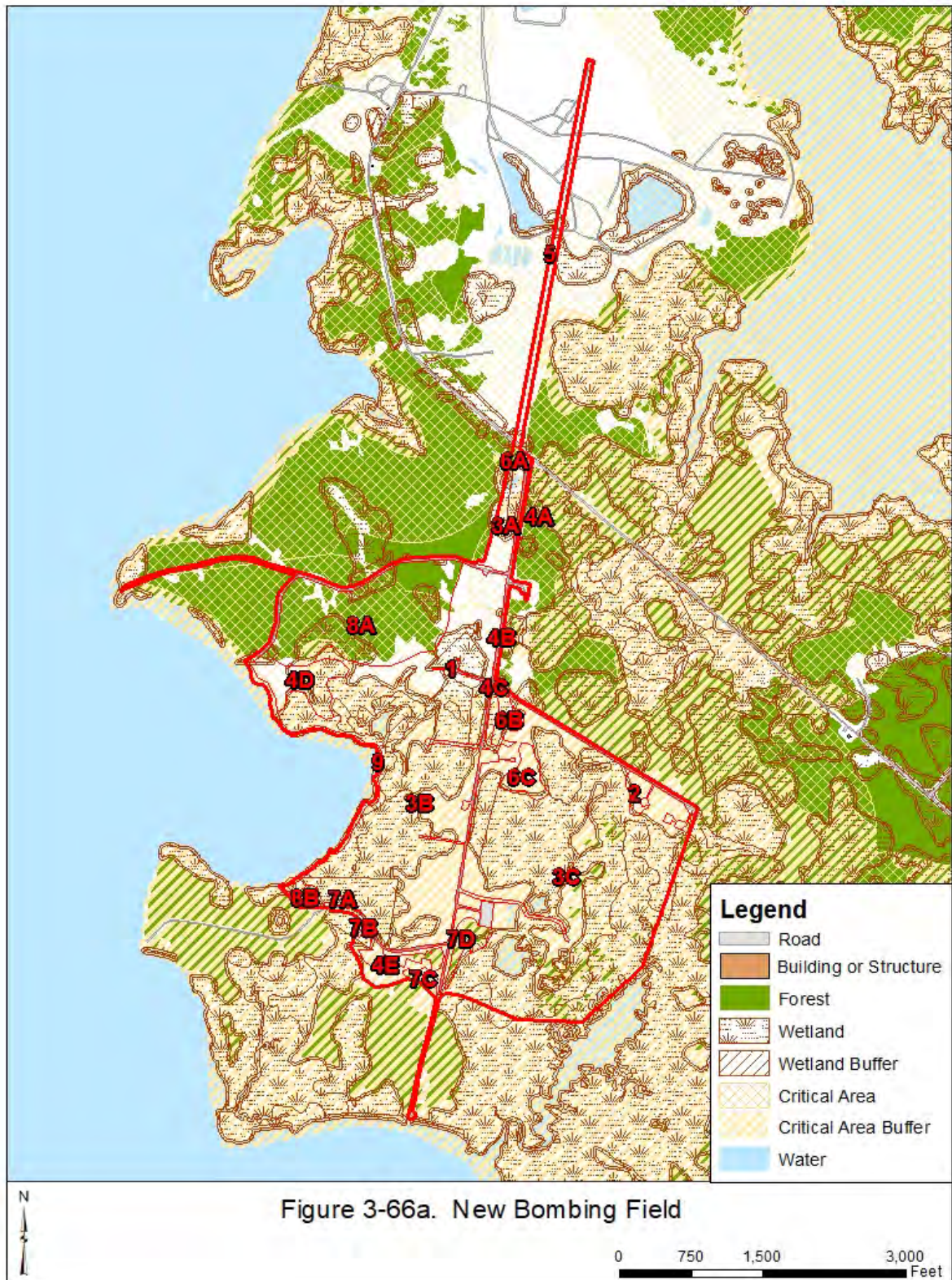
### 3.2.47 New Bombing Field

The New Bombing Field is located in the Aberdeen Area. The range encompasses approximately 319 acres.

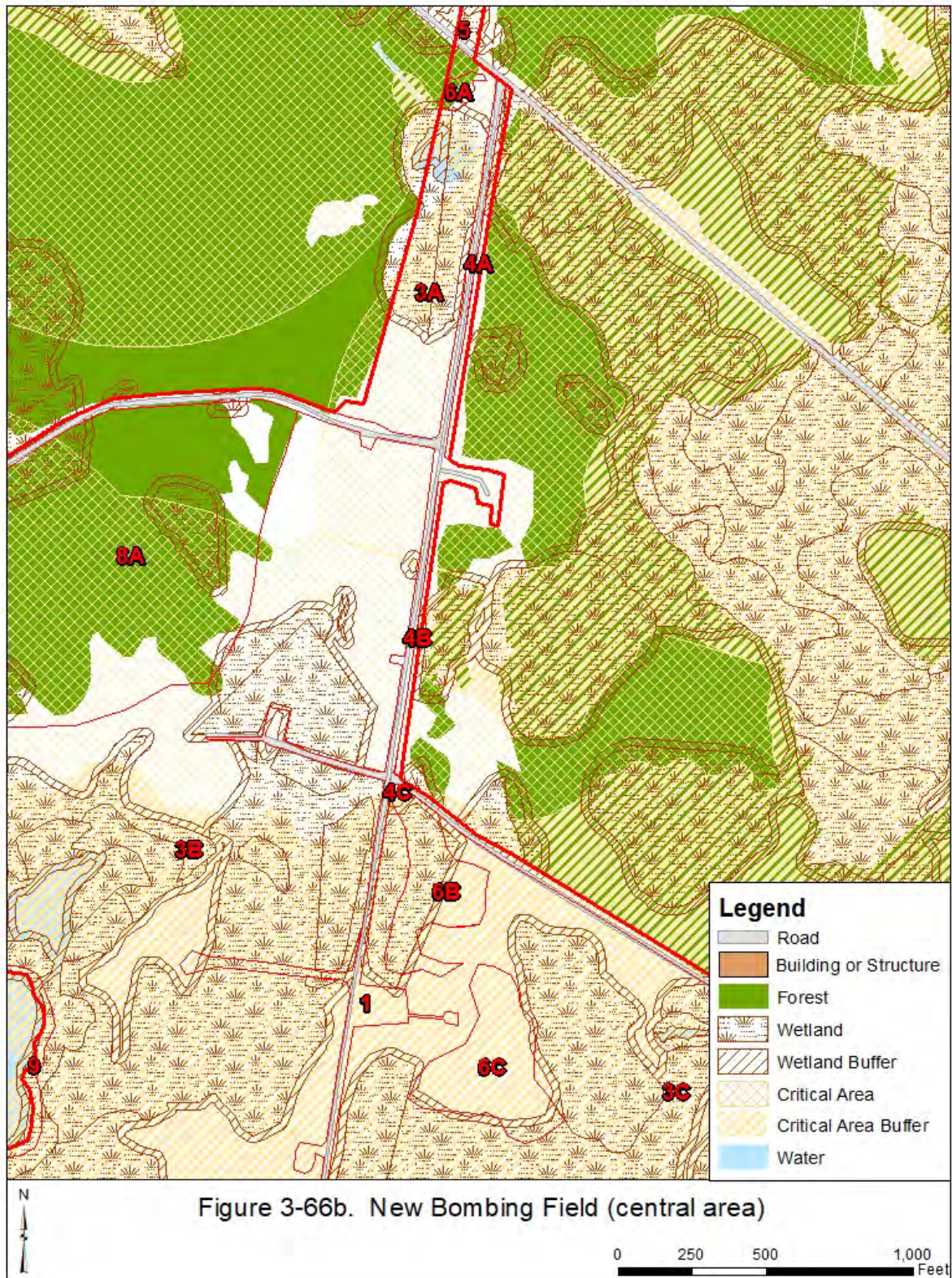
The New Bombing Field is delineated into 9 areas (Figures 3-66a, 3-66b, and 3-66c) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open (Cod Creek Road, access roads, pads)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 3 years	17
2	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 3 years	1.8
3	Support Area (A – field/marsh, Abbey Point Road to Tower Point Road) (B – field/marsh, west of Cod Creek Road) (C - field/marsh, east of Cod Creek Road)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 5 years	6.1 (A) 102 (B) 123 (C)
4	Support Area (A, B, C – utility right-of-way east of Cod Creek Road)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	0.6 (A) 0.4 (B) 0.05 (C) 7.8 (D) 5.1 (E)
5	Support Area (F3/F4 firing line)	Mechanical, with or without herbicide spraying	Every 20 years	7.1
6	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	0.2 (A) 2.6 (B) 3.5 (C)
7	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 10 years	0.3 (A) 1.7 (B) 2.5 (C) 2.8 (D)
8	Natural Area	Conservation	Monitor for encroachment	36 (A) 1.3 (B)
9	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	3.1

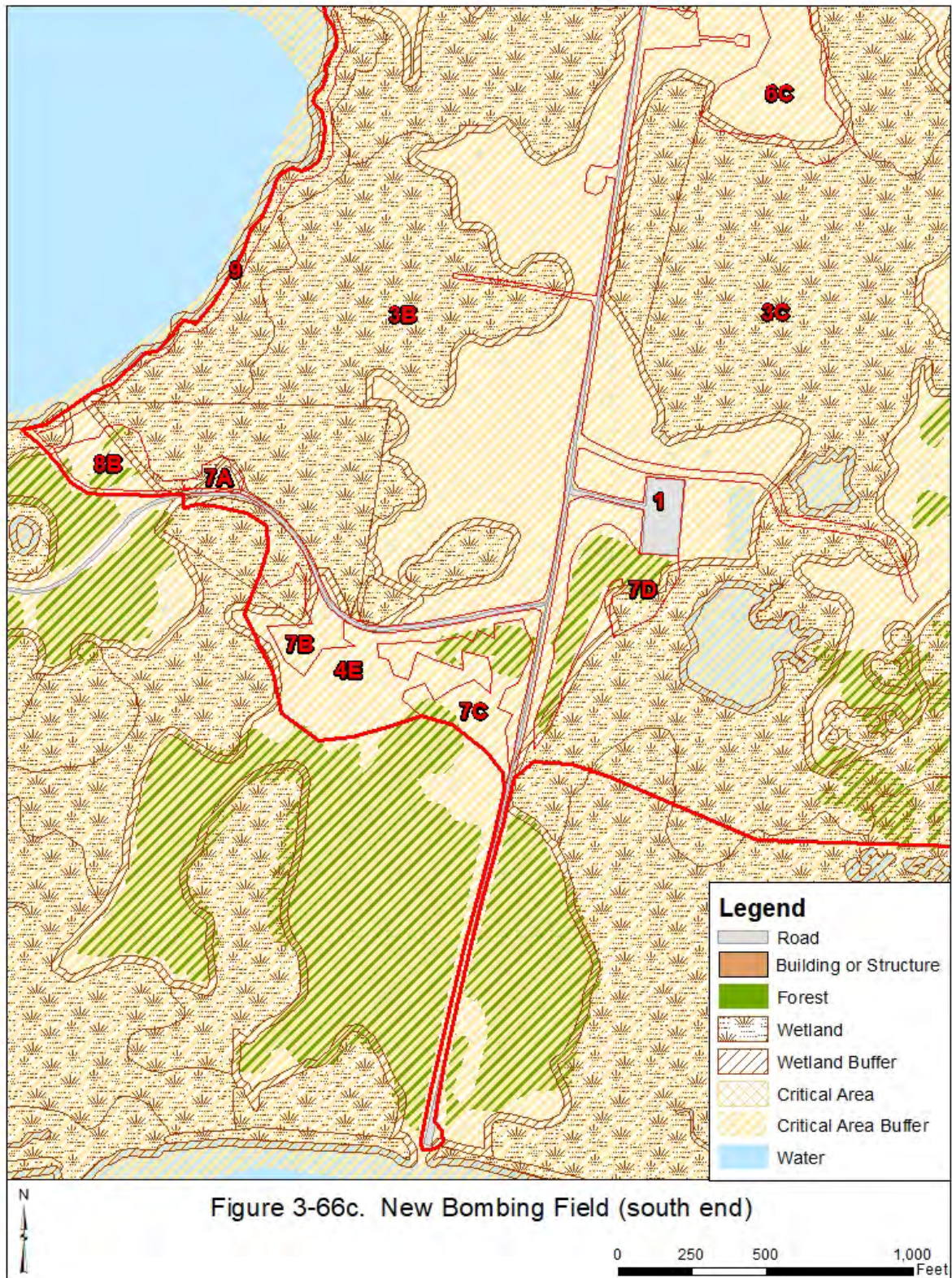












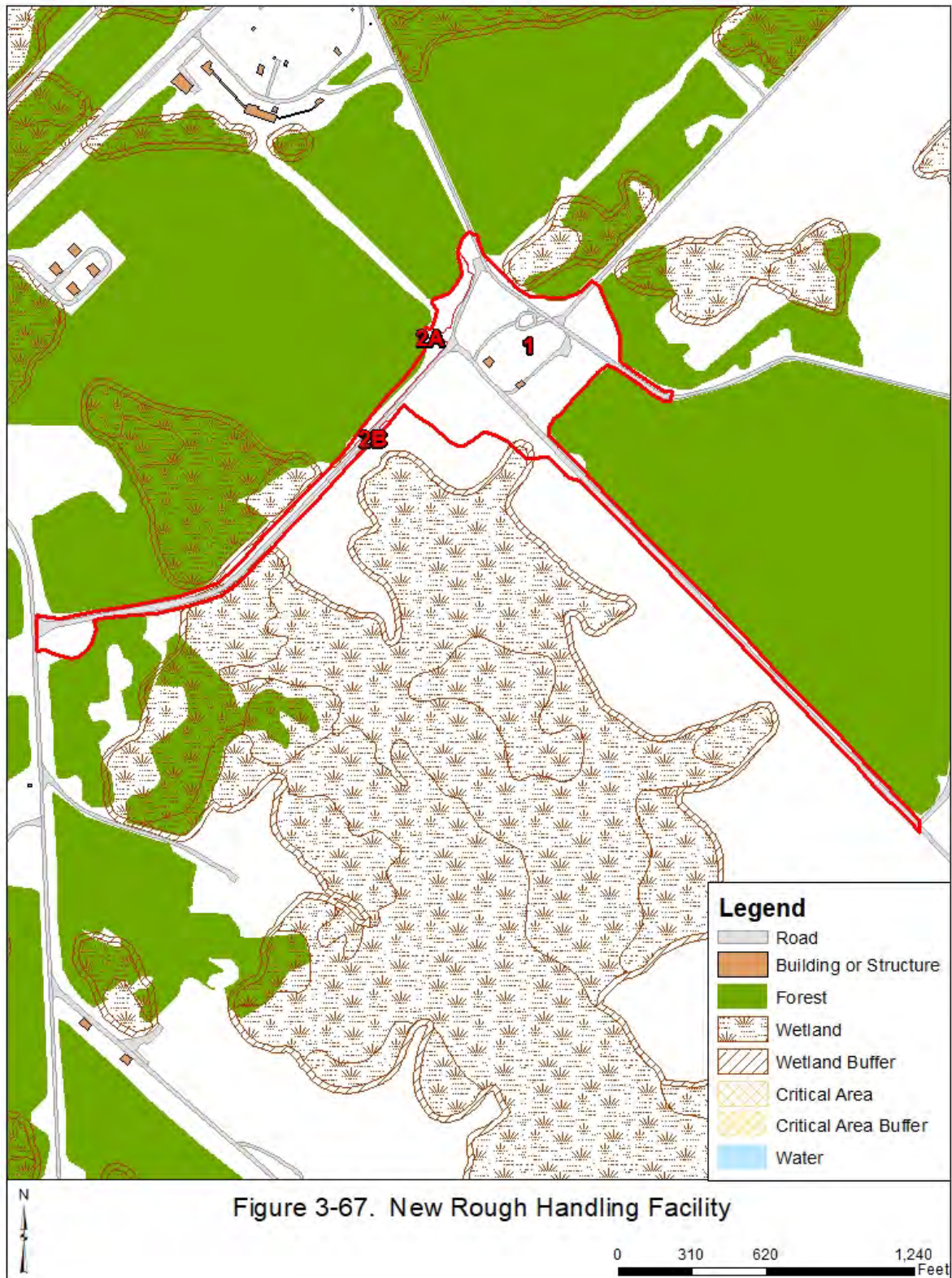


### 3.2.48 New Rough Handling Facility

The New Rough Handling Facility is located in the Aberdeen Area. The range encompasses approximately 16 acres.

The New Rough Handling Facility is delineated into 2 areas (Figure 3-67) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	15
2	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	1.2 (A) 0.06 (B)



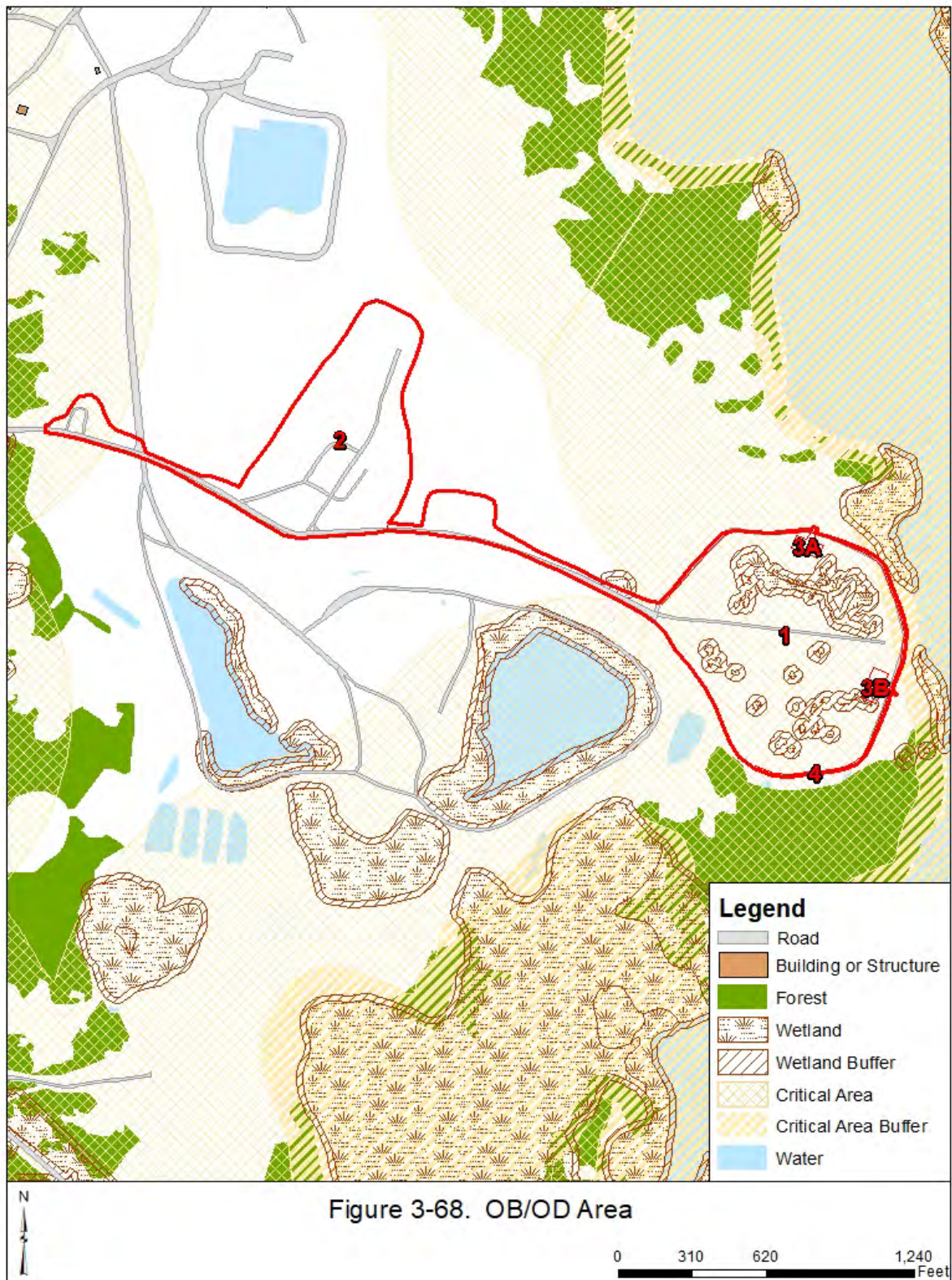
### 3.2.49 Open Burning/Open Detonation (OB/OD) Area

The OB/OD Area is located in the Aberdeen Area. The range encompasses approximately 33 acres. There is a small berm (Area 4) around the north, east, and part of south end of the OD area (Area 1).

The OB/OD Area is delineated into 4 areas (Figure 3-68) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open (OD area, equipment staging area)	Mowing, grading	Twice per year (mowing), small area grading conducted after each detonation to fill in large craters and limit ponding	19
2	Open (OB area, storage area)	Mowing	Twice per year	12
3	Stormwater management	Mechanical, with spot herbicide application on stone overflow weirs	Once per year (spot herbicide application on stone overflow weirs); every 7-10 years for mucking (or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	0.2 (A) 0.2 (B)
4	Berm	Mechanical, with or without herbicide spraying	Every 2 years	0.6





### 3.2.50 Perryman Test Area

The Perryman Test Area is located in the Aberdeen Area. The range encompasses approximately 853 acres.

The Perryman Test Area is delineated into 8 areas (Figures 3-69a, 3-69b, 3-69c, and 3-69d) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open (A – tank access road) (B – 3mi Straight Away) (C – Cross Country #1) (D – Cross Country #2 and Bivouac Site #4) (E – Palmer Road) (F – Secondary A and Bivouac Site #3) (G – Cross Country #3 and Bivouac Site #2)	Mowing	Twice per year	12 (A) 109 (B) 94 (C) 38 (D) 22 (E) 46 (F) 82 (G)
2	Stormwater Management (stormwater pond)	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	7.3
3	Encroachment – Trees to Clear (stormwater pond)	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	1.3
4	Support Area (A – Dig Site #1) (B – Dig Site #2) (C – Dig Site #3) (D – Dig Site #4)	Mechanical, with or without herbicide spraying	Once per year	7.5 (A) 5.9 (B) 3.5 (C) 2.8 (D)
5	Support Area (Auxiliary Landing Field and Bivouac Site #1)	Mechanical, with or without herbicide spraying	Every 2 years	2.4
6	Support Area (A – access road to range tower) (B – Ride Quality) (C – Cross Country #4)	Mechanical (and/or controlled burn for C), with or without herbicide spraying	Every 5 years	0.5 (A) 3.6 (B) 82 (C)

7	Encroachment – Trees to Clear (A – access road to range tower) (B – Ride Quality)	Mechanical, with or without herbicide spraying	Every 5 years	0.06 (A) 1.4 (B)
8	Natural Area	Conservation	Monitor for encroachment	327











Figure 3-69c. Perryman Test Area (central area)



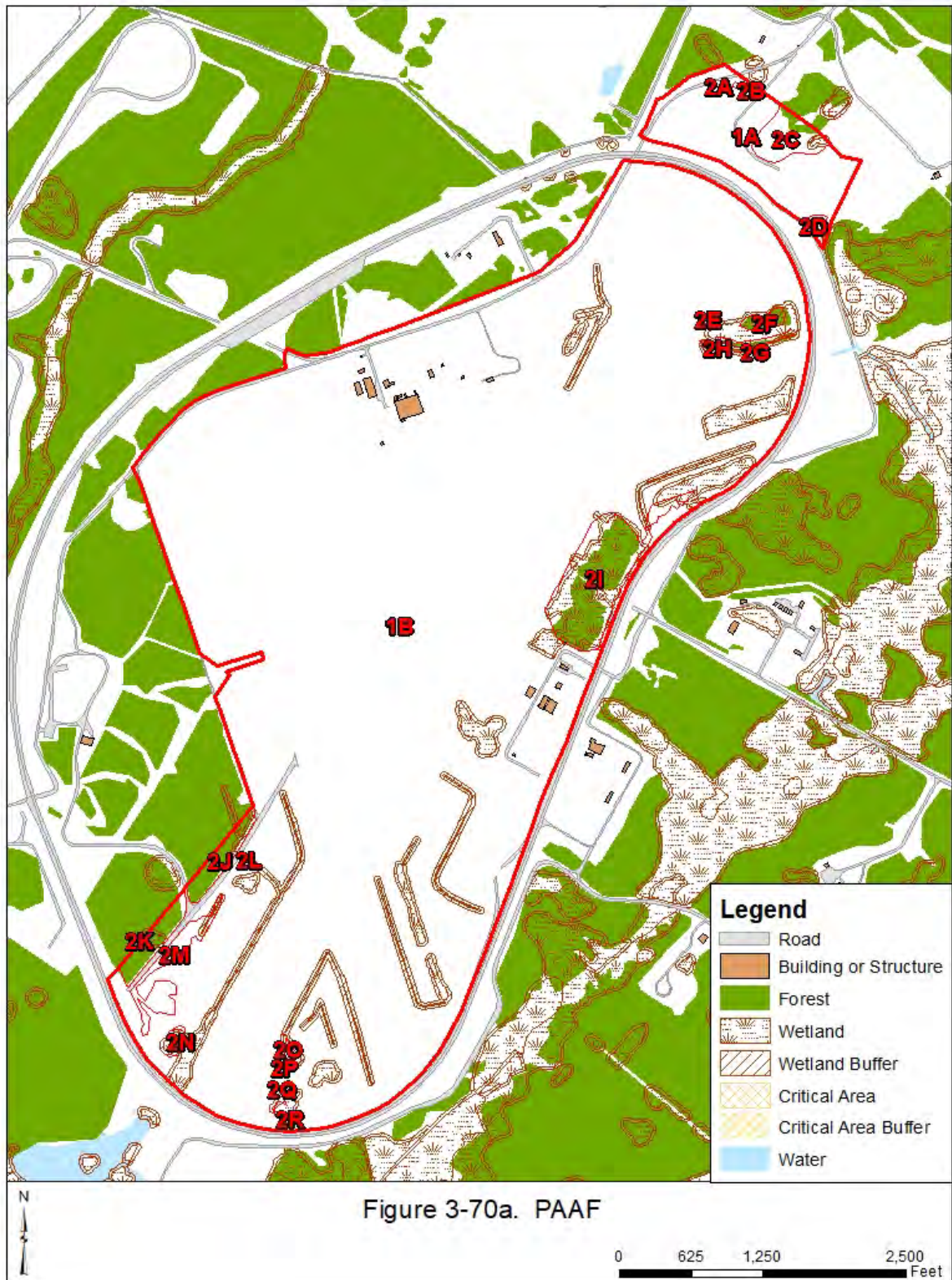


### 3.2.51 Phillips Army Airfield (PAAF)

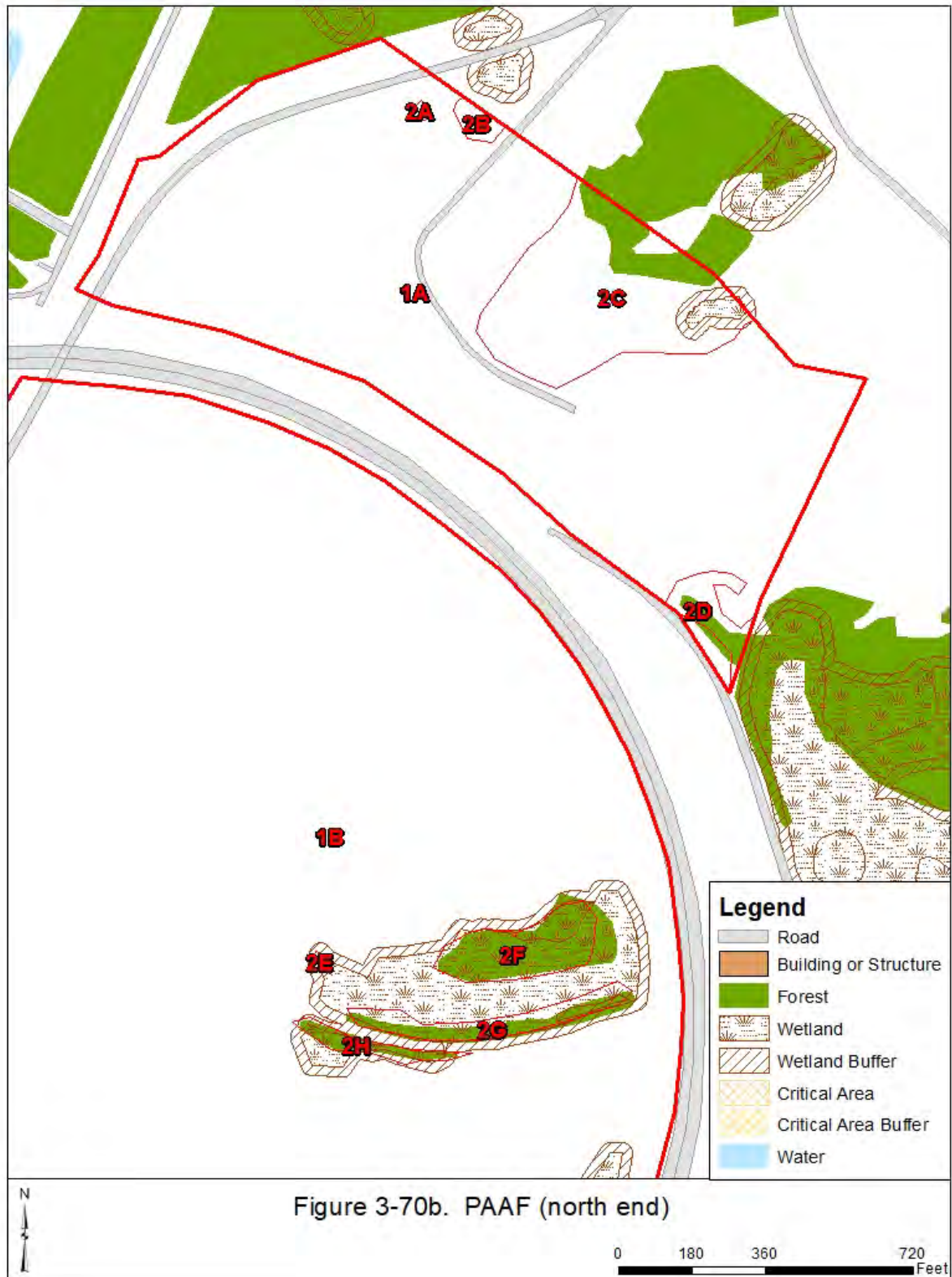
The PAAF is located in the Aberdeen Area. The range encompasses approximately 650 acres.

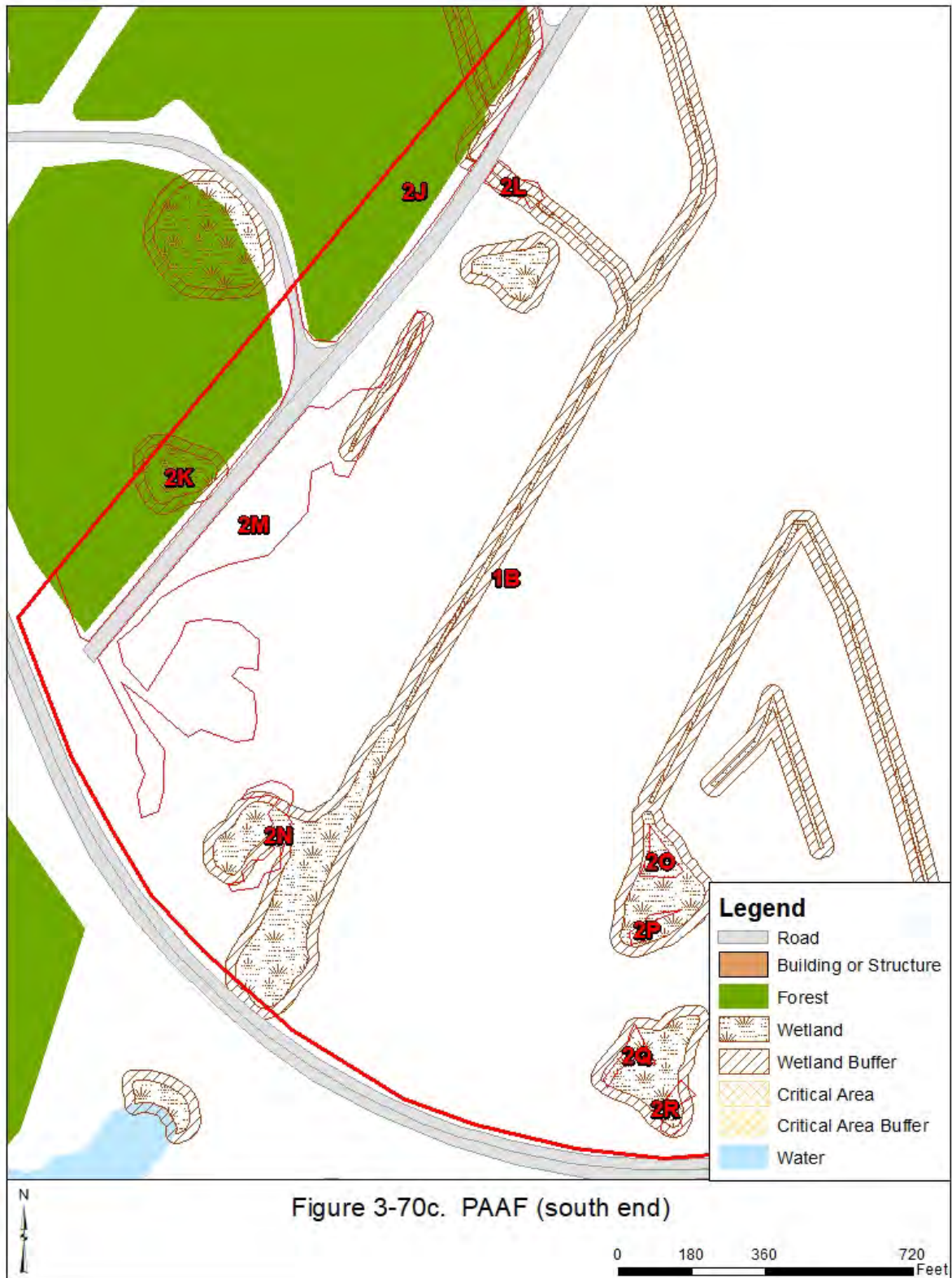
The PAAF is delineated into 2 areas (Figures 3-70a, 3-70b, and 3-70c) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	30 (A) 620 (B)
2	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Once, then maintain as open (Area 1)	0.03 (A) 0.2 (B) 4.3 (C) 0.5 (D) 0.03 (E) 1.1 (F) 0.7 (G) 0.3 (H) 14 (I) 3.1 (J) 3.3 (K) 0.2 (L) 4.1 (M) 0.3 (N) 0.2 (O) 0.07 (P) 0.1 (Q) 0.1 (R)









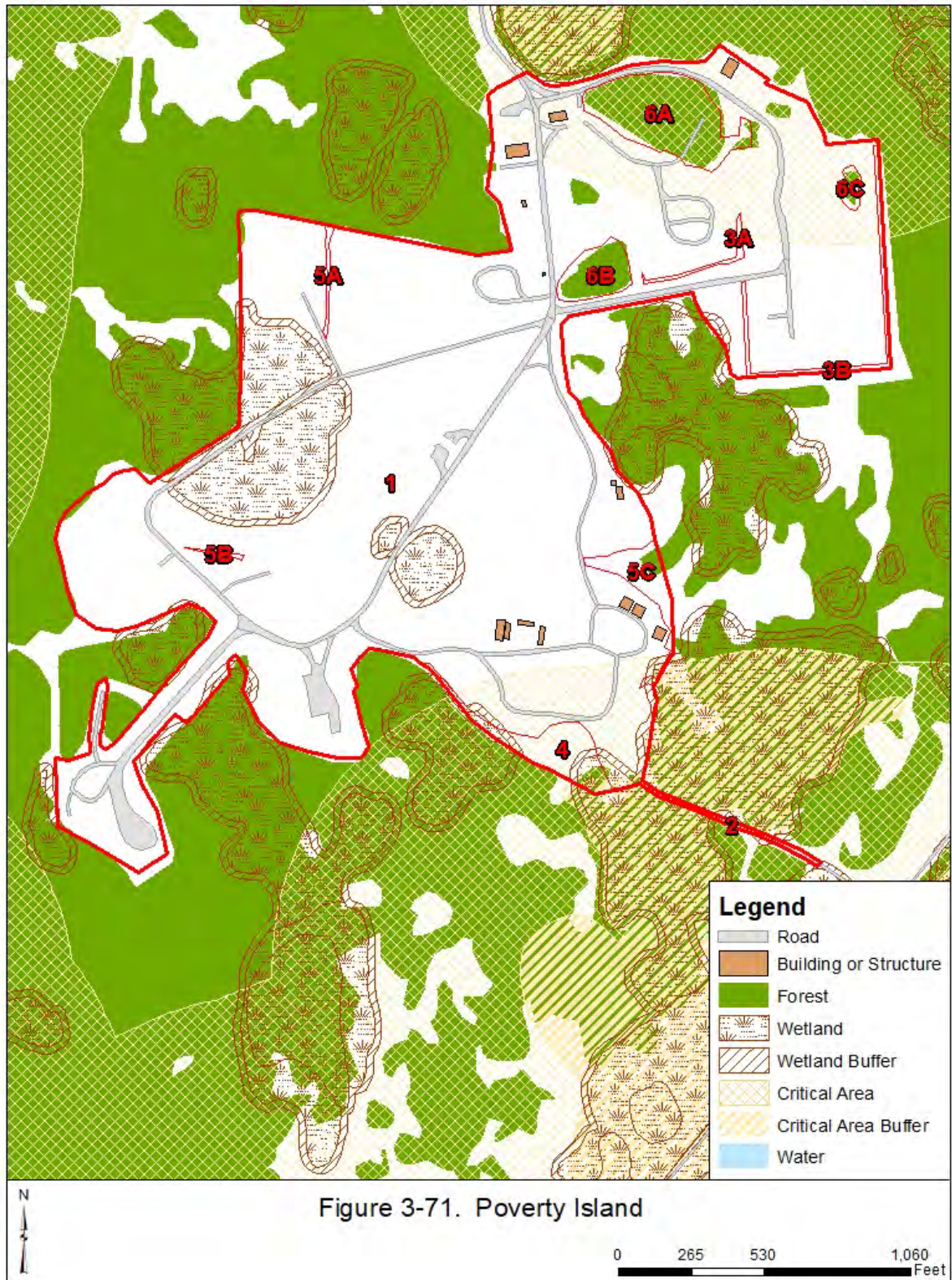
### 3.2.52 Poverty Island

The Poverty Island range is located in the Aberdeen Area. The range encompasses approximately 98 acres.

The Poverty Island range is delineated into 6 areas (Figure 3-71) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	91
2	Support Area (egress road)	Mechanical, with or without herbicide spraying	Every 5 years	0.3
3	Encroachment – Trees to Clear (B – fence line)	Mechanical, with or without herbicide spraying	Once, then maintain as open (Area 1)	0.2 (A) 0.6 (B)
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 2 years	1.4
5	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.1 (A) 0.05 (B) 0.9 (C)
6	Natural Area	Conservation	Monitor for encroachment	2.9 (A) 1 (B) 0.2 (C)





### 3.2.53 Range 18

The Range 18 is located on Spesutie Island in the Aberdeen Area. The range encompasses approximately 38 acres.

Range 18 is delineated into 6 areas (Figure 3-72) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	16
2	Magazine	Mechanical, with or without herbicide spraying	Once per year	0.3
3	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	1.6 (A) 6.8 (B) 1.4 (C) 0.4 (D)
4	Natural Area – Mitigation	Conservation	Monitor for encroachment	0.3 (A) 0.2 (B)
5	Natural Area	Conservation	Monitor for encroachment	0.08 (A) 8.7 (B)
6	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	2.4





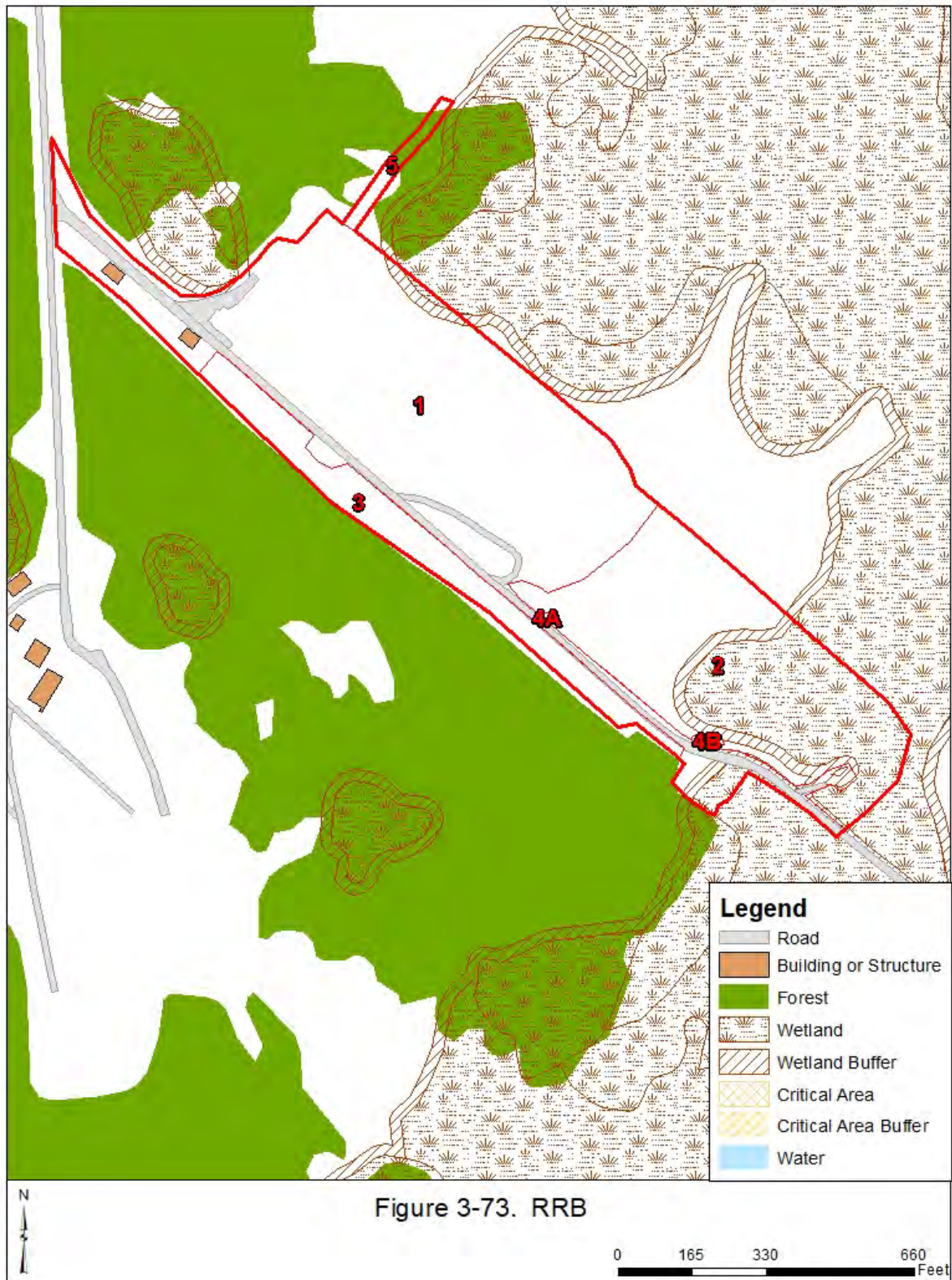


### 3.2.54 Recoilless Range B (RRB)

The RRB range is located in the Aberdeen Area. The range encompasses approximately 20 acres.

The RRB range is delineated into 5 areas (Figure 3-73) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing, with or without controlled burn	Twice per year	12
2	Support Area	Mechanical and/or controlled burn, with or without herbicide spraying	Every 3 years	6
3	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	1.9
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.01 (A) 0.03 (B)
5	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 5 years	0.3



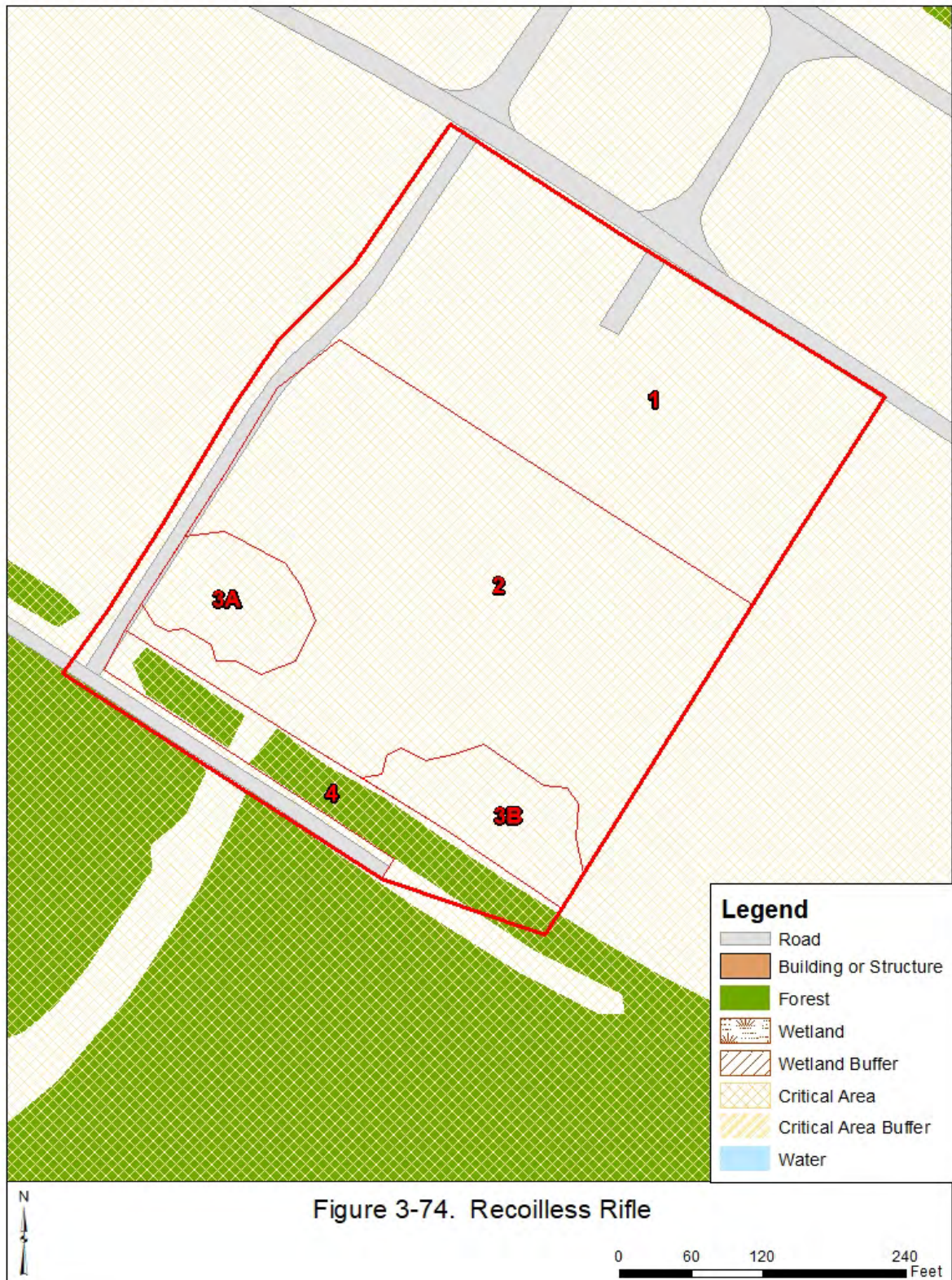
### 3.2.55 Recoilless Rifle

The Recoilless Rifle range is located in the Aberdeen Area. The range encompasses approximately 6 acres.

The Recoilless Rifle range is delineated into 4 areas (Figure 3-74) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	2.4
2	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	2.4
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.3 (A) 0.3 (B)
4	Natural Area	Conservation	Monitor for encroachment	0.4





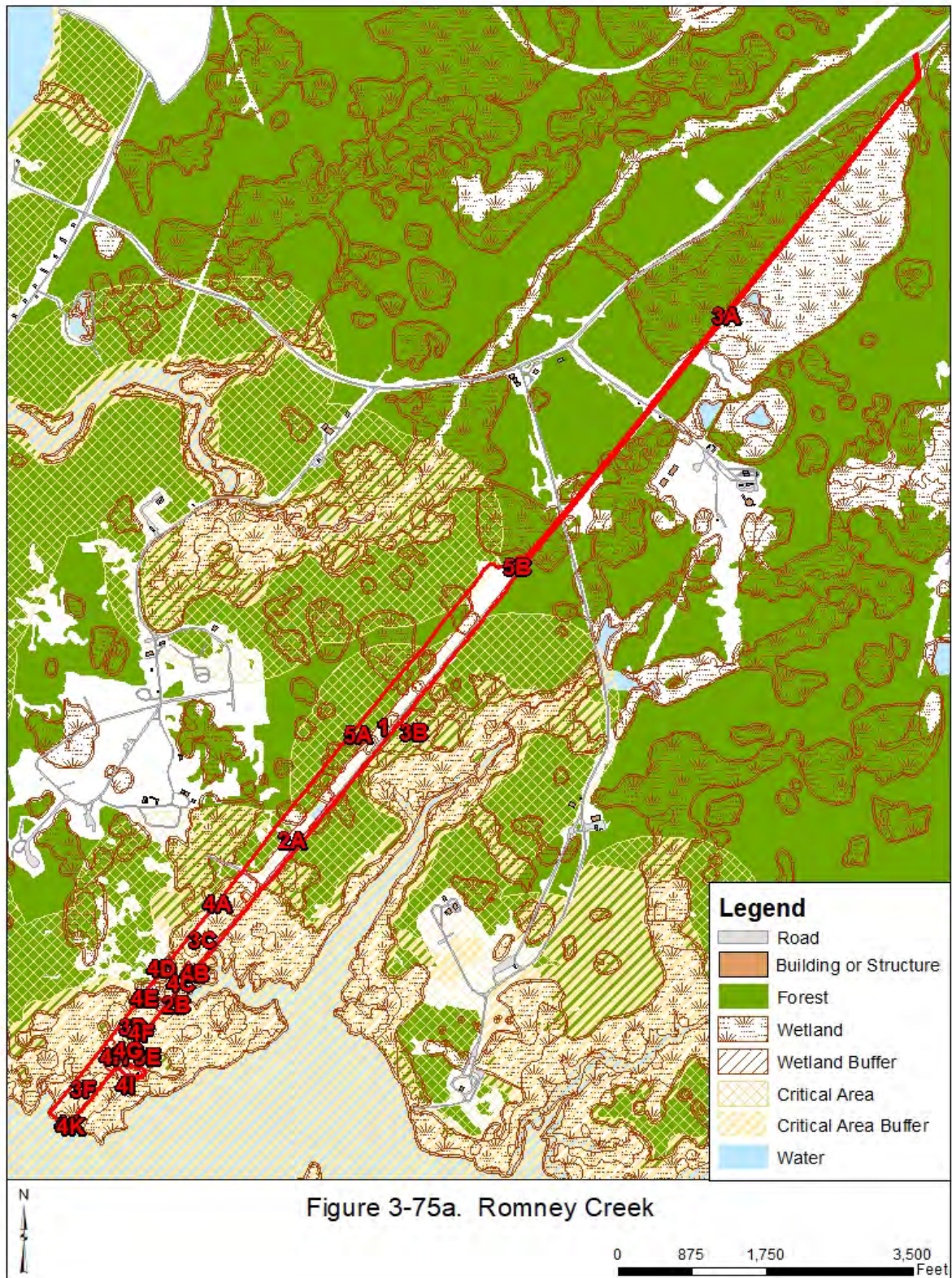
### 3.2.56 Romney Creek

The Romney Creek range is located in the Aberdeen Area. The range encompasses approximately 72 acres.

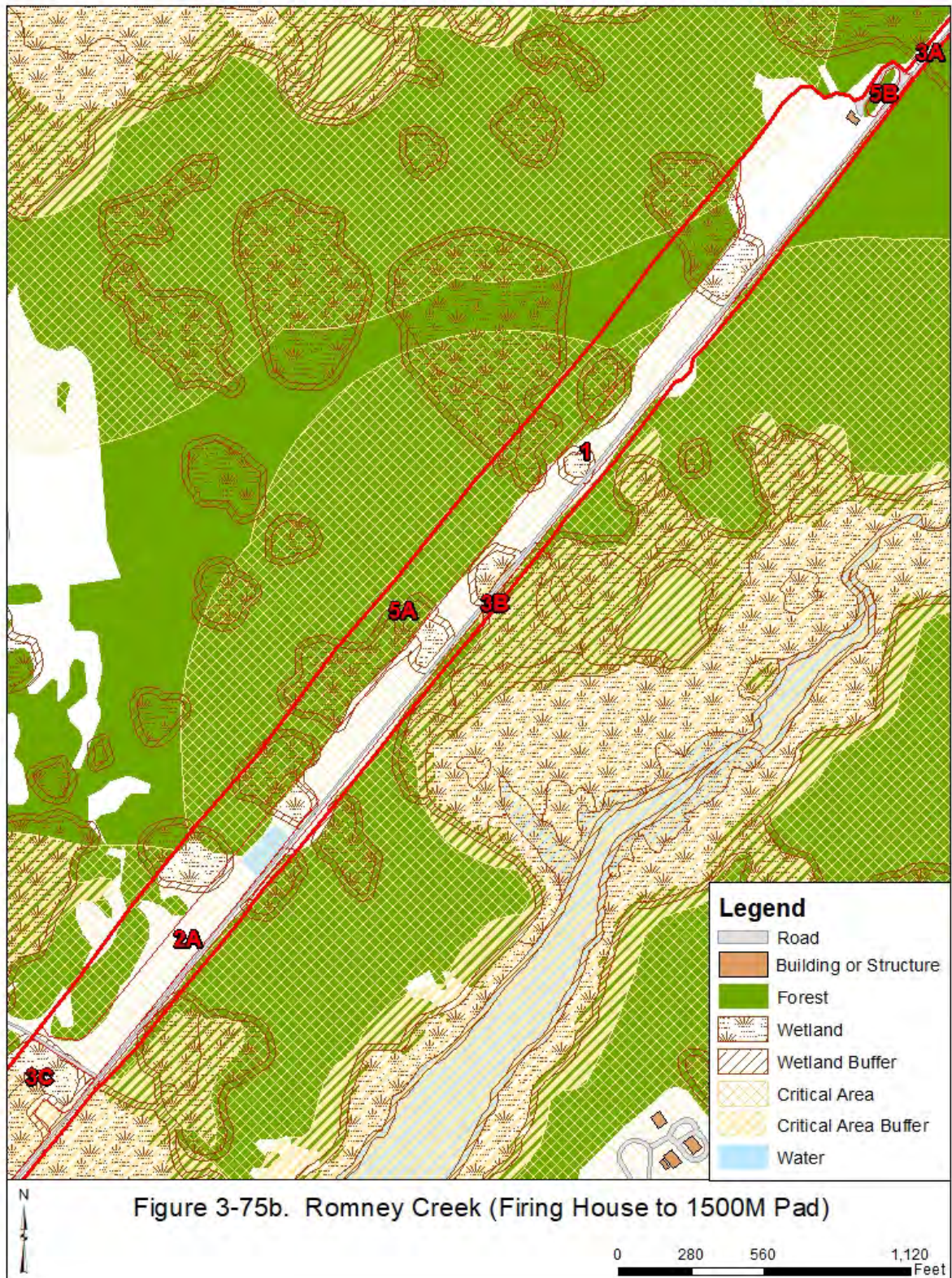
The Romney Creek range is delineated into 5 areas (Figures 3-75a, 3-75b, and 3-75c) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open (range road, Firing House to creek)	Mowing	Twice per year	17
2	Support Area (A – 1000M to egress road) (B – RC2)	Mechanical, with or without herbicide spraying	Every 5 years	4.3 (A) 0.3 (B)
3	Support Area (A – range road, RC13 to Firing House) (B – Firing House to egress road) (C – egress road to RC2) (D – RC2 to Elevation/Depression) (E – Elevation/Depression) (F – Elevation/Depression to creek)	Mechanical, with or without herbicide spraying	Every 10 years	6.9 (A) 2.6 (B) 11 (C) 3.6 (D) 0.6 (E) 6 (F)
4	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 10 years	0.06 (A) 0.08 (B) 0.02 (C) 0.2 (D) 0.5 (E) 0.05 (F) 0.02 (G) 0.8 (H) 0.4 (I) 0.05 (J) 0.03 (K)
5	Natural Area	Conservation	Monitor for encroachment	17 (A) 0.3 (B)

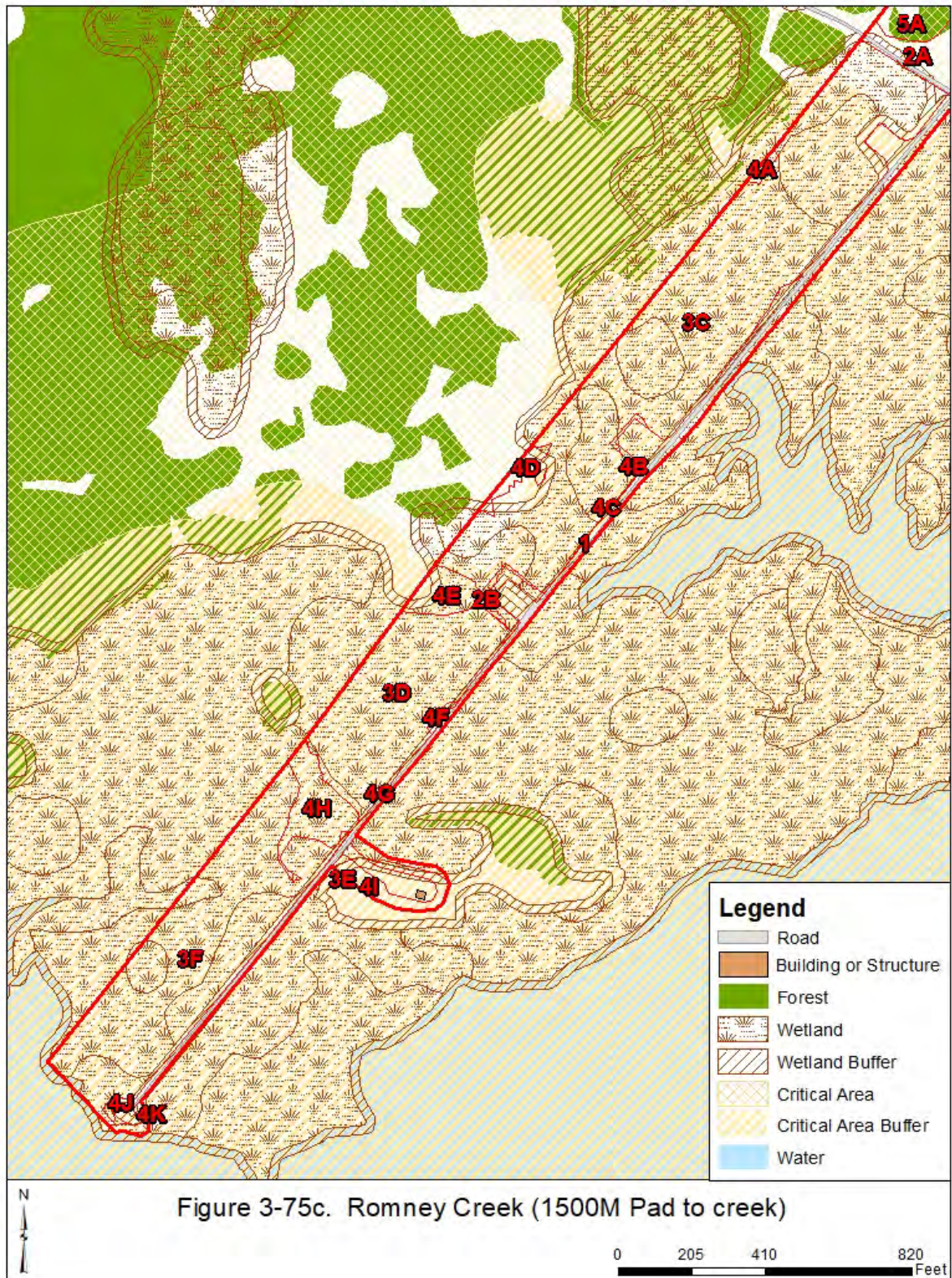












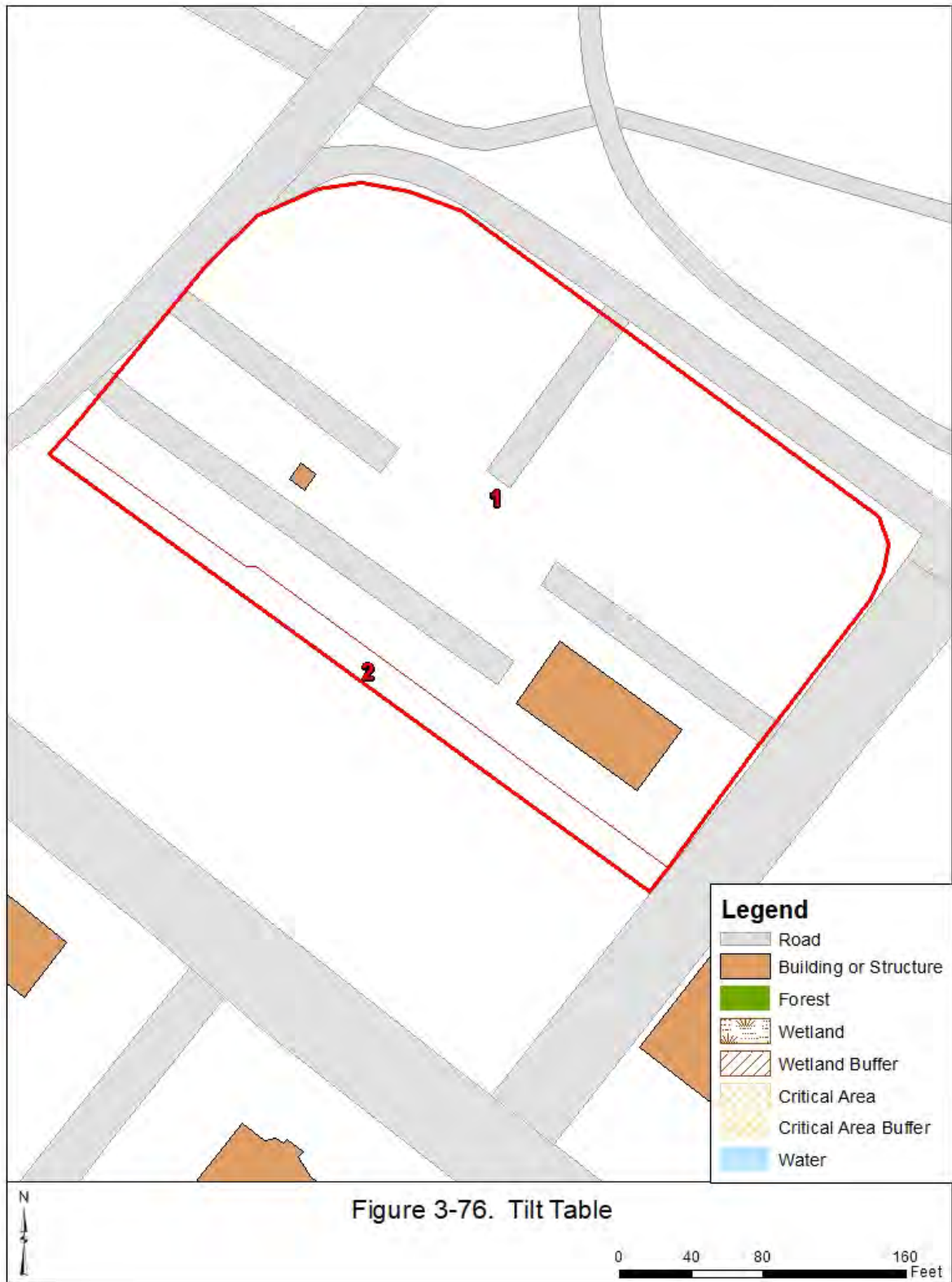
### 3.2.57 Tilt Table

The Tilt Table is located in the Aberdeen Area. The range encompasses approximately 2 acres.

The Tilt Table is delineated into 2 areas (Figure 3-76) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	2.1
2	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.2





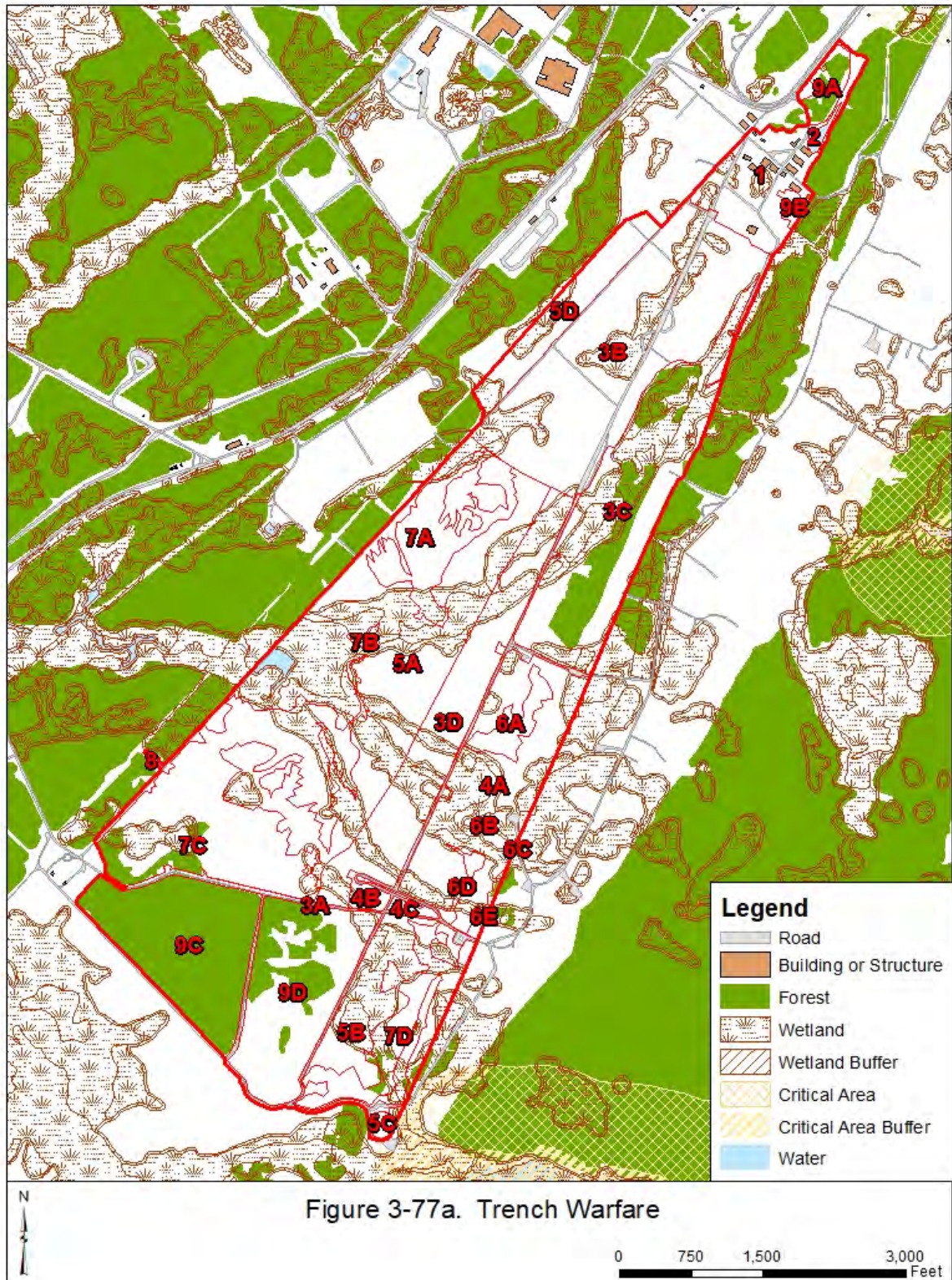
### 3.2.58 Trench Warfare

The Trench Warfare range is located in the Aberdeen Area. The range encompasses approximately 686 acres.

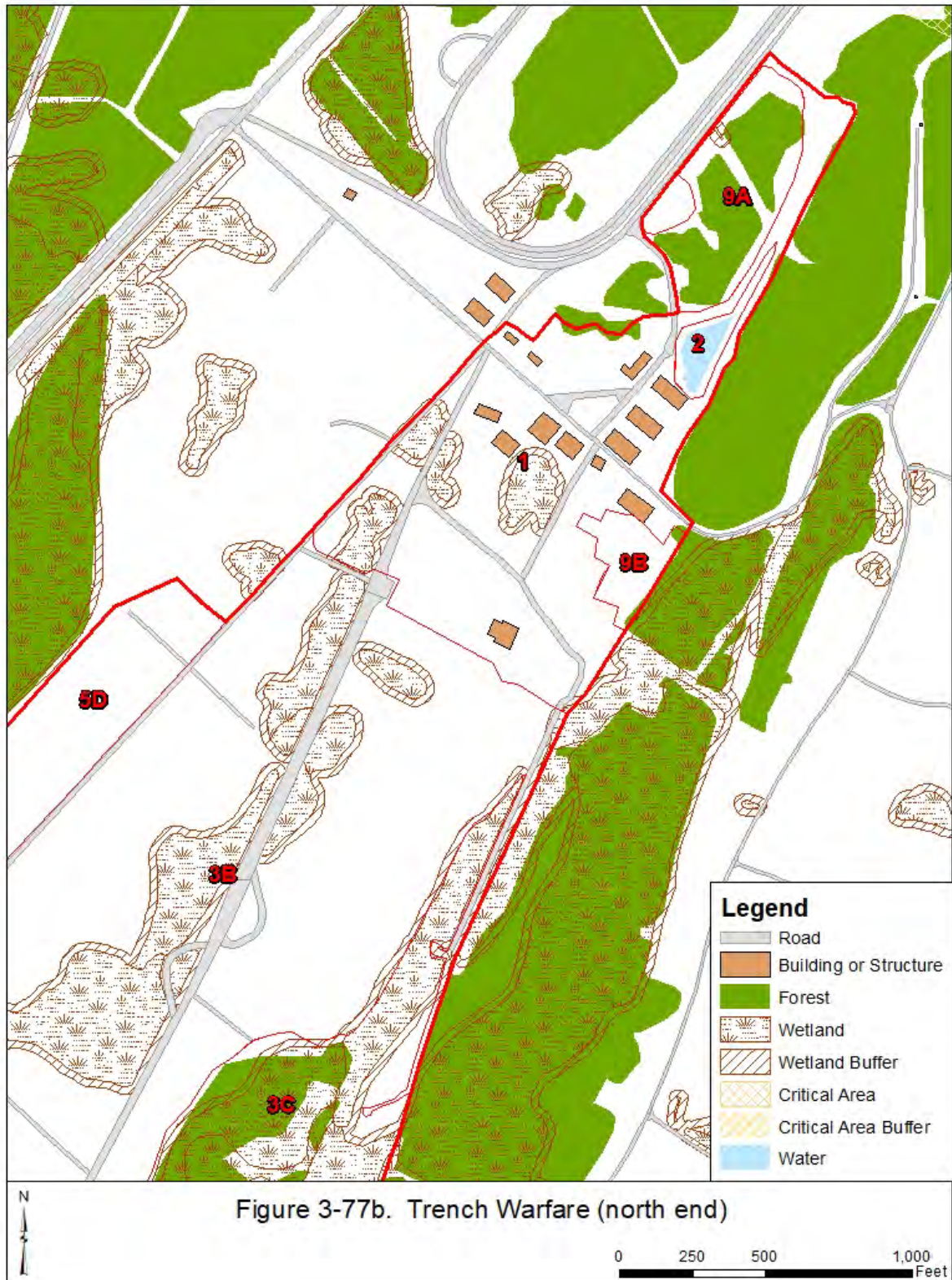
The Trench Warfare range is delineated into 9 areas (Figures 3-77a, 3-77b, and 3-77c) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	26
2	Stormwater Management	Mechanical	Once per year, or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	1
3	Support Area (A – range roads, south of 1000M)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 3 years	15 (A) 90 (B) 67 (C) 48 (D)
4	Support Area (A – 1500M to laser board)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 5 years	51 (A) 2.4 (B) 1.7 (C)
5	Support Area (A – 1000M to laser board)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 10 years	114 (A) 27 (B) 1.6 (C) 18 (D)
6	Encroachment – Trees to Clear (1500M to laser board)	Mechanical and/or controlled burn, with or without herbicide spraying	Every 5 years	6.2 (A) 0.2 (B) 0.1 (C) 2.4 (D) 1.5 (E)
7	Encroachment – Trees to Clear (1000M to 3000M)	Mechanical, with or without herbicide spraying	Every 10 years	22 (A) 0.5 (B) 71 (C) 22 (D)
8	Support Area	Not applicable	None required	0.3
9	Natural Area	Conservation	Monitor for encroachment	5.4 (A) 1.2 (B) 46 (C) 44 (D)

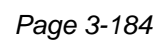












### 3.2.59 Underwater Explosion Test Facility (UTF)

The UTF is located in the Aberdeen Area. The range encompasses approximately 65 acres.

The UTF is delineated into 4 areas (Figure 3-78) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	28
2	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	32
3	Natural Area	Conservation	Monitor for encroachment	2.6 (A) 0.9 (B) 0.5 (C)
4	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	1 (A) 0.1 (B)





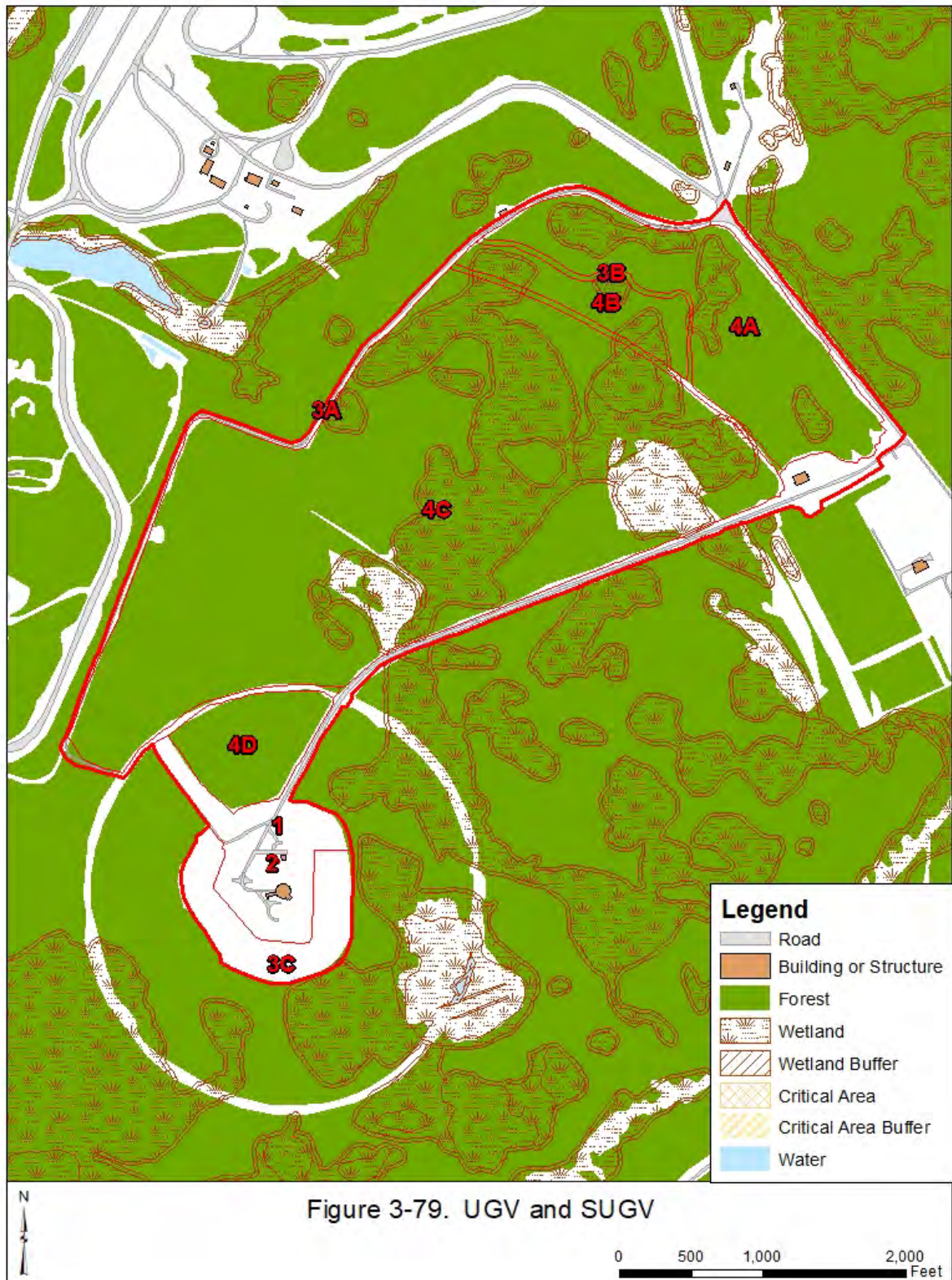
### 3.2.60 Unmanned Ground Vehicle (UGV) and Small Unmanned Ground Vehicle (SUGV) Test Area

The UGV and SUGV Test Area is located in the Aberdeen Area. The range encompasses approximately 310 acres.

The UGV and SUGV Test Area is delineated into 4 areas (Figure 3-79) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open (Rifle Range Road to B861)	Mowing	Twice per year	31
2	Artificial Wetland	Mowing	Re-route discharge, then maintain as open (Area 1)	0.03
3	Support Area (A – perimeter course) (B – bypass course)	Mechanical, with or without herbicide spraying	Every 3 years	8.8 (A) 4.1 (B) 13 (C)
4	Natural Area	Conservation	Monitor for encroachment	42 (A) 11 (B) 185 (C) 14 (D)







### 3.2.61 Unexploded Ordnance (UXO) Detection Site

The UXO Detection Site is located in the Aberdeen Area. The range encompasses approximately 29 acres.

The UXO Detection Site is delineated into 3 areas (Figure 3-80) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	27
2	Berm	Mechanical, with or without herbicide spraying	Every 2 years	0.3 (A) 0.2 (B) 0.2 (C)
3	Natural Area	Conservation	Monitor for encroachment	0.4



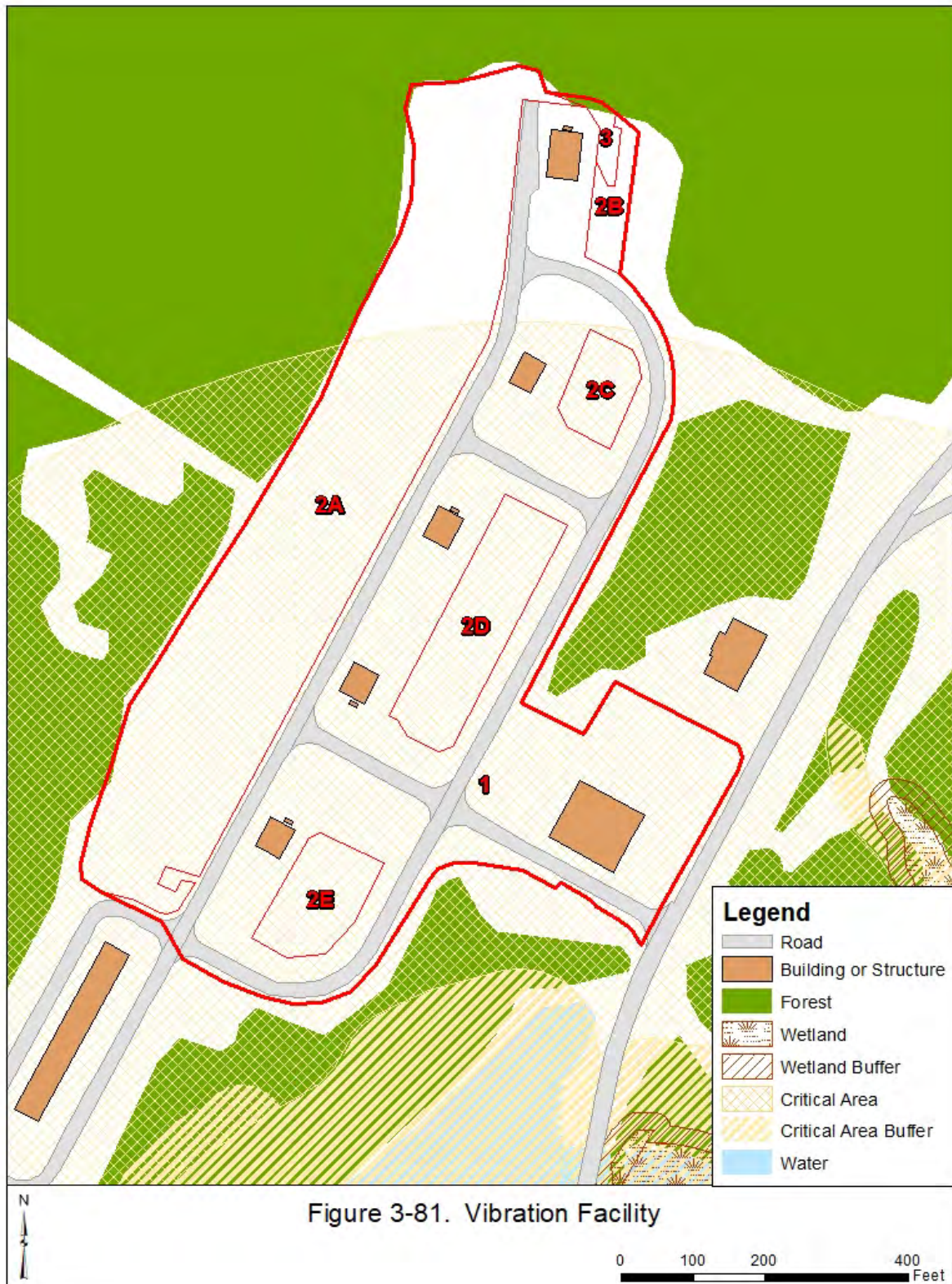
### 3.2.62 Vibration Facility

The Vibration Facility is located in the Aberdeen Area. The range encompasses approximately 15 acres.

The Vibration Facility is delineated into 3 areas (Figure 3-81) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	9.5
2	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	4.9 (A) 0.2 (B) 0.3 (C) 0.8 (D) 0.4 (E)
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 3 years	0.08





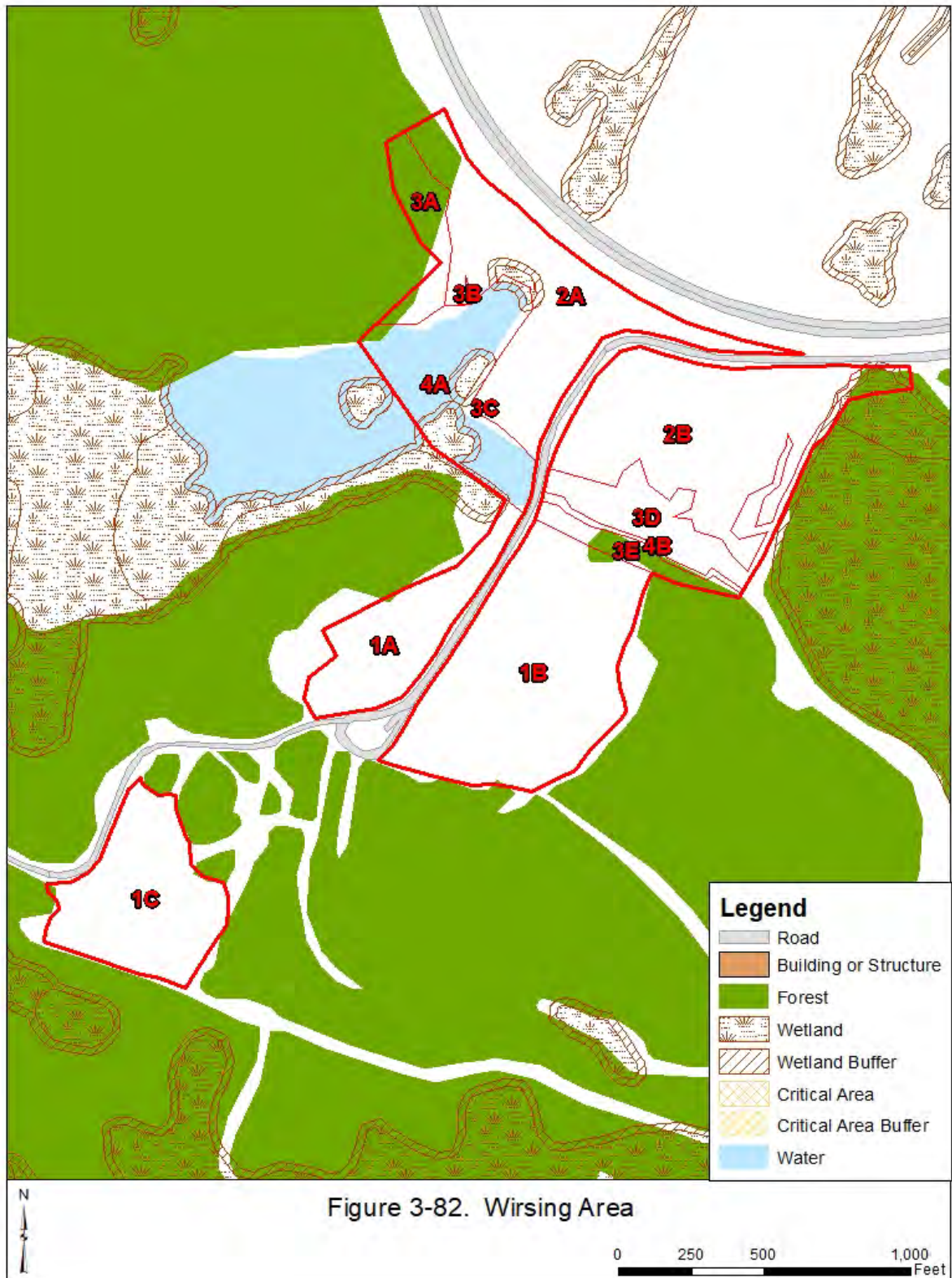
### 3.2.63 Wirsing Area

The Wirsing Area is located in the Aberdeen Area. The range encompasses approximately 51 acres.

The Wirsing Area is delineated into 4 areas (Figure 3-82) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	4.2 (A) 11 (B) 5.8 (C)
2	Support Area	Mechanical, with or without herbicide spraying	Every 10 years	8.2 (A) 9.2 (B)
3	Encroachment – Trees to Clear	Mechanical, with or without herbicide spraying	Every 10 years	1.8 (A) 0.02 (B) 0.003 (C) 3.7 (D) 1.1 (E)
4	Natural Area	Conservation	Monitor for encroachment	5.2 (A) 0.3 (B)







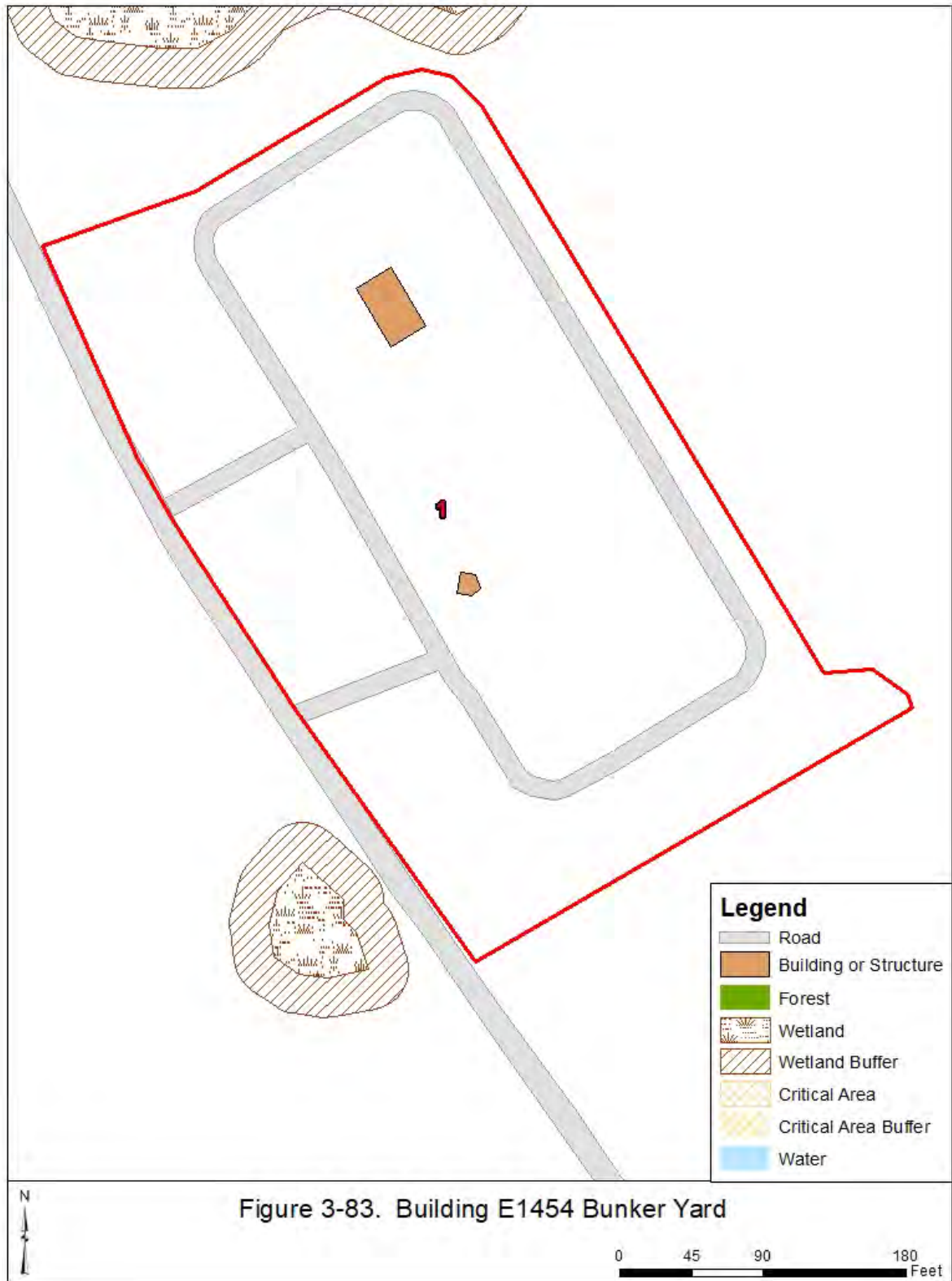
### 3.3 CBC RANGES

#### 3.3.1 Building E1454 Bunker Yard

The Building E1454 Bunker Yard is located in the Edgewood Area. The range encompasses approximately 3 acres.

The Building E1454 Bunker Yard is delineated into a single area (Figure 3-83) with associated vegetation maintenance prescription.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	3.5

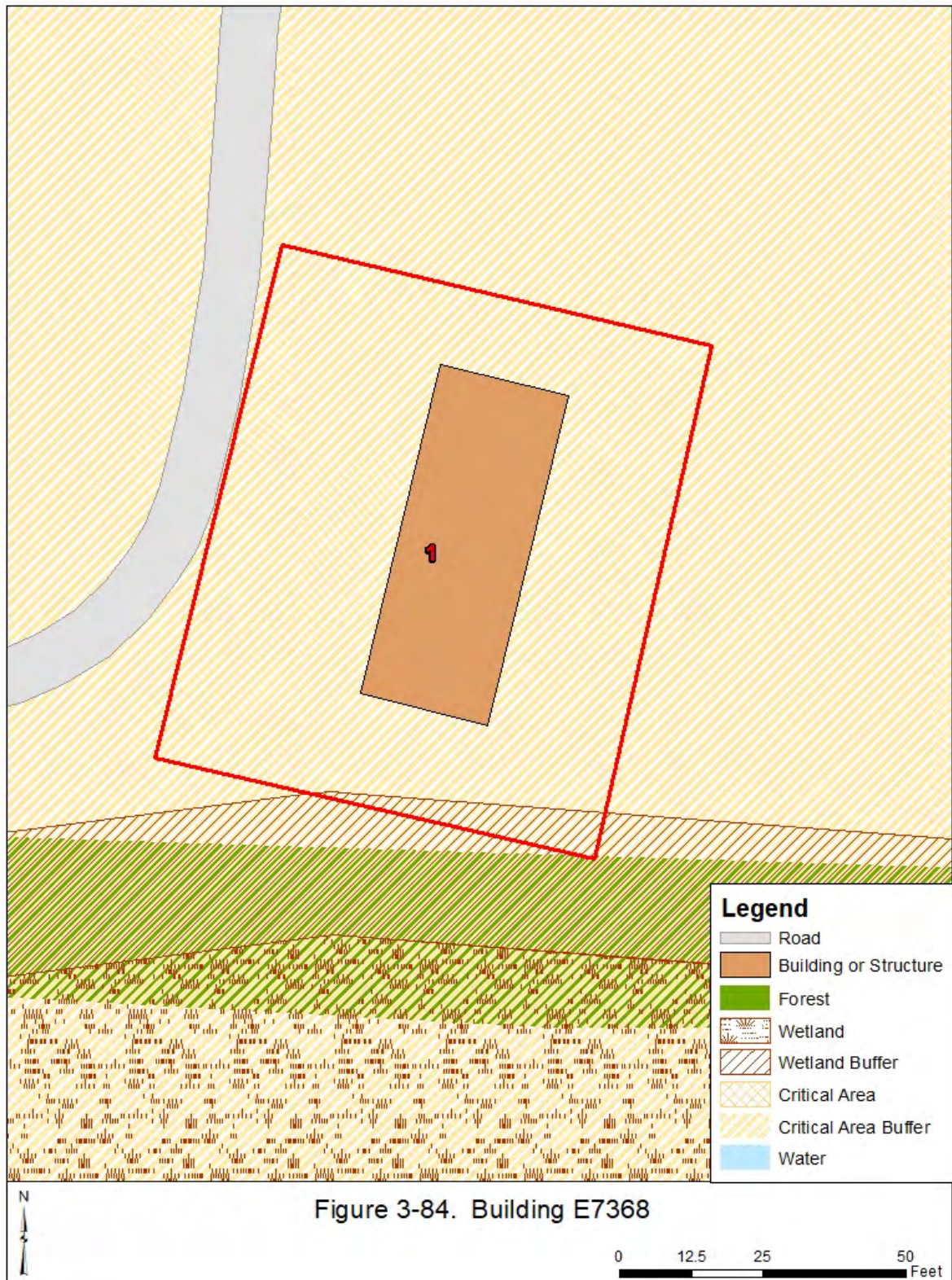


### 3.3.2 Building E7368

The Building E7368 is located in the Edgewood Area. The range encompasses approximately 0.2 acres.

The Building E7368 is delineated into a single area (Figure 3-84) with associated vegetation maintenance prescription.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	0.2



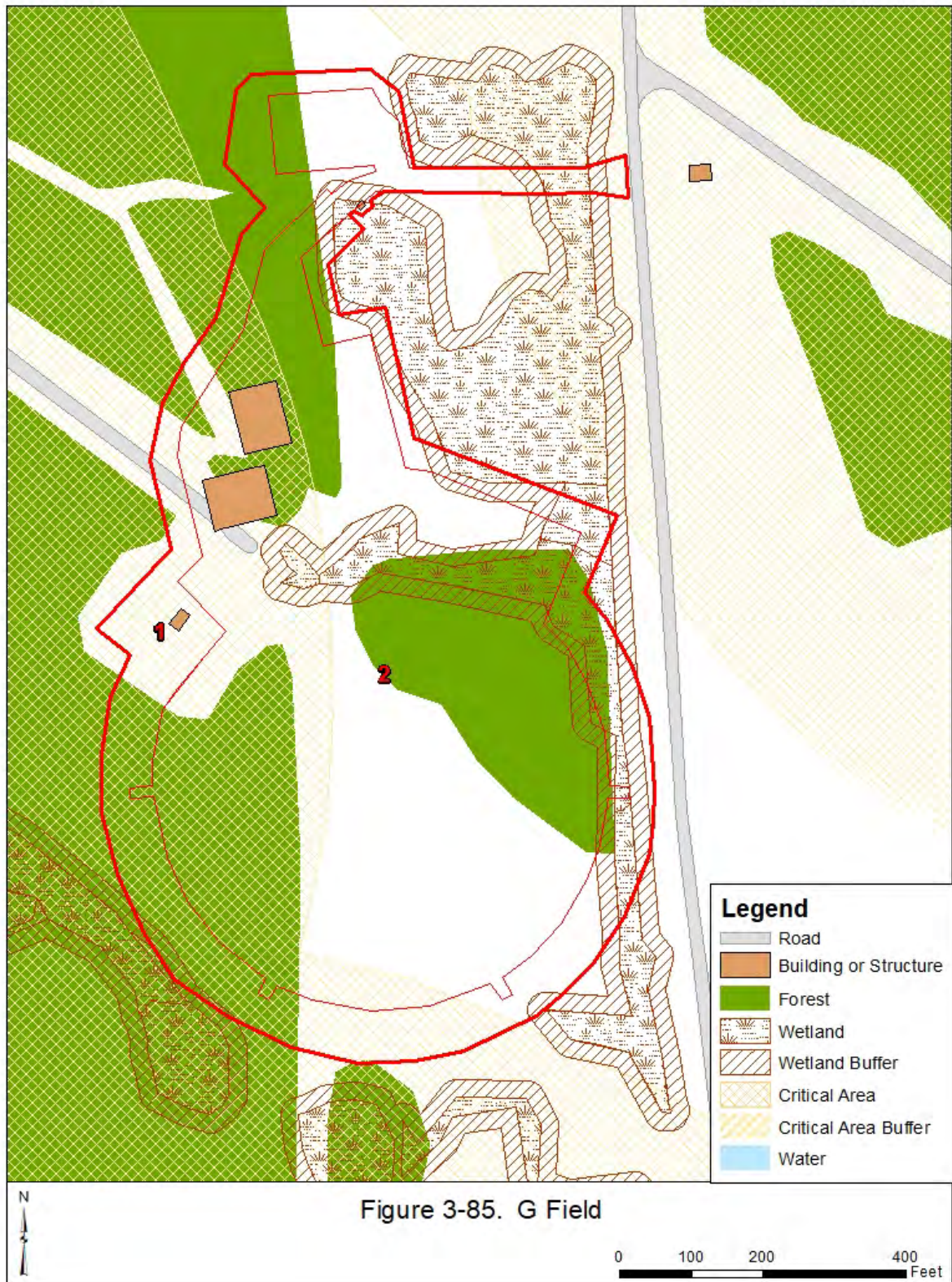
### 3.3.3 G Field

The G Field range is located in the Edgewood Area. The range encompasses approximately 16 acres.

The G Field range is delineated into 2 areas (Figure 3-85) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	4.5
2	Gravel stands, pads	Mechanical, with or without herbicide spraying	Once per year	11







### 3.3.4 M Field

The M Field range is located in the Edgewood Area. The range encompasses approximately 231 acres.

The M Field range is delineated into 5 areas (Figure 3-86) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	224
2	Support Area	Mechanical, with or without herbicide spraying	Every 3 years	2.1
3	Support Area	Mechanical, with or without herbicide spraying	Every 10 years	0.4
4	Soil Stockpile	Not applicable	Not applicable	2.7
5	Building Demolition	Not applicable	Not applicable	1.9

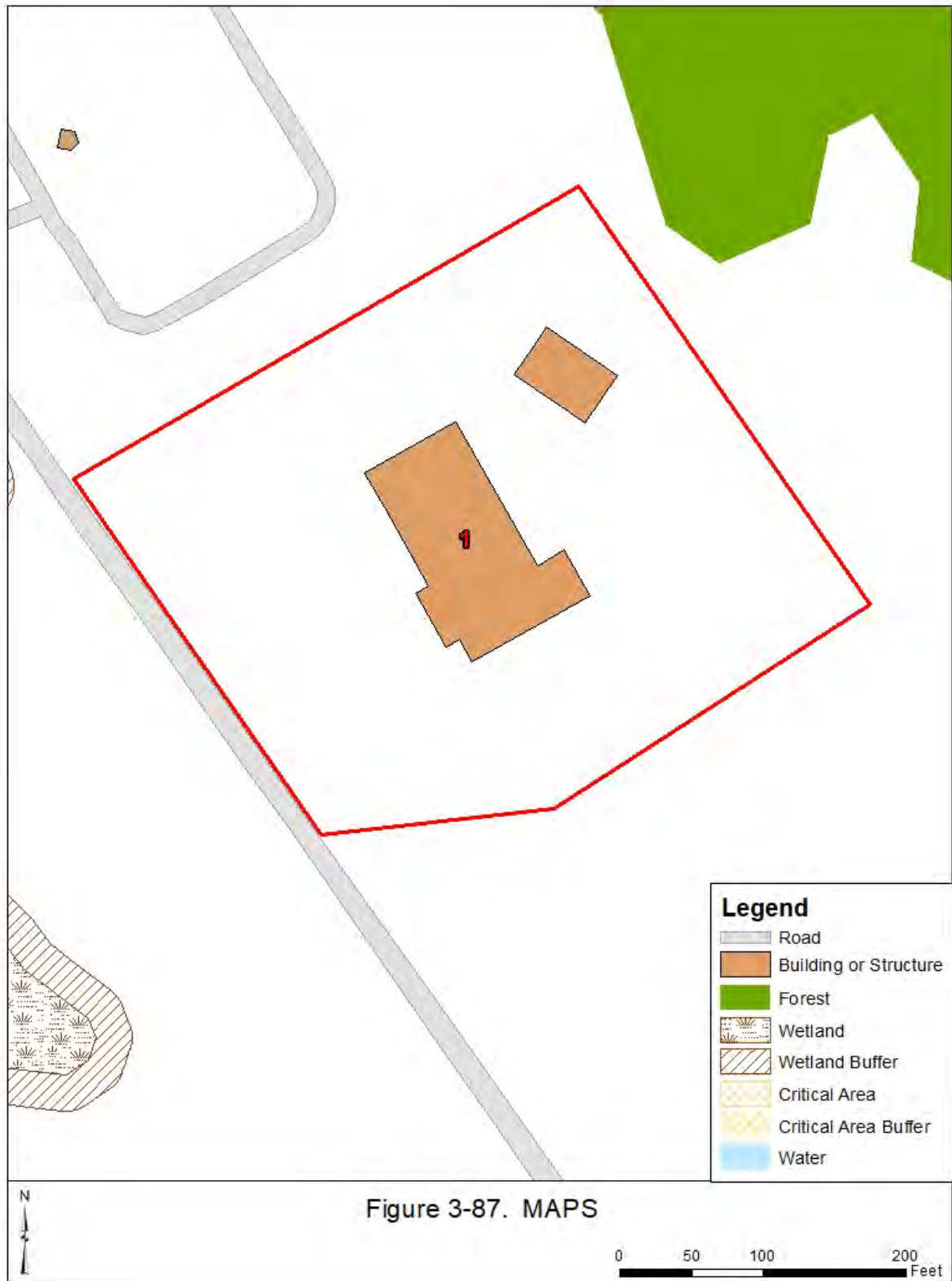


### 3.3.5 MAPS

The MAPS range is located in the Edgewood Area. The range encompasses approximately 3 acres.

The MAPS range is delineated into a single area (Figure 3-87) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	3.3



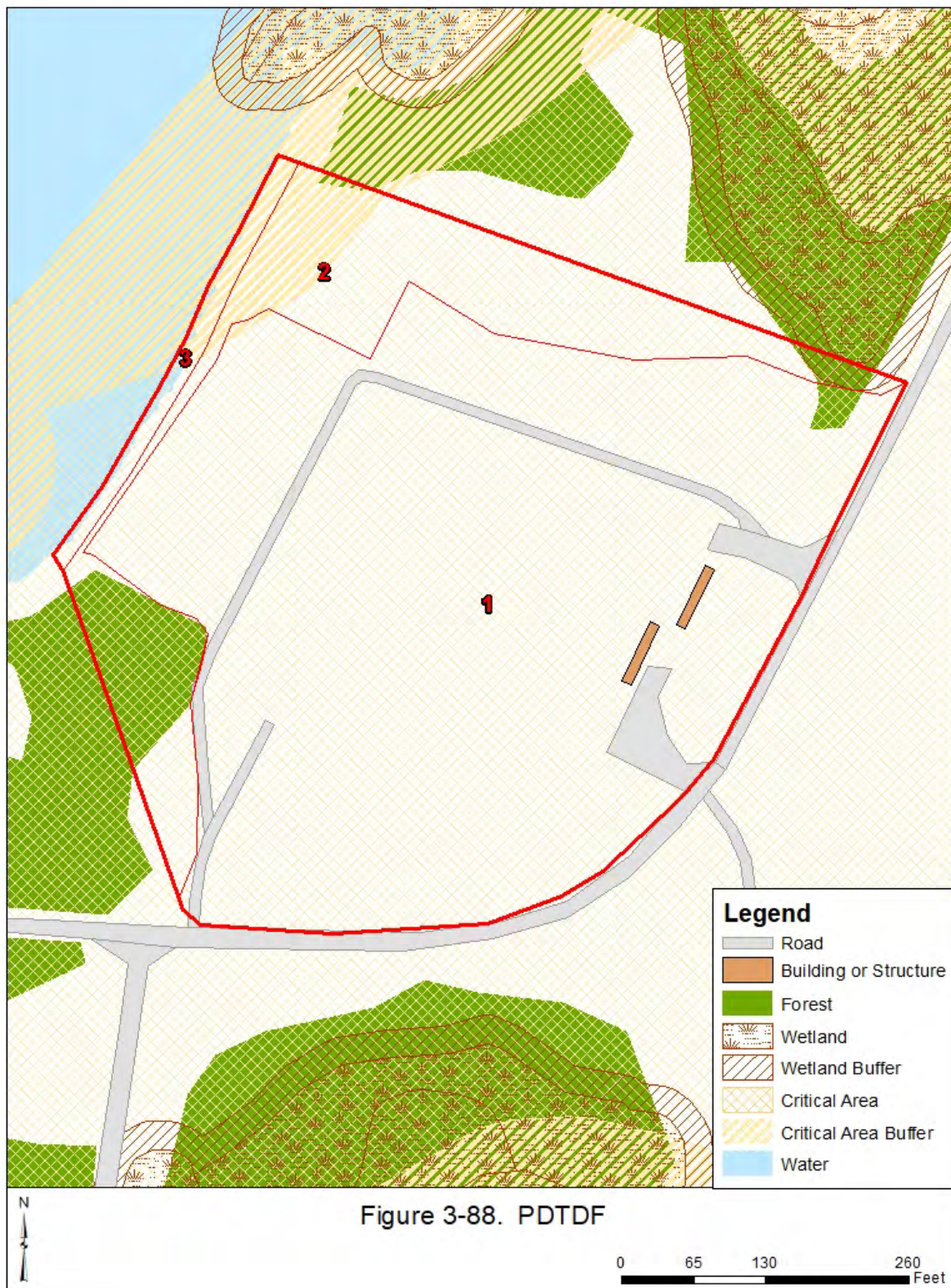
### 3.3.6 Prototype Detonation Test and Destruction Facility (PDTDF)

The PDTDF range is located in the Edgewood Area. The range encompasses approximately 8 acres.

The PDTDF range is delineated into 3 areas (Figure 3-88) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing	Twice per year	6.4
2	Natural Area	Conservation	Monitor for encroachment	1.5
3	Shoreline, Beach, Riprap	Shoreline protection	Monitor, keep riprap clear	0.2







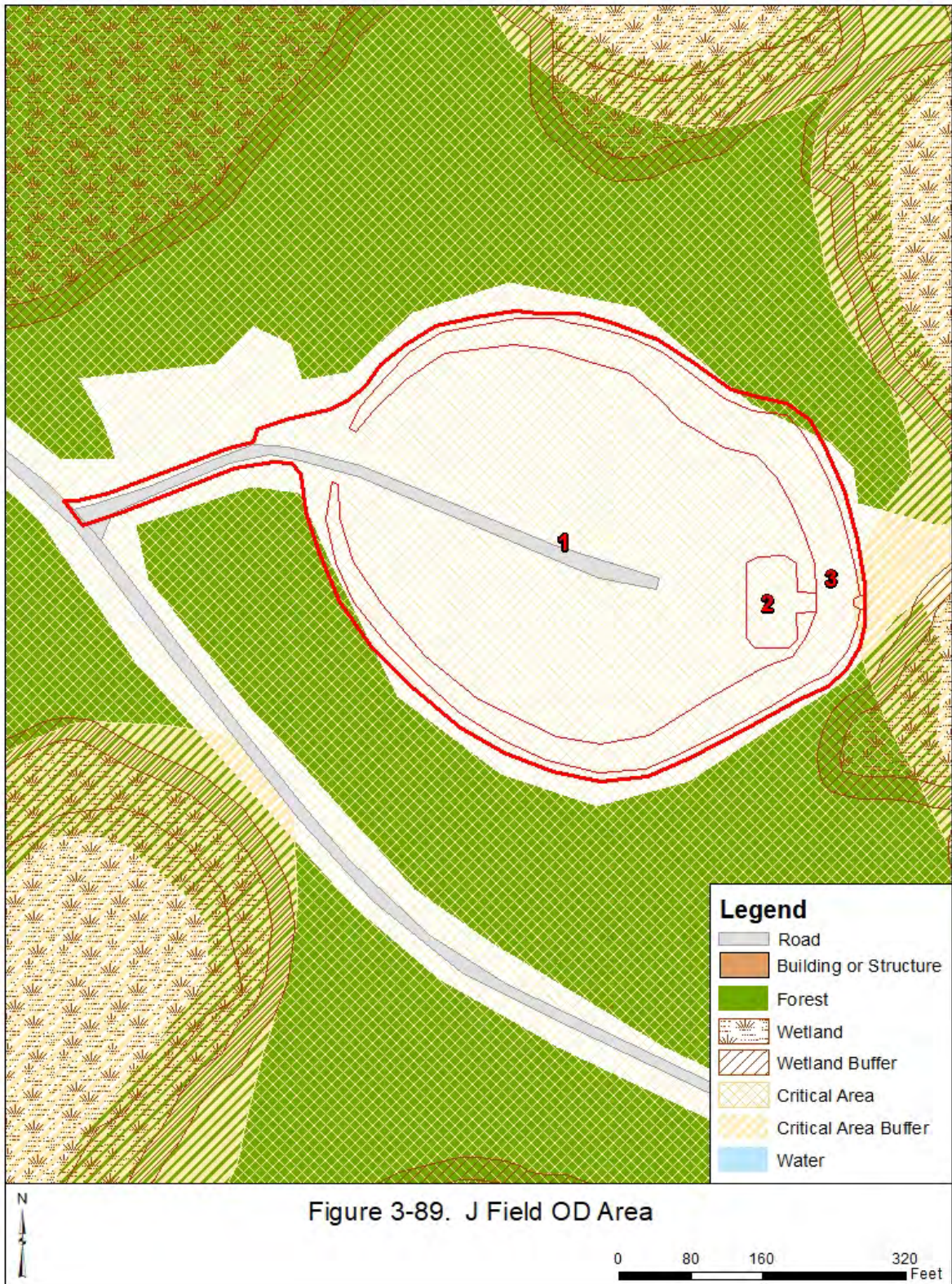
### 3.4 CARA RANGE

#### 3.4.1 J Field OD Area

The J-Field OD Area is located in the Edgewood Area. The range encompasses approximately 6 acres. There is a flood protection berm (Area 3) around the north, east, and south end of the OD area (Area 1).

The J-Field OD Area is delineated into 3 areas (Figure 3-89) with associated vegetation maintenance prescriptions.

Area	Area Type	Maintenance Type	Frequency	Acres
1	Open	Mowing, tilling	Twice per year (late June and late August)	4.4
2	Stormwater management	Mechanical, with spot herbicide application on stone overflow weir	Once per year (spot herbicide application on stone overflow weirs); every 7-10 years for mucking (or as recommended in APG Stormwater BMP Maintenance Plan (Draft, June 2020 or as superseded)	0.14
3	Berm	Mechanical, with or without herbicide spraying	Every 2 years	1.2



# ATTACHMENT 1

General Consistency Determination  
(to be added)

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# **APPENDIX K**

Wildland Fire Management Plan





Wildland Fire Management Plan  
is available for review at the office of:

DPW Environmental Division  
Conservation Branch  
Building E5183 Blackhawk Road, Room 213  
Aberdeen Proving Ground, Maryland 21010  
Phone: 410-436-0465



## **APPENDIX L**

Installation Management Command Programmatic Consultation  
for Northern Long-Eared Bat





# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

5600 American Boulevard West, Suite 990  
Bloomington, Minnesota 55437-1458



IN REPLY REFER TO:

FWS/R3/ES

**MAY 04 2015**

Col. Robert Witting  
Colonel, U.S. Army Commanding  
U.S. Army Installation Management Command  
U.S. Army Environmental Command  
2450 Connell Road  
Joint Base San Antonio Fort Sam Houston, TX 78234-7664

Re: Request for Concurrence on the Programmatic Informal Consultation on Impacts of Operations on Installation Management Command Installations on the Northern Long-eared Bat

Dear Col. Witting:

This responds to your April 24, 2015 request for our concurrence that select military mission operations of the Army's Installation Management Command (IMCOM), are not likely adversely affect the threatened northern long-eared bat (*Myotis septentrionalis*). Although you requested a conference report, the northern long-eared bat listing is effective as of today; therefore, the U.S. Fish and Wildlife Service (Service) is responding to your request under Section 7(a)(2) of the Endangered Species Act, as amended (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.; ESA).

As discussed in your letter, the U.S. Assistant Chief of Staff for Installation and staffs from the U.S. Army Environmental Command (USAEC), IMCOM, the U.S. Army National Guard and the Service have been coordinating on a programmatic informal consultation for select Army mission activities. This informal consultation includes conservation measures outlined in your April 24, 2015, Biological Evaluation (BE) entitled "Informal Conference & Management Guidelines on the Northern Long-eared Bat (*Myotis septentrionalis*) for Ongoing Operations on Installation Management Command Installations". The conservation measures will be incorporated into activities to avoid adverse effects to northern long-eared bats, thus achieving a "may affect, not likely to adversely affect" determination for Section 7 consultation for these projects. This programmatic informal consultation only addresses the consultation requirements for those projects that can implement the conservation measures and meet the project conditions and effect determinations described in the biological evaluation. The Service was a part of, and worked to help construct the biological evaluation, including all analysis and design of conservation measures. Therefore, based on the analysis in biological evaluation, we concur that all projects designed to fully meet the required terms

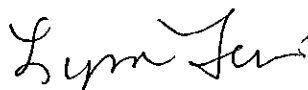
will only have effects on northern long-eared bat that are insignificant (unlikely to rise to the level of take), discountable (take is extremely unlikely to occur), or wholly beneficial.

Under the terms of this programmatic informal consultation, IMCOM is responsible for ensuring activities are within the scope of, and adhere to the criteria of the programmatic BE. Each IMCOM installation will screen applicable installation activities through an IMCOM/USFWS cooperatively generated checklist to ensure the activity is conducted as described in the BE. For each activity completed under the programmatic informal consultation, each installation will document their activities and compliance, and IMCOM will provide an annual report to the Service for all actions taken under this informal consultation.

The programmatic informal consultation agreement will be in effect for a period of three years, unless we receive information that indicates the consultation must be revised. To track and monitor the consultation, IMCOM and the Service will meet on an annual basis, or as needed, to: (1) discuss the annual report of covered projects, (2) evaluate and discuss the continued effectiveness of the programmatic consultation, and (3) update procedures, conservation measures, or project criteria, if necessary. If through this review process, IMCOM or the Service believes that this programmatic informal consultation is not being implemented as intended or is having unanticipated impacts on the species, they may request formal review and possible revision. IMCOM may also request revision if data endorses inclusion of new, or modification of established, measures in the BE that support a "may affect, not likely to adversely affect" determination.

We applaud your commitment to protect the northern long-eared bat and the collaborative approach of all of the participating divisions of the Army. With the completion of this programmatic informal consultation, we look forward to our continued collaboration on your conservation strategy and formal consultation approach for the northern long-eared bat. If the project description changes or new information reveals that the effects of the proposed action may affect listed species in a manner or to an extent not considered, further review pursuant to the ESA may be required. If you have any questions or need further information, please contact Karen Herrington of my staff at 850-348-6495.

Sincerely,



Lynn Lewis  
Assistant Regional Director, Midwest Region

cc: Paul Phifer, USFWS, ARD Ecological Services, Northeast Region  
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USFWS, New York Ecological Services Field Office, Cortland, NY  
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USFWS, Rock Island Ecological Services Field Office, Rock Island, IL  
USFWS, Twin Cities Ecological Services Field Office, Bloomington, MN  
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**Informal Conference & Management Guidelines**  
on the  
**Northern Long-eared Bat (*Myotis septentrionalis*)**  
for  
**Ongoing Operations on Installation Management  
Command Installations**

**May 2015**



**Prepared By:  
U.S. Army Environmental Command**

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## I. General

A. *Purpose.* Pursuant to Section 7(a)(4) of the Endangered Species Act (ESA), federal action agencies are required to confer with the United States Fish and Wildlife Service (USFWS) if their proposed action is likely to jeopardize the continued existence of a listed species (50 CFR 402.10(a)). Action agencies may also confer with the USFWS if the proposed action may affect a proposed species or proposed critical habitat. Species listed as threatened or endangered under the ESA are afforded protection against “take”. After the listing becomes effective, pursuant to Section 7(a)(2) of the ESA, federal action agencies are required to consult with the USFWS if their proposed action may affect the listed species (50 CFR 402.14(a)).

The intent of this informal conference and subsequent consultation is to evaluate military operations and sustainment/enhancement activities on Installation Management Command (IMCOM) installations and facilities that may affect, but are not likely to adversely affect (NLAA) the northern long-eared bat (*Myotis septentrionalis*; NLEB), a species to be listed as threatened under the ESA on 04 May 2015 (USFWS 2015). No additional species are addressed or covered within this action. IMCOM has determined effects and proposes conservation measures to avoid or minimize adverse effects to the NLEB. If USFWS concurs in the resulting conference report, this will be a programmatic informal conference and programmatic informal consultation. Any activities not included in this consultation will be subject to separate section 7(a)(2) consultation after the listing becomes effective.

This evaluation includes: 1) consultation requirements; 2) IMCOM structure; 3) distribution and status of the species; 4) description of Military Missions and Operations; 5) survey results; 6) proposed conservation measures to limit potential impacts from Military operations and activities; and 7) conclusions.

The resulting conference report will serve as guidelines that establish a programmatic baseline for managing the NLEB on applicable IMCOM installations and facilities to avoid likely future conflicts. It can be used in developing management and conservation goals and objectives for the NLEB as part of an installation’s Integrated Natural Resource Management Plan (INRMP). An installation INRMP will supplement these guidelines with detailed measures to meet installation-specific NLEB conservation and unique military mission needs. The requirements established for the NLEB in the INRMPs will apply to all activities on the installation.

B. *Applicability.* The programmatic guidelines are applicable to IMCOM installations and areas of operations identified in this document. Some of these IMCOM installations have already completed an informal/formal conference/consultation with their local USFWS Field Office and will not be subject to this programmatic conference but instead retain the requirements within their specific document, unless the requirements are complimentary and/or the installation, in coordination with USFWS, chooses to adopt the conservation measures defined herein. The remaining IMCOM installations identified in this document with no prior USFWS coordination will be subject



to this programmatic conference and consultation. All IMCOM installations outside the known range of the NLEB are not considered in this programmatic document. The overarching intent is to facilitate IMCOM installations ability to utilize the most appropriate conservation measures in regards to NLEB through section 7 conference/consultation.

C. *Timeline and Revision.* HQ IMCOM will revise these guidelines as necessary to be consistent with the listing rule of the NLEB, future Recovery Plans, or incorporation of the latest and best scientific data available. This informal conference will cover a period of three years but will be reviewed annually for applicability and continued concurrence between IMCOM & USFWS on its content. During the annual review if there is continued concurrence or if the document needs to be amended IMCOM and USFWS will coordinate according to the guidelines in the conference report. At any time, IMCOM or the USFWS may revoke or revise this programmatic consultation if it is determined that it is not being implemented as intended.

D. *Goal.* This documents intent is to provide programmatic coverage to all IMCOM installations for the training and land management activities and processes that are similar throughout. Additionally it is IMCOM's goal to implement management guidelines that will allow the accomplishment of military missions & sustainment while concurrently developing and implementing methods to assist in the conservation of the NLEB.

## **II. Additional Conference/Consultation**

A. *Conference/Consultation Requirement.* In proposing actions that deviate from these guidelines that “may affect” the NLEB or for actions in which further consultation has been agreed to, IMCOM installations will comply with the conference/consultation requirements of section 7 of the ESA per the implementing regulations at 50 CFR part 402; and Army policies and guidance.

1. *Informal Conference/Consultation.* IMCOM recognizes that informal conference/consultation with the USFWS is critical to resolving potential problems and establishing the foundation to address issues in a proactive and positive manner. For any “may affect” determinations, IMCOM and IMCOM installations will seek to modify proposed actions and work with the USFWS to obtain concurrence on a “may affect, but not likely to adversely affect” (NLAA) determination. Issue resolution through informal conference/consultation is the preferred method.

2. *Formal Consultation.* If implementation of these guidelines is not possible or feasible for a proposed action and adverse affects cannot be avoided, the subject IMCOM installation will initiate formal Section 7 conference/consultation in accordance with the procedures in 50 CFR 402 and applicable Army policies and guidance. For formal consultations, the IMCOM installation will implement the reasonable and prudent measures (RPMs) identified in the Biological Opinion (BO) to ensure no impacts on mission implementation.

B. *Confirmation.* IMCOM will re-initiate consultation on these guidelines if (i) information arises indicating that implementation of the guidelines may not avoid adverse impacts on the NLEB for certain activities; (ii) data/new research endorses inclusion of new, or modification of established, measures in the guidelines that still support a NLAA determination; or (iii) a “take” occurs even though IMCOM is fully implementing the guidelines. IMCOM will notify USFWS within five business days if issues pertaining to (i) and/or (iii) arise, and work with the USFWS on addressing such issues through informal consultation. IMCOM will make the necessary changes to the guidelines, if any, and conduct the necessary internal staffing prior to submitting the revised document to USFWS for concurrence. During this period, the NLAA concurrence will still be valid for the conservation measures not subject to any scrutiny or concern.

C. *Programmatic Informal Consultation Process.* Each IMCOM installation will screen applicable installation activities through an IMCOM/USFWS cooperatively generated checklist to ensure the activity is conducted as described in this BE. For each activity completed under the programmatic informal consultation, each installation will document their activities and actions taken describing how compliance was maintained with the conservation guidelines within this document. IMCOM will collectively report annually to the USFWS on information collected in the annual Army Environmental Database Environmental Quality (AEDB-EQ) data call for actions taken in regards to NLEB at each installation. This informal conference will cover a period of three years but will be reviewed annually for applicability and continued concurrence between IMCOM & USFWS on its content. All other species that require Section 7 consultation or Migratory Bird Treaty Act compliance will be reported in separate documentation by the individual installation if applicable.

D. *Emergency Consultation.* Unpredictable catastrophes such as wildfires, tornados, or significant hurricane damage may present conditions that cannot be anticipated under these guidelines. In the case of a catastrophic event, IMCOM installations will implement these guidelines to the greatest extent possible, but imminent threat to life or property may take precedence. IMCOM installations will record impacts on NLEB habitat and any definitive impacts on bats resulting from the event, and document any actions that were necessary during the event such as creation of fire breaks, removal of hazardous trees, etc. The subject IMCOM installation(s) will initiate emergency consultation with their associated USFWS field office as soon as possible. IMCOM will reevaluate conservation and management requirements, if necessary, to better prepare for the conservation of the NLEB during such unanticipated events.

E. *Endangered Species Act 4(d) Rule.* With a 4(d) rule in place, any actions taken by an agency that are exempted in the 4(d) rule will not require an incidental take statement in a biological opinion. Therefore installations could drastically reduce the consultation timeframes and conservation measures required for forestry activities (including harvest & prescribed burning), prairie management, right of way expansion,

and other activities defined therein by conducting Section 7 Consultation only on activities contained within the 4d Rule.

F. *Other Listed Species*. Other ESA listed Threatened or Endangered species may occur on IMCOM installations listed in this BE. This BE only addresses the NLEB because consultation has already occurred for the other listed or, depending on the IMCOM installation, activities may have no effect on other listed species. Prior to implementing any Conservation Measure identified in this PBE, the IMCOM installation will address and assess impacts of such measures on applicable listed species. Conservation Measures and Reasonable and Prudent Measures of any relevant Biological Opinion(s) will continue to be implemented for listed species on sites subject to this consultation. If necessary, the IMCOM installation will informally consult with the USFWS to address a situation where implementation of a Conservation Measures may affect NLEB or other listed species.

### **III. Installation Management Command (Action Area).**

Military installations particularly those managed by IMCOM have a demonstrated track record of sound natural resource stewardship and management. This demonstrated ability creates some of the most diverse natural resource areas supporting a multitude of rare and imperiled species while seamlessly blending that with the daily needs of advanced military training. It is the blending of these two seemingly contradictory things which continues to be the IMCOM goal as training capability is directly dependent on our ability to maintain the natural infrastructure of Army lands.

The primary purpose of IMCOM installations is to provide for the sustainment, enhancement, and readiness of the U.S. Military. Military training and enhancement activities are generally divided into the following categories: sustainment operations, engineering operations, air operations, water operations, field training operations, live munitions training, demolition, smokes/obscurants, and research, development, testing, and evaluation (RDTE). All of these activities occur in dispersed Training Areas; some of these activities occur in localized Training Areas year-round at all times of the day and night. Natural resource management activities also occur on most IMCOM installations which may include forest management, prairie management, wildlife management, recreation, erosion control, and other land management activities and uses as described in each installations INRMP.

The U.S. Army Command, IMCOM is a federal agency, and as such, must comply with Federal statutes and regulations. IMCOM supports active and reserve military installations worldwide. IMCOM is organized into four regions (Europe, Atlantic, Central, & Pacific), of which the Atlantic and Central Regions are within the range of the NLEB. There are 19 individual Army installations within the Atlantic Region and 6 installations within the Central Region that have the potential for NLEB's. Table 1 below lists each installation, its IMCOM Regions, the State in which it exists, and its approximate size. While there are approximately 809,000 million acres in total for these

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installations only 453,000 of that is forested habitat which may or may not be suitable NLEB habitat.

Funding and policy guidance for natural resources management on installations are provided by IMCOM. IMCOM also provides natural resources technical support, and is responsible for tracking projects, quality assurance of compliance documents, and execution of funds. While IMCOM provides support across its installations, the individual installations are relatively autonomous in their completion of day-to-day management of the installation. Therefore some installations have conducted or are in the process of conducting individual Section 7 actions as it relates to their local situation and may not need the programmatic coverage provided by this document.

Table 1: IMCOM Installations Within the Range of the Northern Long-eared Bat.

<u>IMCOM Region</u>	<u>Installation Name</u>	<u>State</u>	<u>Approx. Size (ac)</u>	<u>Approx. Forested (ac)</u>	<u>Indiana or Gray Bat</u>	<u>NLEB</u>	<u>Bat Surveys</u>	<u>Hibernacula &lt;=5 miles</u>	<u>Consultation</u>	<u>WNS Decon</u>
ATL	Aberdeen Proving Ground*	MD	72,500	18,000			scheduled FY15	No	No - poor habitat	NA
ATL	Carlisle Barracks*	PA	500	0						
CEN	Detroit Arsenal*	MI	341	0			None			
ATL (Reserve)	Devens Reserve Training Facility	MA	5,000	4,000	Verified absence	Historic presence	Occasional	No	No	NA
ATL	Fort AP Hill	VA	76,000	66,500	Out of Range	Historic presence	Occasional-in process	No	Informal	No
ATL	Fort Belvoir	VA	8,658	4,300	Indiana	Assumed	By project & Annual	No	Consultation in progress	Developing
ATL	Fort Campbell	KY	102,414	48,200	Indiana & Gray	Present	By project & Annual	Yes and on-site	Informal and Formal with INRMP	Yes
ATL	Fort Detrick*	MD	12,000	82			None	No Known	No	No
ATL	Fort Drum	NY	107,625	74,000	Indiana	Present	Annual	No	Informal and Formal BO	Yes
ATL	Fort George G. Meade	MD	5100	1,700	Out of Range	Assumed	None	No Known	Informal	N/A
ATL	Fort Hamilton*	NY	50	0			None			
ATL	Fort Knox	KY	109,000	81,000	Indiana	Present	Annual	Yes and on-site	Informal and Formal with INRMP	Yes
CEN	Fort Leavenworth	KS	5,600	3,500	Verified absence	Not Detected	Occasional	No Known	No	NA

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<u>IMCOM Region</u>	<u>Installation Name</u>	<u>State</u>	<u>Approx. Size (ac)</u>	<u>Approx. Forested (ac)</u>	<u>Indiana or Gray Bat</u>	<u>NLEB</u>	<u>Bat Surveys</u>	<u>Hibernacula &lt;=5 miles</u>	<u>Consultation</u>	<u>WNS Decon</u>
ATL	Fort Lee*	VA	5,376	2,300	Not Detected	Not Detected	Periodic (every 2-3 years)	No	No - poor habitat	Yes
CEN	Fort Leonard Wood	MO	61,000	44,500	Indiana & Gray	Present	Annual	Yes and on-site (Indiana)	Informal	
CEN (Reserve)	Fort McCoy	WI	60,000	45,400	Out of Range	Present	Periodic (every 2-3 years)	Yes	Informal	No
CEN	Fort Riley	KS	100,656	16,400	Out of Range	Verified absence	Annual	No	Informal	Yes
ATL	Joint Base Myer-Henderson Hall*	VA	270	0			None			
ATL	Natick Soldier System Center*	MA	124	0						
ATL	Picatinny Arsenal	NJ	6,400	4,000	Indiana	Present	Occasional	Yes	Informal	Yes
ATL	Redstone Arsenal	AL	38,000	23,900	Gray	Present	By project & Annual	Yes	Informal Consultation	Yes
CEN	Rock Island Arsenal	IL	946	200	Verified absence	Assumed	Periodic (every 2-3 years)	No	Informal Consultation	Developing
ATL	U.S. Army Adelphi	MD	200	120			scheduled FY15	No Known	No	Developing
ATL	U.S. Army Adelphi - Blossom Point*	MD	1,600	1,000			None	No	No - poor habitat	NA
ATL	West Point Military Reservation	NY	16,080	14,000	Possible Historic Presence	Present	Annual	Yes and on-site	Informal Consultation	Yes
<b>Total</b>			809,348	453,102						

\* Indicates no habitat or highly unlikely to occur due to unsuitable habitat.

### IV. Distribution and Status of the NLEB.

According to the NLEB final rule (USFWS 2015), the bat is known or believed to occur throughout or part of 37 States and the District of Columbia within the US. In Canada it is found from all Provinces from the Atlantic Coast westward to the southern Yukon Territory and eastern British Columbia. The northeast is considered to be the core range of the species and the area that has been hit hardest by white-nose syndrome. Based on hibernacula data, population numbers of NLEB have experienced a decline of approximately 99% in this core area (USFWS 2013). White-nose syndrome is the most severe and immediate threat to NLEB survival, and is the basis for the final listing of the species as threatened IAW ESA sections 3(6) and 4(a)(1) – Factor C: Disease or Predation. Currently, 12 IMCOM installations representing 9 States assume

NLEB presence or have recorded the NLEB potentially occurring on site (Table 1). A few other IMCOM installations have the potential for the NLEB to occur onsite, but surveys have not been completed to date. In general, the status of the species as a whole is declining and the status of the species on various installations ranges from declining in the east to stable in areas where effects of WNS have not yet occurred.

The active season of the NLEB is roughly April – October (USFWS 2015a). However, the spring staging and fall swarming periods can begin earlier in mid-March and extend to late November (USFWS 2014) (refer to Table 2). During the active season NLEBs roost singly or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees and snags, typically  $\geq 3$  inches diameter at breast height (DBH) in over 35 different tree species. They are also known to roost in sheds and barns, but the overwhelming majority of roosts are in trees (USFWS 2014). NLEBs have been known or suspected of occurring on some of the installations listed in Table 1. Tree species such as black and red oak, silver and sugar maples, hickories, American beech, short-leaf pine, hemlock, birch, spruce, etc.  $\geq 3$  inches DBH are known to occur on IMCOM installations throughout the range of NLEB. Summer roosting habitat is available and possibly used on these sites.

Table 2: Active Season Dates for the Northern Long-eared Bat based on Table 1 of the Northern Long-Eared Bat Conference Guidance (USFWS 2014). Individual IMCOM installations should confirm dates with their local USFWS Field Office.

<b><u>State/Region</u></b>	<b><u>Active Season</u></b>
Alabama	Apr 1-Nov 30
Illinois	Apr 1-Nov 15
Kansas	Apr 1-Nov 1
Kentucky	Apr 1-Nov 15
Massachusetts	Contact FO
Maryland	Contact FO
Michigan	Apr 1-Oct 1
Missouri	Apr 1-Nov 15
New Jersey	Apr 1-Nov 15
New York	Apr 1-Oct 30
Pennsylvania	Contact FO
Virginia	Apr 1-Nov 15
Wisconsin	Apr 1 - Oct 15

As described in the final rule (USFWS 2015), NLEBs predominantly overwinter in hibernacula that include caves and abandoned mines. The hibernacula are typically large, with large passages and entrances, relatively constant, cooler temperatures (0 to 9 °C (32 to 48 °F), and with high humidity to such a large degree that droplets of water are often observed on their fur. The NLEB has also been found to overwinter in structures resembling mines and caves such as abandoned railroad tunnels and hydro-electric dam facilities, to name a few. There are only a few known NLEB hibernacula on



or within five miles of the IMCOM installations. Through development of the IMCOM INRMPs and the Army ACUB program, IMCOM installations have a very good knowledge base on hibernacula occurring on the installation or in the local region. This document addresses potential impacts on or conservation of hibernacula and associated swarming and staging areas for known hibernacula on or within 5 miles of an IMCOM installation. More specific information on NLEB seasons by state is depicted in Table 2.

IMCOM installations, described in Table 1, have conducted both project-level and installation-wide bat surveys to support the military mission. Installations will continue to survey at the level necessary to meet their mission requirements and comply with ESA. Installations that have not surveyed will conduct NLEB surveys to determine presence/absence in suitable habitat as funding allows.

More detailed information on the life history and habitat requirements of the NLEB can be found in the 2015 final rule (USFWS 2015).

As used in this BE, known roost trees are defined as trees that NLEBs have been documented as using during the active season (approximately April–October). Once documented, a tree will be considered to be a “known roost” as long as the tree and surrounding habitat remain suitable for NLEB. However, a tree may be considered to be unoccupied if there is evidence that the roost is no longer in use by NLEB (USFWS 2015).

Known, occupied hibernacula are defined as locations where one or more northern long-eared bats have been detected during hibernation or at the entrance during fall swarming or spring emergence. Given the documented challenges of surveying for northern long-eared bats in the winter (use of cracks, crevices), any hibernacula with northern long-eared bats observed at least once, will continue to be considered “known hibernacula” as long as the hibernacula and its surrounding habitat remain suitable for northern long-eared bat. However, a hibernaculum may be considered to be unoccupied if there is evidence (e.g., survey data) that it is no longer in use by following the USFWS Indiana Bat Hibernacula Survey protocols (USFWS 2015).

Refer to the Glossary, Section X, for additional definitions.

## **V. Activities That Will Not Affect NLEB.**

All activities at installations outside the range of the NLEB will result in no effect to the species. Within the range, all activities that occur in unsuitable habitat will result in no effects to the species and do not require the implementation of any conservation measures. The Northern Long-eared Bat Interim Conference and Planning Guidance (USFWS 14) states, “Trees found in highly-developed urban areas (e.g., street trees, downtown areas) are extremely unlikely to be suitable NLEB habitat.” Therefore, IMCOM considers that all sites within highly-developed urban areas that are not within 1000 feet of suitable forested/wooded habitat are excluded from these guidelines and

ESA conference/consultation requirements. Examples of highly-developed areas include but are not limited to: some cantonment areas, some housing areas, industrial areas, highly developed training sites, and developed testing facilities

IMCOM determines that all of the above proposed actions and sites will have “no effect” on the NLEB.

## **VI. Activities That May Affect NLEB.**

For installations that contain habitat elements for the NLEB within its range, as identified in Table 1, IMCOM will adopt the below conservation practices, unless the installation has verified NLEB absence by utilizing the published USFWS Indiana bat (and NLEB) summer survey protocols.

A. Existing Military Training, Firing and Maneuver ranges: Military training activities are generally divided into the following categories: sustainment operations, engineering operations, air operations, water operations, field training operations (such as but not limited to: foot training, bivouacking, etc), live munitions training, demolition, smokes/obscurants, and research, development, testing, and evaluation (RDTE). All of these activities occur in dispersed Training Areas; some of these activities occur in localized Training Areas. Firing and maneuver ranges on IMCOM installations provide training and testing for the M16/M4 weapons family, M249 and M240 series machine guns, M9 and M1911 series pistols, M203 and MK19 grenade launchers, anti-tank weapons, helicopter gunnery, tank firing, 105 mm through 203 mm cannons, tracked and wheeled vehicles, live grenades, demolitions, and other military operations. The NLEB within these active ranges have been repeatedly exposed to loud noises associated with munitions, detonations, and training vehicles. Camp Atterbury (USFWS 2010), Fort Leonard Wood (USFWS 2010), and Fort Drum (USFS 2008) have assessed range and training noise impacts on Indiana bats (*Myotis sodalis*). Fort Leonard Wood monitored radio-telemetered Indiana bats and found that the bats did not avoid active ranges or alter foraging behavior during night-time maneuvers. A 2002 study on Camp Atterbury found that five of eleven Indiana bats tracked with radio transmitters periodically roosted in the impact area (Whitaker & Gummer 2002). Given these findings, along with the abundance and installation-wide distribution of the bats on the sites, they concluded, and USFWS concurred, that sound intensity and duration associated with past training events have not adversely affected Indiana bats due to the bats having become habituated to such stimuli. It is reasonable to believe that the NLEB have also become habituated to ongoing operational noise on existing IMCOM ranges.

Recent studies have indicated that anthropogenic noise can alter foraging behavior and success of bats, including some gleaning species like the NLEB (Bunkley et al., 2015; Schaub et al., 2008; Siemers and Schaub, 2011). Based on the potential that new sound stimuli may affect the NLEB by influencing foraging behavior and success, the relevant IMCOM installation will consult with the USFWS when new

activities are proposed that significantly differ in sound intensity, quantity/duration of noise events, from those described above.

Bats are vulnerable to mortality from vehicle strikes (Siebert and Connor, 1991; Glista and DeVault, 2008; Russell et al., 2009). Collisions with vehicles are documented for the endangered Indiana bat, as well as the NLEB (Russell et al., 2009). In this study, researchers monitored highway crossings of a roost of approximately 23,000 bats, mainly little brown bats (*Myotis lucifugus*). A total of 26,442 occurrences of bats crossing the highway during dusk (10 days) and dawn (six days) were recorded and 29 road-killed bats were found, one being an Indiana bat. In Glista and DeVault (2008), researchers surveyed 158.5 km of roads for mortality of vertebrates. A total of one road-killed bat (eastern red bat, *Lasiurus borealis*) was found during the road mortality detection surveys – travelling at speeds less than 40 km/h). Finally, Siebert and Connor recorded one road-killed bat during their 50 surveys of a 1.6km of highway (U.S. 33 NW of Athens, OH) spanning from June 1987 to August 1988. The Biological Opinion for Construction, Operation, And Maintenance of the U.S. 33 Nelsonville Bypass Road, OH (USFWS 2005), identified vehicle collision as an anticipated take of Indiana bat. Although we might expect bat mortality associated with vehicle collisions to diminish along with road size/traffic volume, the frequency at which bats attempt to cross roads, especially forest species like the NLEB, likely increases as road size and traffic decrease. Effects of vehicle collisions to bats are likely to be discountable regardless of road size, but should be considered that bats may respond differently to different types of roads. However, in contrast to the roads and maneuver sites on IMCOM installations, the stretches of road discussed above have a constant volume of traffic during times of bat activity, and vehicles are travelling at greater speeds than what typically occurs on IMCOM installations. The numbers and intensity of night time maneuvers and vehicle use on IMCOM installations, as well as operating speed of such vehicles, do not rise to the level associated with public highway use. Therefore, the likelihood of bat road mortality occurring during dusk to dawn on IMCOM installations is determined to be discountable.

In conclusion training activities at firing and maneuver ranges are not likely to adversely affect the NLEB.

B. Aircraft Operations. As with ranges, flight training has and continues to occur on multiple IMCOM installations within the range of the NLEB. Studies have shown that helicopters tend to elicit a heightened response compared to fixed-wing aircraft. Even though that may be the case, helicopter training on IMCOM installations usually occurs as hovering operations occurring over fields or other open areas, thus any impacts from noise or downdrafts would be temporary and minimal to roosting bats and trees. For ongoing night time operations, foraging bats will continue to be exposed to sound levels that have been shown not to alter foraging behavior (USFWS 2010). Given that NLEB forages in the canopy layer (USFWS 2013), collision during night time flight operations are very unlikely to occur. Based on the nature and implementation of air operations, and the assumed level of habituation to flight training stimuli, it is determined that sound generated by ongoing training activities at existing ranges is not likely to adversely

affect the NLEB. Similar conclusions were made at Fort Leonard Wood, (3D/I 1996), involving night-time maneuvers; air operations at Fort Drum, (USFWS 2009); and ongoing training activities at Camp Atterbury (USFWS 2010).

If there are any indications that flight training may be adversely impacting bats such as the observation of tree limbs and/or bark being blown off by helicopter downdraft, the applicable IMCOM installation will initiate consultation with their local USFWS field office. Consultation with the appropriate USFWS field office will also occur if flight training activities are introduced to new sites that have new impacts not discussed above, or if there is intensive low level hovering over forested areas during the active season (summer maternity season, and if applicable to the site, spring staging and fall swarming season), or if there is any other change to flight operations that may affect NLEB in a manner significantly different than those described above.

In conclusion, use of aircraft is not likely to adversely affect the NLEB.

C. Military Training Smoke and Obscurants: Smoke/obscurants are used to conceal military movements and help protect troops and equipment in combat conditions. They can be used throughout the Training Area as part of another military operation, or as part of an independent training scenario. Although they would be primarily used during the day, smoke/obscurants may be deployed at night. Training on some IMCOM installations may include, but is not limited to smokes and obscurants such as fog oil, colored smoke grenades, white phosphorous, and graphite smoke. The effects of these smokes and obscurants were assessed in the Fort Drum (USFS 2008;; Army 2014; USFWS 2009; USFWS 2013; USFWS 2015) and Camp Atterbury BAs and associated BOs (USFWS 2010). Research was cited indicating that prolonged dermal and respiratory exposures to these items, except for the graphite smoke, could have adverse effects on roosting and foraging Indiana bats. Given the similar roosting behavior and foraging locations of the NLEB, it is likely they will also be adversely affected by these smokes and obscurants. However, measures can be taken to avoid adverse effects of some smokes.

Camp Atterbury (USFWS 1998) conducted an ecological risk assessment (ERA) to assess which training materials and pesticides may cause adverse effects to Indiana bats. The ERA indicated that chemicals found in M18 colored smoke grenades may cause acute toxicological effects. They determined that Indiana bats roosting within 36 meters of the deployed grenades may inhale unsafe concentrations of M18 colored smoke during a one-minute period following release. To avoid the potential for adverse effects from colored smoke on NLEB, installations will not release M18 colored smoke grenades within 50 meters of forested suitable NLEB habitat during the active season if USFWS protocol surveys have not been completed. However, sites where surveys have been conducted and determined NLEB roost locations, M18 colored smoke grenades will not be used during the NLEB active season within 50 meters of known roost trees, which are described in Section IV of this document. Therefore, by implementing this measure, it is believed the effects of colored smoke on NLEB will be insignificant.

Citing data from a National Research Council's report on the toxicity of military smokes and obscurants, Fort Drum determined that based on the low toxicity on experimental animals, the use of graphite smoke may affect, but is not likely to adversely affect the known and undiscovered maternity colonies of Indiana bats. The USFWS concurred that any adverse effects associated with graphite smoke are discountable or insignificant (USFWS 2009).

In the 2012 Fort Drum BO (USFWS 2012), the USFWS included a table of a number of studies that provided estimates of fog oil concentrations from typical smoke screening operations. The highest level of fog oil recorded was 140 mg/m<sup>3</sup>, which was the upper level of a range for a 30 minute release that averaged a 51.8 mg/m<sup>3</sup> concentration 200 meters from the source. A 120 min release recorded a maximum level of 105 and 102 mg/m<sup>3</sup> at 200 and 100 meters, respectively, from the source of release. The COE Engineer Research and Development Center conducted a study to evaluate the health effects of fog oil aerosols in a surrogate species (Red-winged Blackbird) for the Red-cockaded Woodpecker (Driver et al. 2002). Based on the results of the study, they concluded that adult Red-winged Blackbirds can apparently sustain fog oil exposures of about 400 mg/m<sup>3</sup> for 4 hours with no detectable adverse effects.

Table 3. 2012 Fort Drum BO of Estimates of Fog Oil Concentrations Resulting From Typical Smoke Screening Operations at Given Distances From the Source.

Study	Distance from source (meters)	Average (mg/m <sup>3</sup> )	Range (mg/m <sup>3</sup> )	Maximum (mg/m <sup>3</sup> )
Lilegren et al. 1988 <sup>A</sup>	100	7.7		
	200	3.6		
	400	2.6		
Policastro et al. 1989 <sup>A</sup>	25	116		
	100	8		
	200	3		
Driver et al. 1993 <sup>B</sup> (30 min release)	100	64.3	27-120	
	200	51.8	7-140	
	400	27.9	1.8-93	
	1000	6.9	1.6-24	
Driver et al. 1993 <sup>B</sup> (300 min release)	100	64		
	200	29		
	400	8.7		
	1000	1.6		
Getz et al. 1996 (120 min release)	100	64	25-102	
	200	56	8-105	
	500	46	1.3-90	
	1000	13	0.8-25	
U.S. Army 1997 <sup>B</sup>	100	3.8		13.5
	250	3.5		12.7
	500	2.7		11.2
	1,000	1.2		4.3
Department of the Army 1997 (30 min release)	100		0-14	
	1000		0.1-1	
A- Results from studies conducted in the field				
B- Results from modeling				
Table is summarized from Getz et al. 1996 and ENSR 1999.				

The Lethal Concentration (LC)<sub>50</sub> of rats for inhalation of fog oil after 3.5 hours was 5,200 mg/m<sup>3</sup>. Less than 15% of the rats died at 4,000 mg/m<sup>3</sup> (NRC 1999). Roosting NLEBs would most likely be exposed to fog oil levels well below those lethal to rats and having no detectable adverse effects on blackbirds. It would appear that release of fog oil at least 100 meter from any known or suspected roost sites would be sufficient to avoid impacts on NLEB. However, in a study conducted on Fort Leonard Wood, it was estimated that Indiana bats within 4,000 m of static smoke training and 7,000 m of mobile smoke training had the potential to inhale unsafe quantities of fog oil (USFWS 2009). To ensure that NLEB are not adversely affected by fog oil, IMCOM sites will not use fog oil during the NLEB active period, unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

White phosphorous (WP) ignites when it is exposed to air and may cause burns. Smoke typically lasts up to 15 minutes. Rats exposed to WP for 15 min/day, 5 days/week for 13 weeks at 1,740 mg/m<sup>3</sup> (H<sub>3</sub>PO<sub>4</sub>) resulted in the death of 32% of the rats within 6 weeks. Rats produced clear signs of irritation when exposed to H<sub>3</sub>PO<sub>4</sub> at a concentration of 525 mg/m<sup>3</sup> for 60 minutes. Longer term exposure at concentrations of 884 mg/m<sup>3</sup> (15 min per day, 5 days per week for 6 or 13 weeks), resulted in slight laryngitis and tracheitis. A similar exposure, but at higher concentrations (H<sub>3</sub>PO<sub>4</sub> at 1,742 mg/m<sup>3</sup>), resulted in wheezing, dyspnea, moderate-to-severe laryngitis and tracheitis, and interstitial pneumonia. No such effects were reported for rats exposed for 15 min per day, 5 days per week for 13 weeks with H<sub>3</sub>PO<sub>4</sub> at 280 mg/m<sup>3</sup>. Reproduction and development of rats showed that higher WP exposure (1,742 mg/m<sup>3</sup> for 15 min/day, 5 days/week for 10 weeks) were associated with lower natal weights and had severe effects on survivability (NRC 1999).

It has been estimated that an exposure concentration of WP could reach 202 mg/m<sup>3</sup> (H<sub>3</sub>PO<sub>4</sub>) 100 m downwind from deployment and about 1.4 mg/m<sup>3</sup> (H<sub>3</sub>PO<sub>4</sub>) 5,000 m downwind. It was cited that the EPA does not expect community exposures to be severe at a distance of greater than 300 m; however, particularly susceptible individuals might experience respiratory irritation even at a distance of 5,000 m (NRC 1999).

To avoid the potential for adverse effects WP on NLEB, installations will not release WP within 200 meters of forested suitable NLEB habitat during the active season if USFWS protocol surveys have not been completed. However, sites where surveys have been conducted and determined NLEB roost locations, WP will not be used during the NLEB active season within 200 meters of known roost trees, which are described in Section IV of this document. Therefore, by implementing this measure, the anticipated level of WP at that distance should not expose NLEB to concentrations of H<sub>3</sub>PO<sub>4</sub> that would be likely to adversely affect them.

For “other” smokes and obscurants, we cannot negate the potential for adverse affects on NLEB from exposure. Therefore, to avoid any potential for adverse affects, these items will not be employed during the NLEB active season. IMCOM installations will consult with the USFWS if any of these “other” smokes or obscurants are being



considered for release during the NLEB active season and there is scientific evidence to support that such substances can be released in a manner to avoid adverse effects or ensure such effects are insignificant or discountable.

Summary of Conservation Measures for Military Smoke & Obscurants:

1. M18 colored smoke grenades will not be used within 50m of forested suitable NLEB habitat during the NLEB active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.
2. M18 colored smoke grenades will not be used within 50m of known roost trees during the active season (see Table 2) after USFWS protocol surveys have been completed or site specific consultation has been completed with the local USFWS Field Office.
3. Fog oil will not be released within forested suitable NLEB habitat during the NLEB active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.
4. WP will not be released within 200 meters of forested suitable NLEB habitat during the NLEB active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.
5. WP will not be used within 200m of known roost trees during the active season (see Table 2) after USFWS protocol surveys have been completed or site specific consultation has been completed with the local USFWS Field Office.
6. Other smoke/obscurants will not be employed during the NLEB active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.
7. No smoke or obscurants will be released within 0.5 miles of known hibernacula outside of the active season as defined in Table 2.

In conclusion military smoke and obscurants may affect, but are not likely to adversely affect the NLEB by implementing the above conservation measures.

D. Construction: Construction projects can include new buildings, building additions, new or upgraded utilities, etc. As part of construction there may be multiple activities including tree removal, site preparation, equipment staging and maintenance areas, etc. On IMCOM installations where NLEB are known (or assumed – no P/A

surveys conducted to date but within range and suitable summer habitat) to roost, tree cutting and clearing for construction projects will occur during the NLEB inactive season (Table 2) or when verified absence has been determined utilizing the published USFWS protocols. If there is a need to remove a single or small cluster of trees during the active season, the installation will follow procedures listed in Section VI.G. below to determine if such removal can be done with insignificant or discountable effects on NLEB. Tree cutting and clearing may cause loss of habitat; however, inactive season tree removal effects would be discountable by following similar conservation measures to the Federal Highway Administration and Federal Railroad Administration's Range-wide Biological Assessment for Transportation Projects for Indiana Bat and NLEB (FHA 2015)

Other construction activities such as site grading, road construction, vertical and horizontal building, and other activities are likely to occur during the NLEB active season during day light hours. Noise and vibrations generated by heavy equipment within or directly adjacent to roosting trees could temporarily disturb roosting bats. For known roost sites, or areas of suitable habitat without verified absence, that are greater than 100m from the construction site, it is anticipated that the intensity of noise and vibration associated with the construction will diminish a sufficient amount to reduce the likelihood of disturbing bats that roost in these particular areas. Also High light levels may deter bats from areas as their nocturnal behavior may have evolved in response to predation risks (Speakman 1991, Sparks et al. 2005). By angling the light away from potential foraging and roosting areas, the area will be darker thus providing bats more protection from predators. By implementing 100 meter buffers around areas of suitable habitat without verified absence, IMCOM determines that such activities "may affect, but not likely to adversely affect" the NLEB in regards to disturbance activities related to construction. Additional coordination will occur for projects within 0.25 miles of known roosts.

Hibernacula may be affected by construction activities if the activity is conducted too close to or during the inactive season. Construction activities such as site grading, road construction, vertical and horizontal building, and other activities are likely to occur during the NLEB inactive season (Table 2) during day light hours. Noise and vibrations generated by heavy equipment within or directly adjacent to hibernacula could temporarily disturb roosting bats. Because all construction activities will occur >0.5 miles from hibernacula during the winter to be included as part of this informal consultation, no direct effects to NLEB will occur. Additional consultation is required for any construction activities <0.5 miles from hibernacula.

In addition, in areas where NLEBs are already subject to noise and vibrations associated with ongoing actions, construction activities occurring in such area would not likely have an adverse effect on NLEBs.

Additionally, site-specific consultation with the local USFWS field office will often be needed to adequately assess the potential direct and indirect effects associated with construction projects. However, across the range of the species no effects are anticipated if construction projects:

- 1) Are located entirely (including staging areas & construction footprint) beyond 100 m<sup>1</sup> of NLEB suitable summer habitat and 5 mi of hibernacula OR
- 2) Involve maintenance, alteration, or demolition of bridges/structures without any signs of bats as verified by a trained biologist, pest management specialist, or similar professional individual.

Some projects may occur near or within suitable NLEB habitat, but the project will result in no effects or discountable likelihood of effects even without the implementation of any avoidance or minimization measures, if the proposed project is based on the following:

- 1) Activities are completely within existing road surfaces (e.g., road line painting).
- 2) Activities are within existing ROWs or at existing facilities that contain suitable habitat but that do not remove or alter the habitat (e.g., mowing, brush removal).
- 3) Activities are wetland or stream protection associated with wetland mitigation without any tree removal.
- 4) Are located in areas with verified absence determined by USFWS protocol surveys<sup>2</sup>

Other projects may occur near or within NLEB suitable habitat which will require the implementation of conservation measures to avoid or minimize impacts to the point of insignificant/discountable for the projects to be included in this programmatic consultation. Construction projects that involve any of the features listed below are not likely to adversely affect NLEBs.

- 1) Structure Maintenance: during the active season (Table 2) that does not bother roosting bats in any way (e.g., activity away from roosts inside common rooms in structures, normal cleaning and routine maintenance).
- 2) Bridge Maintenance: during the active season (Table 2) that does not bother roosting bats in any way (e.g., road paving, wing-wall work, work above that does not drill down to the underside of the deck, some abutment, beam end, scour, or pier repair).
- 3) Structure or Bridge Maintenance: outside the active season that does not alter roosting potential for bats.
- 4) Tree Removal must occur outside the active season (Table 2) AND must not remove known roosts (as defined herein) AND
  - must be entirely within 100 feet of existing road surfaces in order to have no linear acreage limits; (this would include roads within cantonment, state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)

OR

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<sup>1</sup> Addresses potential for noise/disturbance adjacent to suitable habitat.

<sup>2</sup> See protocols for minimum number of years negative survey results are valid

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- if located >100 feet of existing road surfaces, must be limited to no more than 10 acres per project (10 acres is 5% of a 200 acre home range)

The following additional conservation measures will be taken for all construction to further eliminate the potential to affect NLEB:

1. **Roost Tree Protection.** No known roost trees, as defined herein, will be felled, unless there is a human health and safety concern. If there is a need to remove a known roost tree, the installation will follow procedures listed in Section VI.G. below to determine if such removal can be done with insignificant or discountable effects on NLEB.
2. Construction activities outside of suitable habitat will not occur within 100 meters of any known roost trees without additional site-specific consultation.
3. Construction activities that remove suitable habitat within 0.25 miles of any known roost trees without additional site-specific consultation. Construction activities will also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas, and any other issue important NLEB.
4. **Time of Year Restriction for Tree Falling.** A time of year restriction for clearing trees (> 3 in DBH) has been established to protect known or potential roost trees during the active season (see Table 2), unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.
5. Flagging or signs will be used to demarcate areas to be cleared vs. not cleared prior to any construction activities for a given project. Flagging will be removed upon completion of the project.
6. Via Scope of Works, Contracts, Briefings, etc., all personnel responsible for construction activities will be informed about the need to follow design plans, stay within flagging, and minimize impacts to wildlife and other environmental concerns.
7. **Outdoor Lighting Minimization.** For all future projects, IMCOM will evaluate the use of outdoor lighting and seek to minimize light pollution by angling lights downward or via other light minimization measures.
8. **Demolition.** If the building has pre-existing known NLEB colonies, then the appropriate environmental personnel of the IMCOM installation must be contacted before demolition is to occur. If during the course of demolition, NLEB are discovered, then all work must cease and USFWS must be immediately contacted. If the structure is safe to leave as is, then it will be left

until after October 15, or until bats have stopped using the structure. If the structure is unsafe and poses a risk to human health and safety, IMCOM will attempt to exclude the bats immediately. If this is not possible, or NLEB are found to be using the structure during the maternity season when pups are not volant, IMCOM will contact USFWS to discuss the most appropriate next course of action.

9. Water Quality BMPs will be established for each construction site in accordance with the appropriate federal laws and state permits.

In conclusion construction & maintenance activities may affect, but are not likely to adversely affect the NLEB by implementing the above screening criteria and conservation measures.

E. Forest management: Forest management includes both even-aged (e.g., clearcutting or shelterwood) and uneven-aged (single tree or group selection) harvest methods to manage forests to support military training, timber production/health, and wildlife habitat creation/enhancement. Environmental conditions (e.g., wet or rocky soils), training requirements, and stand characteristics dictate harvest methods. Forest management practices such as timber harvest and silviculture are essential to maintaining diverse quality forested habitat for both the NLEB and military training. A number of forest management practices occur on military installation such as but not limited to: harvest, thinning, and/or planting operations. Operations that require tree removal have the potential to alter NLEB habitat. In the final listing rule USFWS anticipates that habitat modifications resulting from forest management and silviculture will not significantly affect the conservation of the northern long-eared bat. However, timber harvest operations performed during the species' active season may directly kill or injure individuals.

Removal of trees could have an indirect effect from loss of potential roosting and foraging areas. The degree of potential impact would be dependent on whether the removal is temporary (i.e., timber harvest, to include clearcuts) or permanent (construction). As stated in the proposed listing rule for NLEB (USFWS 2013), studies to date have found that NLEBs show a varied degree of sensitivity to timber harvesting practices and the amount of forest removal occurring varies by State.

The following additional conservation measures will be taken for all forest management activities to further eliminate the potential to affect NLEB:

1. Time of Year Restriction for Tree Falling. A time of year restriction for clearing trees (> 3 in DBH) has been established to protect known or potential roost trees during the active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office
2. Roost Tree Protection: No known roost trees, as defined herein will be felled, unless there is a human health and safety concern. If there is a need to

remove a known roost tree, the installation will follow procedures listed in Section VI.G. below to determine if such removal can be done with insignificant or discountable effects on NLEB. Clearcutting or similar harvest will not occur within 0.25 mi (250 m) and overstory roost tree removal within 100 meters of documented maternity roost trees without further consultation with the USFWS. Tree thinning/removal will also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas, and any other issue important to NLEB.

3. Forest Management will not be conducted within 0.5 miles from “known hibernacula” when bats are present during the inactive season. Forest management near hibernacula may affect swarming and staging areas through habitat loss around the hibernacula. Additional site-specific consultation will occur for forest management within 0.5 miles of hibernacula.
4. Tree Removal Acreage Limits:
  - if located >100 feet of existing road surfaces, must be limited to no more than 10 acres of clearcutting (or similar forest practice like seed tree or shelterwood harvest) per project (10 acres is 5% of a 200 acre home range). NOTE: There is no acreage limit for selective harvest practices conducted during winter, as roosting habitat will remain available.OR
  - must be entirely within 100 feet of existing road surfaces in order to have no acreage limits; (this would include roads within cantonment , state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)
5. Snag Retention. All snags will be left in silvicultural treatments unless there is a safety concern for the contractor or the military units training in the stands (e.g., maneuver corridors), or unless the treatment is a salvage harvest or clearcut. Snags should be distributed and retained throughout the landscape.

In conclusion forest management activities may affect, but are not likely to adversely affect the NLEB by implementing the above screening criteria and conservation measures.

F. Prescribed Burns: Prescribed fire is used to improve line-of-sight on ranges and observation points for direct and indirect firing, maintain grassland/open shrubland for open maneuver training, reduce fuel accumulation to minimize wildfire risk, and manage species habitat. It is also used as a tool to maintain ecological health of grassland and forested areas and regenerate oak ecosystems. The majority of natural and prescribed fires on IMCOM installations occur in impact or surface danger zone areas, due to live fire training and testing operations. The vegetation that occupy these areas are fire dependent. Other prescribed fires are generally conducted in grasslands



and forests, during the growing and dormant seasons, and all prescribed fires are implemented in accordance with the installation's Integrated Wildland Fire Management Program and State regulations.

Prescribed fire is gaining acceptance as a means of restoring and perpetuating oak (*Quercus*) dominated ecosystems in the eastern U.S. (Dickinson et al., 2010). As stated in the final listing rule (USFWS 2015), a U.S. Forest Service review of prescribed fire and its effects on bats generally found that fire had beneficial effects on bat habitat. Bats are resilient to fire and some species prefer burned areas for foraging and roosting (e.g. Boyles and Aubrey 2005, Loeb and Waldrop 2007). There is little scientific evidence to indicate that fire has adverse effects on NLEB. NLEB roost-switching frequency, distance between successive roosts, and duration of individual roost tree use were similar between fire and control treatment areas (Johnson et al. 2009). Following prescribed fires, NLEB benefit from increased abundance of insects and availability of roost sites (Lacki et al. 2009). During prescribed fire, NLEB have been shown to exit their roosts during the day and switch roosts as necessary to limit their exposure (Dickinson et al. 2009). In fact, most bats are quick and highly vagile so that escape and relocation to unburned areas easily can occur (Carter et al. 2009). However, neonatal bats that cannot fly would be at greater risk to smoke and fire effects than juveniles or adults. Although, exposure of tree roosting bats to carbon monoxide (CO) is unlikely to be a concern when fireline intensity is low (~1.5 m flame length) (Dickinson et al., 2010). In largely forested landscapes, there are infinite amounts of available roosts for alternate use (Carter et al. 2000). During the active season, bats frequently roost-switch but use torpor to conserve energy and extra arousals when bats are in deep torpor are a cause for concern. The maternity roosting season, from 01 June to 31 July when young pups are not Volant, and to a much lesser extent during the active season, is the only time NLEB might be directly affected by prescribed burns to elicit take. During all other times of the year research has shown that NLEB are not adversely affected by burns conducted under prescribed conditions.

#### Conservation Measures for Prescribed Burning:

1. Not within 0.5 miles from "known hibernacula" when bats are present during the inactive season (see Table 2 for active season).
2. Not within forested suitable NLEB habitat during the active season (see Table 2) unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.
3. Prescribed burns will be conducted under a site specific burn plan per the Installation Integrated Wildland Fire Management Plan which is integrated with the ecosystem management goals and objectives of a tripartite approved (IMCOM, State, and USFWS) Integrated Natural Resource Management Plan (INRMP).

4. Time of Day Restriction. For prescribed burns not within forested suitable NLEB habitat, whenever possible, all efforts will be made to have all flames extinguished and smoke generation minimized by sunset to reduce potential direct impacts to foraging bats during the active season (see Table 2)
5. Containment Measures. For prescribed burns within 100 meters of forested suitable NLEB habitat, make use of naturally occurring firebreaks or, if necessary, establish wet lines to preclude fire from entering the adjacent NLEB habitat during the active season (see Table 2), unless USFWS protocol surveys have been completed to verify absence or site specific consultation has been completed with the local USFWS Field Office.

In conclusion prescribed burning activities may affect, but are not likely to adversely affect the NLEB by implementing the above conservation measures. Additionally prescribed burning is determined to provide an overall beneficial effect to overall habitat quality.

G. Specific Single, Group, or Hazard Tree Removal: Removal of single, multiple, or cluster of trees during the active season in suitable habitat, trees that do not pose a risk to human life or property will be analyzed for signs of bats being present (emergence surveys) prior to removal according to USFWS Indiana bat (and NLEB) summer survey protocols. If NLEB are roosting in such tree(s), the applicable IMCOM installation will consult with their local USFWS field office. If bat species are determined present and immediate removal of the tree(s) is necessary, the tree(s) will be removed in a manner that will minimize impacts on the bats such as first disturbing the tree(s) to cause them to abandon the roost. If there are hazard trees that are considered an imminent threat to human life or loss of property and need to be removed during the active season, the IMCOM installation will remove such trees and inform the USFWS field office of the action only if NLEB are present on the installation and the IMCOM installation will initiate emergency consultation per the procedures in accordance with 50 CFR 402.05.

H. Pesticide Use: All pesticides will be applied in accordance with their label and applicable laws and regulations. All pesticides are also applied in accordance with the installation INRMP and the Integrated Pest Management Plan (IPMP). IMCOM installations will regularly check Protection Bulletins on EPA's Endangered Species Protection Program (ESPP) website to determine whether pesticide use in a certain geographic area may affect NLEB. Limitations on pesticide use will be implemented as required to protect NLEBs in all areas. Application of pesticides in and around buildings or other structures are not likely to have any effect on NLEB. If NLEBs are found roosting in a building, then pesticides will be used sparingly and no foggers will be used in and around the occupied building.

To minimize the exposure of NLEB to pesticide and to keep in from drifting into known roost tree areas or water bodies the following conservation measures will be followed:

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### Conservation measures for Pesticide use:

1. Only pesticides registered by the EPA and State of use may be applied and only in accordance with their label.
2. Aerial application of pesticide will only occur outside the active season unless additional consultation with the USFWS is accomplished. Aerial applications will occur between the hours of sunrise and one hour before sunset. This will protect foraging bats in undiscovered foraging areas from direct exposure.
3. Whenever possible, herbicides that have low toxicity to mammals will be utilized with the tow behind power blowers. Herbicides that may be somewhat toxic to mammals will be mixed and applied at a rate that should minimize any potential exposure concerns.
4. Application of pesticides from ground mounted vehicles (i.e., ATVs, tractors) that spray chemicals directly onto the ground and do not result in broad dispersal will be conducted at least 100 ft (30 m) from known roost trees during the active season (coordinate with local USFWS field office).
5. Application of pesticides that result in broad dispersal (e.g., tow behind power blowers) will be conducted at least 250 ft (76 m) away from known roost trees during the active season (coordinate with local USFWS field office). Pesticides will not be applied between sunrise and one hour before sunset. Location-specific applications (i.e. hatchet or stem injections of trees, individual application to specific plants) may be used within 50 ft (15 m) of known roosts. This measure minimizes the risk of exposure to bats and potential effects from pesticides.
6. Pesticides applied from tow behind power blowers will use appropriate nozzles and drift control additives, and will be applied using low pressure to reduce drift and potential swirling motion from the blower. All efforts will be made to only spray 10 feet from ground level or below.
7. Pesticides will not be applied outdoors when the wind speed exceeds 8 mi/hr for all applications except power mist blowers. Pesticides applied via power mist blower will only be applied with wind speeds <5 mi/hr. This is to reduce the risk of pesticide drift, which could impact water quality or non-target areas. Care will be taken to make sure that any spray drift is kept away from non-target areas and individuals. Additionally, aerial application utilizing helicopters should employ large droplet technology through special nozzles on drop tubes to ensure the herbicide stays on target.
8. If a bat colony is found roosting in a building, then insecticides will be used sparingly and no foggers will be used. This will minimize impacts to roosting northern long-eared bats if they are found within a building.

In conclusion by implementing these conservation measures IMCOM believes the effects on NLEB will be insignificant.

I. Pest Control: IMCOM facilities may have pest control complaints, such as but not limited to bats, moles (order Insectivora), raccoons (*Procyon lotor*), squirrels (order Rodentia), skunks (order Carnivora), woodchucks (order Rodentia), insects, and other such species. Each issue is handled on a case-by-case basis depending on the pest species and the situation. When possible, wildlife will be deterred from areas by removing features that are attractive to the species (e.g. eliminating potential food/nesting sources, plugging openings into buildings, etc.). If deterrence efforts are ineffective, then it may be necessary to set live traps and relocate or euthanize animals, or use lethal control methods such as trapping, shooting, and/ or chemical control. All pest control efforts are performed in accordance with the installation INRMP and the IPMP.

Lethal traps are primarily used for rodents and moles. Adhesive traps are allowable for rodent and insect control in buildings, however, if placed incorrectly, they may inadvertently capture bats. Both adult and juvenile bats are susceptible to capture in glue traps which could result in injury or mortality. To prevent accidental capture of bats, no adhesive traps can be placed in such a manner that they could capture bats. Glue traps will not be placed in any crawl space or attic compartment within buildings or in areas where bats are known to occur. If bats are present within the building, then live traps for rodents will be used instead of glue traps.

If there are large scale infestations of rodents and moles, chemical means may be necessary to effectively manage the outbreak. Bait stations will not be placed where it may be accessible to children or pets and must be monitored to prevent access to non-target animals.

#### Conservation Measures for Pest Control:

1. No Lethal Control. No lethal control methods are permitted for bats unless there is a suspected human health risk for exposure to rabies or other disease. If individual bats are in buildings and there is no evidence of maternity use, then all efforts will be made to safely capture and release individual bats. Or, the bats will be excluded by establishing one-way valves over the roost's exit (if feasible).
2. Time of Year Restriction for Exclusion. The exclusion will only be done during times of the year when pups are not present or when they are volant (i.e., August - early May). The time of year restriction will minimize the risk of separating mothers from non-volant young, so it will prevent potential pup mortality during exclusion activities. Sealing cracks and crevices in buildings will also be done during the late fall through early spring. Sealing cracks and

crevices prevents bats from entering a building and reduces human/bat conflicts.

3. Adhesive Trap Restrictions. No adhesive traps used for rodents or insects will be placed in such a manner that they could capture bats—glue traps will not be placed in any crawl space or attic compartment within buildings or in areas where bats are known to occur.
4. Chemical Measures. Any use of chemical or insecticides will be utilized in accordance with section “H” above.

In conclusion by implementing these conservation measures IMCOM believes the effects on NLEB will be insignificant in regards to pest control management activities.

J. Recreational Activities: Recreational activities on IMCOM installations typically consist of hunting, fishing, trapping, hiking, mountain biking, camping, horseback riding, wildlife watching, and other consumptive and non-consumptive activities. These activities whether dispersed or concentrated are low impact activities that do not alter the landscape or generate a disturbance that would be considered to affect the NLEB. Continued use of IMCOM installations for these or similar activities is expected to continue without restriction, in accordance with the Sikes Act (16 U.S.C. 670, et seq.). However development of new areas for these activities that would be considered construction or habitat alteration “may affect”; therefore those projects would utilize the conservation measures identified earlier in this document for those actions.

Hunting activities have the potential to directly affect roosting NLEB if a hunter should place a stand in a NLEB roost. Hunters are unlikely to place tree stands in snags due to the instability of snags and the risk that the tree may fall. Thus, NLEB roosting in standing dead trees are not likely to be adversely affected by tree stands during the non-hibernation seasons. Tree stands may disturb roosting NLEB or damage roosts that are located within crevices of live trees or are in a dead tree limb of a live tree. Installment of a tree stand may cause NLEB to abandon the roost. Hunting primarily occurs in the fall-winter when NLEB are moving to the hibernacula or are already in the hibernacula, so NLEB are more likely to roost alone or in small groups within trees or are within the hibernacula. But since hunting typically occurs in seasons when NLEB are less likely to be present, the use of tree stands may affect but is not likely to adversely affect roosting NLEB.

Hunting activities also have the potential to directly affect roosting NLEB if a hunter should shoot at game flying through the air or in a tree and the shot hits a tree containing roosting NLEB. The likelihood of this happening is expected to be extremely rare, given the combination of occurrences that need to come together (i.e., the hunter being in a location suitable for NLEB to be roosting and game birds or waterfowl to be flying, the hunter shooting at the right angle into a tree to hit and kill a NLEB, etc.).

Additionally, most NLEB would presumably be within the hibernacula when the majority of hunting is conducted (October-February).

There is potential that individuals hunting game may shoot into a forested area which has NLEB roosts. Fired projectiles may strike a NLEB roost and remove bark from the tree, rendering the roost unsuitable for future use. Snags are ephemeral in nature and frequently slough bark. NLEB are known to frequently switch roosts assumed because of the fleeting nature of snags. Since strikes of snags are expected to occur infrequently, NLEB are unlikely to be adversely affected by hunting. Thus effects are discountable.

Skeet shooting could potentially result in injury or mortality of a foraging NLEB if skeet shooting was conducted in extreme early morning or at sunset when NLEB may be active. Skeet ranges located adjacent to suitable NLEB summer foraging habitat have a likelihood that a NLEB could be struck during skeet shooting but is highly improbable.

Legal use of Off Road Vehicles (ORV) should have no known indirect effects to NLEB as ORV's will remain on the road at all times and will not damage vegetation in the area. However, unauthorized ORV use off-trail may damage vegetation which can expose the soil to the elements and could lead to increased soil erosion. Soil erosion may lead to declines in water quality. Lower water quality may reduce aquatic insect availability, which are prey for NLEB. In addition, streams/wetlands may be converted overtime into mud pits that are unsuitable for drinking by NLEB. Given the amount of ample water and natural habitat available on IMCOM installations, it is unlikely that ORV use will adversely affect NLEB. Thus, effects are discountable.

Recreational activities that occur in the vicinity of hibernacula are pass through in nature except possibly for stationary hunting. Stationary hunting would only create a disturbance when a shot or shots were fired but no different than the single unlikely instance as with pass through hunting. Additionally as in section "A" noise activities associated with the firing of weapons has been shown to not adversely affect NLEB.

In conclusion, the majority of recreational activities with the exclusion of ORV use, hunting, and skeet shooting, are expected to have no known effects on NLEB. Given the conservation measures for each and remote nature of potential effects, recreational activities may affect but are not likely to adversely affect NLEB.

## **VII. Additional General Conservation Measures**

This section identifies the Conservation Measures (CM) proposed throughout this document that are considered necessary to either avoid adverse affects or to ensure the expected effects are beneficial, insignificant or discountable. Additional CMs are also proposed to promote the conservation of the NLEB.



- IMCOM will use the most current National WNS Decontamination Protocols approved by USFWS for planned activities that involve close or direct contact with bats, their environments, and/or associated materials.
- IMCOM will explore cooperative management efforts with adjacent landowners, if such efforts would complement installation NLEB conservation initiatives and/or support mission implementation.
- IMCOM will explore cooperative NLEB management strategies, solutions, and efforts with other federal, state, and private organizations and landowners in the region.
- IMCOM will seek funding opportunities to conduct USFWS presence/absence surveys on individual installations subject to the availability of funds.
- IMCOM installations will continue to manage their ecosystems to support and enhance military training, testing, & readiness in accordance with their INRMP to retain habitat and biological diversity, and long term sustainability.
- IMCOM & the USFWS will develop a screening criteria check list so individual installations may quickly and categorically apply the above listed measures described in the programmatic process.
- IMCOM will centrally report activities taken by individual installations under this programmatic opinion annually to the USFWS from data gathered through the annual AEDB-EQ installation data call.

## VIII Conclusions

**A. Northern Long-Eared Bat.** Based on IMCOM's intent to follow USFWS guidance on NLEB management, carry out actions as described in Section V, and to implement the conservation measures identified in Section VI, IMCOM has determined that implementation of actions IAW with this document **"may affect, but not likely to adversely affect"** the NLEB as a threatened species listed under the ESA.

**B. Request of Conference Report.** IMCOM requests that the USFWS review our findings and determinations stated herein and provide a conference report that reflects IMCOM's proposed conservation measures for reducing adverse effects. If necessary, the applicable IMCOM installation(s) will initiate site specific consultation with their USFWS Field Office on activities that are not included in this BE or if there is additional site specific information to suggest alternate conservation measures.

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## X. Glossary

**Action area** - all areas to be affected directly or indirectly by the action and not merely the immediate area involved in the action.

**Active season** – the time period when bats are not in hibernation. This includes spring emergence, young rearing, and breeding (swarming) and is typically from April through October (specific dates are defined by geographical area see Table 2).

**Critical habitat** - (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of the ESA, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the ESA, upon a determination by the Secretary that such areas are essential for the conservation of the species (defined in Section 3 of the ESA).

**Emergency** - An emergency is a situation involving an act of God, disasters, casualties, national defense or security emergencies, etc., and includes response activities that must be taken to prevent imminent loss of human life or property.

**Exfoliating bark** - tree bark that peels away from a trunk or a branch of a tree; when a tree dies, plates of bark spring away from the bole of the tree. Some living trees, such as shagbark hickory and white oak, have bark that peels back from the living cambium.

**Hibernaculum** (plural **hibernacula**) - a site, usually a cave or mine, where any bat species hibernates during the winter (see suitable habitat).

**Is likely to adversely affect** – the appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial.

**Known hibernacula** – a location where one or more northern long-eared bats have been detected during hibernation or at the entrance during fall swarming or spring emergence. Given the documented challenges of surveying for northern long-eared bats in the winter (use of cracks, crevices), any hibernacula with northern long-eared bats observed at least once, will continue to be considered “known hibernacula” as long as the hibernacula and its surrounding habitat remain suitable for northern long-eared bat. However, a hibernaculum may be considered to be unoccupied if there is evidence (e.g., survey data) that it is no longer in use by northern long-eared bats (USFWS 2015).

**Known roost tree** – a tree that male or female NLEBs have been documented as using during the active season (approximately April–October). Once documented, a tree will

be considered to be a “known roost” as long as the tree and surrounding habitat remain suitable for NLEB. However, a tree may be considered to be unoccupied if there is evidence that the roost is no longer in use by NLEB (USFWS 2015).

**May affect** - the appropriate conclusion when a proposed action may pose any effects on listed species or designated critical habitat.

**No effect** - the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or designated critical habitat.

**Not likely to adversely affect (NLAA)** - the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial.

**Beneficial effects** are contemporaneous positive effects without any adverse effects to the species. **Insignificant effects** relate to the size of the impact and should never reach the scale where take occurs. **Discountable effects** are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

**Snag** - a standing dead (or mostly dead) tree, generally with <10 percent living canopy.

**Staging** - the departure of bats from hibernacula in the spring, including processes and behaviors that lead up to departure (see suitable habitat).

**Suitable habitat** - Summer and/or winter habitat that is appropriate for use by NLEB (may be known or unknown in terms of documented use). See most recent summer survey guidance)

- **Winter** (hibernacula) is restricted to underground caves and cave-like structures (e.g., abandoned mines, railroad tunnels). These hibernacula typically have large passages with significant cracks and crevices for roosting; relatively constant, cooler temperatures (0-9 degrees C) and with high humidity and minimal air currents.
- **Summer** for NLEB consists of the variety of forested/wooded habitats where they roost, forage, and travel. This includes forested patches as well as linear features such as fencerows, riparian forests and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Isolated trees are considered suitable habitat when they exhibit the characteristics of a suitable roost tree and are less than 1000 feet from the next nearest suitable roost tree, woodlot, or wooded fencerow. May also include structures for roosting (e.g., barn).
- **Spring staging/fall swarming** for NLEBs consists of the variety of forested/wooded habitats where they roost, forage, and travel within 5 miles of a hibernaculum. This includes forested patches as well as linear features



such as fencerows, riparian forests and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Isolated trees are considered suitable habitat when they exhibit the characteristics of a suitable roost tree and are less than 1000 feet from the next nearest suitable roost tree, woodlot, or wooded fencerow.

**Suitable roost tree** - any tree in which bats roost when they emerge from the hibernacula. Females gather in maternity colonies and males may roost singly or in small groups. During summer NLEBs roost singly or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees and snags, typically  $\geq 3$  inches dbh.

**Survey** - a method of sampling, such as mist netting, that provides data concerning the presence/absence of bats at a site; also, the act of enumerating the bats hibernating in a cave or mine. NLEB summer survey guidance can be found at <http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html>

**Swarming** - A phenomenon in which, during late summer and autumn, numerous bats are observed entering and exiting entrances to caves and mines, but few, if any, of the bats may roost within the site during the day. Swarming probably is related to fall breeding activities and locating potential hibernation sites. (See suitable habitat).

**Take** - Take is defined in Section 3 of the ESA as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

**Torpor** – a period of inactivity, with reduced body temperature and metabolism.

**Volant** - able to fly.

**Verified absence** - refers to known or suitable habitat determined to be unoccupied at the time of impact by utilizing USFWS approved protocols.

## **XI. Summary of IMCOM NLEB Programmatic Biological Evaluation Conservation Measures**

### **A) Activities/Areas Not Subject to Conservation Measures:**

- Any Activity that occurs outside the known range of the NLEB (see Section V for details)
- Any activity that occurs within the known range of the NLEB but does not contain suitable NLEB habitat. (see Section V for details)
- Any activity in a highly developed urban area that is <1000' from suitable NLEB habitat. (see Section V for details)
- Any area where NLEB absence has been verified by USFWS Protocol survey.
- Any activity that is conducted under a site specific consultation with the local USFWS Field Office.
- All military activities such as but not limited to: air operations, water operations, field training operations, live munitions training, demolition, and research, development, testing, and evaluation (RDTE). (see Section VI-A for details)
- All activities involving the use of aircraft such as but not limited to: fixed wing, rotary wing, drone, etc...(see Section VI-B for details)
- All categories of outdoor recreation such as but not limited to: hunting, fishing, trapping, hiking, mountain biking, camping, horseback riding, wildlife watching, and other consumptive/non-consumptive activities. (see Section VI-J for details)

### **B) Activities Subject to Conservation Measures:**

- Military Training Smoke and Obscurants: (see Section VI-C for details)
  1. M18 colored smoke grenades will not be used within 50m of forested known/presumed occupied NLEB during the active season (see PBE Table 2 Below). Or within 50m of known roost trees during the active season if USFWS protocol surveys have been completed.
  2. Fog oil will not be released within forested known/presumed occupied habitat during the NLEB active season (see PBE Table 2 Below).
  3. WP will not be released within 200 meters of forested known/presumed occupied NLEB during the active season (see PBE Table 2 Below). Or within 200m of known roost trees during the active season if USFWS protocol surveys have been completed.
  4. Other smoke/obscurants will not be employed during the NLEB active season (see PBE Table 2 Below).
  5. No smoke or obscurants will be released within 0.5 miles of known hibernacula outside of the active season as defined in PBE Table 2 Below.
- Construction: (see Section VI-D for details)
  1. If there is a need to remove a single or small cluster of trees during the active season, the installation will follow procedures listed in that section below.
  2. Consult with USFWS for projects within 0.25 miles of known roost trees. Buffers may also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas.

3. Implement a 0.5 mile buffer around “known” hibernacula where additional consultation is required
  4. Conduct structure, sign, utility, & bridge maintenance: during the active season that does not bother roosting bats in any way (e.g., activity away from roosts inside common rooms in structures, normal cleaning and routine maintenance)
  5. Tree removal outside the active season (see PBE Table 2 Below), that is entirely within 100’ of an existing road surface has no acreage limit. This would include roads within cantonment, state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)
  6. Tree removal outside the active season (see PBE Table 2 Below), that is >100’ of an existing road surface has a 10 acre per project limit.
  7. Flagging or signs will be used to demarcate areas to be cleared vs. not cleared prior to any construction activities for a given project. Flagging will be removed upon completion of the project.
  8. Via Scope of Works, Contracts, etc., all personnel responsible for construction activities will be informed about the need to follow design plans, stay within flagging, and minimize impacts to wildlife and other environmental concerns.
  9. Outdoor Lighting Minimization. For all future projects, IMCOM will evaluate the use of outdoor lighting and seek to minimize light pollution by angling lights downward or via other light minimization measures.
  10. Demolition. If the building has pre-existing known NLEB colonies, then the environmental contact of the IMCOM installation must be contacted before demolition is to occur. If during the course of demolition, NLEB are discovered, then all work must cease and USFWS must be immediately contacted. If the structure is safe to leave as is, then it will be left until after October 15, or until bats have stopped using the structure. If the structure is unsafe and poses a risk to human health and safety, IMCOM will attempt to exclude the bats immediately. If this is not possible, or NLEB are found to be using the structure during the maternity season when pups are not volant, IMCOM will contact USFWS to discuss the most appropriate next course of action.
  11. Water Quality BMPs will be established for each construction site in accordance with the appropriate federal laws and state permits.
- Forest management: (see Section VI-E for details)
    1. IMCOM will screen projects that required tree removal for forest management activities the same as identified for construction.
    2. If there is a need to remove a single or small cluster of trees during the active season, the installation will follow procedures listed in that section below.
    3. Implement a 0.25-mile buffer around known roost trees where additional consultation is required for clearcutting or similar harvest. Buffers will be may also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas.

4. Implement a 0.5 mile buffer around “known” hibernacula where additional consultation is required.
  5. Tree removal outside the active season (see PBE Table 2 Below), that is entirely within 100’ of an existing road surface has no acreage limit. This would include roads within cantonment, state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)
  6. Clearcutting or similar harvest outside the active season (see PBE Table 2 Below), that is >100’ of an existing road surface has a 10 acre per project limit. No acreage limit on selective harvest.
  7. Flagging or signs will be used to demarcate areas to be cleared vs. not cleared prior to any forest management activities for a given project. Flagging will be removed upon completion of the project.
  8. Snag Retention. All snags will be left in silvicultural treatments unless there is a safety concern for the contractor or the military units training in the stands (e.g., maneuver corridors), or unless the treatment is a salvage harvest or clearcut.
- Prescribed Burns: (see Section VI-F for details)
    1. Will not be conducted within 0.5 miles from “known hibernacula” when bats are present during the inactive season (see Table 2 for active season).
    2. Will not occur within forested suitable NLEB habitat during the active season (see PBE Table 2 Below).
    3. Prescribed burns will be conducted under a site specific burn plan per the Installation Integrated Wildland Fire Management Plan
    4. Whenever possible, all efforts will be made to have all flames extinguished and smoke generation minimized by sunset to reduce potential direct impacts to foraging bats during the active season (see PBE Table 2 Below)
    5. Make use of naturally occurring firebreaks or if necessary, establish wet lines 100m around forested known/presumed occupied NLEB habitat during the active season (see PBE Table 2 Below), to preclude fire from entering, to the maximum extent practicable.
  - Specific Single, Group, or Hazard Tree Removal (see Section VI-G for details)
    1. Removal of single, multiple, or cluster of trees during the active season, in areas where there are known roost trees, trees that do not pose a risk to human life or property will be analyzed for signs of bats being present (emergence surveys) prior to removal according to USFWS Indiana bat (and NLEB) summer survey protocols.
    2. If known roost tree removal is determined to be necessary, the applicable IMCOM installation will consult with their local USFWS field office.
    3. If such tree removal is preferred immediately, the applicable IMCOM installation will consult with their local USFWS field office.
    4. If non-ESA bat species are determined present and immediate removal of the tree(s) is necessary, the tree(s) will be removed in a manner that will minimize

- impacts on the bats such as first disturbing the tree(s) to cause them to abandon the roost.
5. If there are hazard trees that are considered an imminent threat to human life or loss of property occurring in suitable NLEB habitat and need to be removed during the active season, the IMCOM installation will remove such trees and inform the USFWS field office of the action only if NLEB are present on the IMCOM installation will initiate emergency consultation per the procedures in accordance with 50 CFR 402.05.
- Pesticide Use: (see Section VI-H for details)
    1. Only pesticides registered by the EPA and State of use may be applied and only in accordance with their label.
    2. Aerial applications will occur outside the active season (see PBE Table 2 Below) and between the hours of sunrise and one hour before sunset. When utilizing helicopters for application they should employ large droplet technology through special nozzles on drop tubes to ensure the herbicide stays on target.
    3. Whenever possible, herbicides that have low toxicity to mammals will be utilized with the tow behind power blowers. Herbicides that may be somewhat toxic to mammals will be mixed and applied at a rate that should minimize any potential exposure concerns.
    4. Application of pesticides from ground mounted vehicles (i.e., ATVs, tractors) that spray chemicals directly onto the ground and do not result in broad dispersal will be conducted at least 100 ft (30 m) from known roost trees during the active season (see PBE Table 2).
    5. Application of pesticides that result in broad dispersal (e.g., tow behind power blowers) will be conducted at least 250 ft (76 m) away from known roost trees during the active season (see PBE Table 2 Below) and will not be applied between sunrise and one hour before sunset.
    6. Location-specific applications (i.e. hatchet or stem injections of trees, individual application to specific plants) may be used within 50 ft (15 m) of known roosts.
    7. Pesticides applied from tow behind power blowers will use appropriate nozzles and drift control additives, and will be applied using low pressure to reduce drift and potential swirling motion from the blower. All efforts will be made to only spray 10 feet from ground level or below.
    8. Pesticides will not be applied outdoors when the wind speed exceeds 8 mi/hr for all applications except power mist blowers. Pesticides applied via power mist blower will only be applied with wind speeds <5 mi/hr.
    9. If a bat colony is found roosting in a building, then insecticides will be used sparingly and no foggers will be used. This will minimize impacts to roosting northern long-eared bats if they are found within a building.
  - Pest Control: (see Section VI-I for details)
    1. No Lethal Control. No lethal control methods are permitted for bats unless there is a suspected human health risk for exposure to rabies or other

disease. If individual bats are in buildings and there is no evidence of maternity use, then all efforts will be made to safely capture and release individual bats. Or, the bats will be excluded by establishing one-way valves over the roost's exit (if feasible).

2. Exclusion will only be done during times of the year when pups are not present or when they are volant (i.e., August - early May). Sealing cracks and crevices in buildings will also be done during the late fall or early spring.
3. No adhesive traps used for rodents or insects will be placed in such a manner that they could capture bats—glue traps will not be placed in any crawl space or attic compartment within buildings or in areas where bats are known to occur.
4. Chemical Measures. Any use of insecticides will be utilized in accordance with the conservation measure associated with "Pesticide Use".

**C) Additional General Conservation Measures.**

1. IMCOM will use the most current National WNS Decontamination Protocols approved by USFWS for planned activities that involve close or direct contact with bats, their environments, and/or associated materials.
2. IMCOM will explore cooperative management efforts with adjacent landowners, if such efforts would complement installation NLEB conservation initiatives and/or support mission implementation.
3. IMCOM will explore cooperative NLEB management strategies, solutions, and efforts with other federal, state, and private organizations and landowners in the region.
4. IMCOM will seek funding opportunities to conduct USFWS presence/absence surveys on individual installations subject to the availability of funds.
5. IMCOM installations will continue to manage their ecosystems to support and enhance military training, testing, & readiness in accordance with their INRMP to retain habitat and biological diversity, and long term sustainability.
6. IMCOM & the USFWS will develop a screening criteria check list so individual installations may quickly and categorically apply the above listed measures described in the programmatic process.
7. IMCOM will centrally report activities taken by individual installations under this programmatic opinion annually to the USFWS from data gathered through the annual AEDB-EQ installation data call.



IMCOM NLEB Programmatic Consultation  
Screening Criteria



## **IMCOM NLEB Programmatic Consultation Screening Criteria**

This document is intended to compliment and facilitate the implementation of the IMCOM Programmatic Consultation by allowing individual installations to screen areas or projects for applicable conservation measures for the NLEB. For all projects purposes screened with this criteria ensure you document the location, size, and disposition for annual reporting.

### **1) Does your area or activity occur within one of the following categories?**

- a. Occurs outside the known range of the NLEB (see Section V for details)
- b. Occurs within the known range of the NLEB but does not occur within 0.5 miles of hibernacula or within 0.25 miles of suitable NLEB summer habitat. (see Section V and the Glossary in Section X for details)
- c. Occurs within a highly developed urban area that is <1000' from suitable NLEB habitat. (see Section V for details)
- d. An area with NLEB verified absence through USFWS Protocol survey(s).
- e. An activity that is conducted under a separate site specific consultation with the local USFWS Field Office.
- f. A military training activity such as but not limited to: air operations, water operations, field training operations, live munitions training, demolition, and research, development, testing, and evaluation (RDTE) that does not utilize smokes, obscurants, or gases. (see Section VI-A for details)
- g. Aircraft activities such as but not limited to: fixed wing, rotary wing, drone, etc...(see Section VI-B for details)
- h. Outdoor recreation such as but not limited to: hunting, fishing, trapping, hiking, mountain biking, camping, horseback riding, wildlife watching, and other consumptive/non-consumptive activities. (see Section VI-J for details)

#### **NO**

Continue to question 2 and all remaining questions.

#### **YES**

No further action is necessary to comply with Endangered Species Act protections for the Northern Long-eared Bat.

### **2) Does your activity utilize military smoke or obscurants?**

#### **NO**

Continue to question 3 and all remaining questions.

#### **YES**

Implement the following applicable conservation measures (see Section VI-C for details), continue to question 3 and all remaining questions.

- 1. M18 colored smoke grenades will not be used within 50m of forested suitable NLEB during the active season (see PBE Table 2 Below). Or within 50m of

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known roost trees during the active season if USFWS protocol surveys have been completed.

2. Fog oil will not be released within forested suitable NLEB habitat during the active season (see PBE Table 2 Below).
3. WP will not be released within 200 meters of forested suitable NLEB habitat during the active season (see PBE Table 2 Below). Or within 200m of known roost trees during the active season if USFWS protocol surveys have been completed.
4. Other smoke/obscurants will not be employed during the NLEB active season (see PBE Table 2 Below).
5. No smoke or obscurants will be released within 0.5 miles of known hibernacula outside of the active season as defined in PBE Table 2 Below.

### **3) Does your activity involve construction?**

#### **NO**

Continue to question 4 and all remaining questions.

#### **YES**

Implement the following applicable conservation measures (see Section VI-D for details), continue to question 4 and all remaining questions.

1. If there is a need to remove a single or small cluster of trees during the active season, the installation will follow procedures listed question 6.
2. Will not occur within forested suitable NLEB habitat during the active season (see PBE Table 2 Below).
3. No known roost trees will be felled, unless there is a human health and safety concern. If there is a need to remove a known roost tree, the installation will follow procedures listed in Section VI.G. to determine if such removal can be done with insignificant or discountable effects on NLEB.
4. Consult with USFWS for projects within 0.25 miles of known roost trees. Buffers may also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas.
5. Implement a 0.5 mile buffer around “known” hibernacula where additional consultation is required.
6. For structure, sign, utility, & bridge maintenance: if needed during the active season, conduct in manner that does not bother roosting bats in any way (e.g., activity away from roosts inside common rooms in structures, normal cleaning and routine maintenance). If needed outside of the active season, conduct in manner that does not alter roosting potential for bats.
7. Tree removal outside the active season (see PBE Table 2 Below), that is entirely within 100’ of an existing road surface has no acreage limit. This would include roads within cantonment, state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)

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8. Tree removal outside the active season (see PBE Table 2 Below), that is >100' of an existing road surface has a 10 acre per project limit.
9. Flagging or signs will be used to demarcate areas to be cleared vs. not cleared prior to any construction activities for a given project. Flagging will be removed upon completion of the project.
10. Via Scope of Works, Contracts, etc., all personnel responsible for construction activities will be informed about the need to follow design plans, stay within flagging, and minimize impacts to wildlife and other environmental concerns.
11. Outdoor Lighting Minimization. For all future projects, IMCOM will evaluate the use of outdoor lighting and seek to minimize light pollution by angling lights downward or via other light minimization measures.
12. Demolition. If the building has pre-existing known NLEB colonies, then the environmental contact of the IMCOM installation must be contacted before demolition is to occur. If during the course of demolition, NLEB are discovered, then all work must cease and USFWS must be immediately contacted. If the structure is safe to leave as is, then it will be left until after October 15, or until bats have stopped using the structure. If the structure is unsafe and poses a risk to human health and safety, IMCOM will attempt to exclude the bats immediately. If this is not possible, or NLEB are found to be using the structure during the maternity season when pups are not volant, IMCOM will contact USFWS to discuss the most appropriate next course of action.
13. Water Quality BMPs will be established for each construction site in accordance with the appropriate federal laws and state permits.

**4) Does your activity involve Forest Management, not including Prescribed Burning?**

**NO**

Continue to question 5 and all remaining questions.

**YES**

Implement the following applicable conservation measures (see Section VI-E for details), continue to question 5 and all remaining questions.

1. IMCOM will screen projects that required tree removal for forest management activities the same as identified for construction.
2. If there is a need to remove a single or small cluster of trees during the active season, the installation will follow procedures listed in that section below.
3. Will not occur within forested suitable NLEB habitat during the active season (see PBE Table 2 Below).
4. No known roost trees will be felled, unless there is a human health and safety concern. If there is a need to remove a known roost tree, the installation will follow procedures listed in Section VI.G. to determine if such removal can be done with insignificant or discountable effects on NLEB.

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5. Implement a 0.25-mile buffer around known roost trees where additional consultation is required for clearcutting or similar harvest. Overstory roost tree removal is also not authorized within 100 meters of documented maternity roost trees without further consultation with the USFWS. Tree thinning/removal will also take into account factors such as the surrounding landscape, habitat connectivity, and distance to other roosts, distance to known foraging areas.
6. Implement a 0.5 mile buffer around “known” hibernacula where additional consultation is required.
7. Tree removal outside the active season (see PBE Table 2 Below), that is entirely within 100’ of an existing road surface has no acreage limit. This would include roads within cantonment, state, local roads, paved roads, and developed hard packed roads, but does not include trails or other travel corridors in training areas)
8. Clear cutting or similar harvest outside the active season (see PBE Table 2 Below), that is >100’ of an existing road surface has a 10 acre per project limit. No acreage limit on selective harvest outside the active season.
9. Flagging or signs will be used to demarcate areas to be cleared vs. not cleared prior to any forest management activities for a given project. Flagging will be removed upon completion of the project.
10. Snag Retention. All snags will be left in silvicultural treatments unless there is a safety concern for the contractor or the military units training in the stands (e.g., maneuver corridors), or unless the treatment is a salvage harvest or clearcut.

### **5) Does your activity involve Prescribed Burning?**

#### **NO**

Continue to question 6 and all remaining questions.

#### **YES**

Implement the following applicable conservation measures (see Section VI-F for details), continue to question 6 and all remaining questions.

1. Will not be conducted within 0.5 miles from “known hibernacula” when bats are present during the inactive season (see Table 2 for active season).
2. Will not occur within forested suitable NLEB habitat during the active season (see PBE Table 2 Below).
3. Prescribed burns will be conducted under a site specific burn plan per the Installation Integrated Wildland Fire Management Plan
4. Whenever possible, all efforts will be made to have all flames extinguished and smoke generation minimized by sunset to reduce potential direct impacts to foraging bats during the active season (see PBE Table 2 Below)
5. Make use of naturally occurring firebreaks or if necessary, establish wet lines 100m around forested known/presumed occupied NLEB habitat during the active season (see PBE Table 2 Below), to preclude fire from entering, to the maximum extent practicable.



**6) Does your activity involve Specific Single, Group, of Hazard Tree Removal?**

**NO**

Continue to question 7 and all remaining questions.

**YES**

Implement the following applicable conservation measures (see Section VI-G for details), continue to question 7 and all remaining questions.

1. Removal of single, multiple, or cluster of trees during the active season, in areas where there are known roost trees, trees that do not pose a risk to human life or property will be analyzed for signs of bats being present (emergence surveys) prior to removal according to USFWS Indiana bat (and NLEB) summer survey protocols.
2. If known roost tree removal is determined to be necessary, the applicable IMCOM installation will consult with their local USFWS field office.
3. If such tree removal is preferred immediately, the applicable IMCOM installation will consult with their local USFWS field office.
4. If non-ESA bat species are determined present and immediate removal of the tree(s) is necessary, the tree(s) will be removed in a manner that will minimize impacts on the bats such as first disturbing the tree(s) to cause them to abandon the roost.
5. If there are hazard trees that are considered an imminent threat to human life or loss of property occurring in suitable NLEB habitat and need to be removed during the active season, the IMCOM installation will remove such trees and inform the USFWS field office of the action only if NLEB are present on the IMCOM installation will initiate emergency consultation per the procedures in accordance with 50 CFR 402.05.

**7) Does your activity involve Pesticide Use?**

**NO**

Continue to question 8 and all remaining questions.

**YES**

Implement the following applicable conservation measures (see Section VI-H for details), continue to question 8 and all remaining questions.

1. Only pesticides registered by the EPA and State of use may be applied and only in accordance with their label.
2. Aerial applications will occur outside the active season (see PBE Table 2 Below) and between the hours of sunrise and one hour before sunset. When utilizing helicopters for application they should employ large droplet technology through special nozzles on drop tubes to ensure the herbicide stays on target.
3. Whenever possible, herbicides that have low toxicity to mammals will be utilized with the tow behind power blowers. Herbicides that may be

somewhat toxic to mammals will be mixed and applied at a rate that should minimize any potential exposure concerns.

4. Application of pesticides from ground mounted vehicles (i.e., ATVs, tractors) that spray chemicals directly onto the ground and do not result in broad dispersal will be conducted at least 100 ft (30 m) from known roost trees during the active season (see PBE Table 2).
5. Application of pesticides that result in broad dispersal (e.g., tow behind power blowers) will be conducted at least 250 ft (76 m) away from known roost trees during the active season (see PBE Table 2 Below) and will be applied between sunrise and one hour before sunset.
6. Location-specific applications (i.e. hatchet or stem injections of trees, individual application to specific plants) may be used within 50 ft (15 m) of known roosts.
7. Pesticides applied from tow behind power blowers will use appropriate nozzles and drift control additives, and will be applied using low pressure to reduce drift and potential swirling motion from the blower. All efforts will be made to only spray 10 feet from ground level or below.
8. Pesticides will not be applied outdoors when the wind speed exceeds 8 mi/hr for all applications except power mist blowers. Pesticides applied via power mist blower will only be applied with wind speeds <5 mi/hr.
9. If a bat colony is found roosting in a building, then insecticides will be used sparingly and no foggers will be used. This will minimize impacts to roosting northern long-eared bats if they are found within a building.

**8) Does your activity involve Pest Control?**

**NO**

Continue to question 9.

**YES**

Implement the following applicable conservation measures (see Section VI-I for details), continue to question 9 and all remaining questions.

1. No Lethal Control. No lethal control methods are permitted for bats unless there is a suspected human health risk for exposure to rabies or other disease. If individual bats are in buildings and there is no evidence of maternity use, then all efforts will be made to safely capture and release individual bats. Or, the bats will be excluded by establishing one-way valves over the roost's exit (if feasible).
2. Exclusion will only be done during times of the year when pups are not present or when they are volant (i.e., August - early May). Sealing cracks and crevices in buildings will also be done during the late fall or early spring.
3. No adhesive traps used for rodents or insects will be placed in such a manner that they could capture bats—glue traps will not be placed in any crawl space or attic compartment within buildings or in areas where bats are known to occur.

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4. Chemical Measures. Any use of insecticides will be utilized in accordance with the conservation measure associated with “Pesticide Use”.

**9) If your activity was not identified through the previous screening questions or cannot be completed within the identified conservation measures, contact your local USFWS Field Office for additional guidance or site specific consultation.**

**Table 2:** Active Season Dates for the Northern Long-eared Bat based on Table 1 of the Northern Long-Eared Bat Conference Guidance (USFWS 2014). Individual IMCOM installations should confirm dates with their local USFWS Field Office.

<b><u>State/Region</u></b>	<b><u>Active Season</u></b>
Alabama	Apr 1-Nov 30
Illinois	Apr 1-Nov 15
Kansas	Apr 1-Nov 1
Kentucky	Apr 1-Nov 15
Massachusetts	Contact FO
Maryland	Contact FO
Michigan	Apr 1-Oct 1
Missouri	Apr 1-Nov 15
New Jersey	Apr 1-Nov 15
New York	Apr 1-Oct 30
Pennsylvania	Contact FO
Virginia	Apr 1-Nov 15
Wisconsin	Apr 1 - Oct 15



## **APPENDIX M**

Eagle Conservation Plan;

APG Standing Operating Procedures

- Eagle Monitoring Surveys
- Response to Eagle Injuries and Mortalities





# **EAGLE CONSERVATION PLAN**

**U.S. Army Garrison  
Aberdeen Proving Ground, Maryland**



**Final**

**August 2015**



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## LIST OF ACRONYMS AND ABBREVIATIONS

%	percent
ACP	Advanced Conservation Practice
ACUB	Army Compatible Use Buffer
APG	Aberdeen Proving Ground
APLIC	Avian Power Line Interaction Committee
BGEPA	Bald and Golden Eagle Protection Act
BRAC	Base Realignment and Closure Act
CFR	Code of Federal Regulations
ECP	Eagle Conservation Plan
ESA	Endangered Species Act
MDDNR	Maryland Department of Natural Resources
U.S.	United States
USFWS	United States Fish and Wildlife Service



## **1. STAGE 1 – SITE ASSESSMENT**

Stage 1 of the Eagle Conservation Plan (ECP) consists of a site evaluation and characterization. This stage is used to evaluate broad geographic areas with regards to important eagle use areas. Potential impacts to resident breeding and non-breeding eagles, and to migrant and wintering eagles are broadly identified. Existing information from literature, databases, and other sources is utilized to judge the appropriateness of potential project sites, taking into account suitability for project development and potential risk to eagles.

### **1.1 Site Evaluation**

The project site is Aberdeen Proving Ground (APG) located in Harford and Baltimore Counties, Maryland. APG is a United States (U.S.) Army installation that encompasses approximately 72,500 acres (113 square miles) of land and water in the northern Chesapeake Bay. The expanse of the installation property allows for research, development, engineering, and testing of all Army materiel including ordnance, weaponry, vehicles, soldier systems, and communication systems. APG is the U.S. Army's oldest active proving ground, and was established in 1917 shortly after the U.S. entered World War I. Since its inception, countless Army systems have been tested for performance and durability at APG including various weaponry systems and all tracked and wheeled vehicles utilized by the U.S. Forces. In addition, APG has served as a center for chemical warfare research and development. From the trenches of France and Belgium in World War I to the desert battlefields of Iraq nearly 80 years later, the research and testing conducted at APG has contributed to the performance, defense, and safety of the U.S. Forces. Because of the Base Realignment and Closure Act (BRAC) of 2005 and other factors, APG has evolved into a major hub of research, development, test and evaluation activity for the joint services. The Army mission at APG is vital to national security. Sustainment of APG's military mission ensures that today's soldiers have the most advanced equipment, systems, and technology possible to succeed at home and abroad.

The installation is geographically divided into two areas, separated by the Bush River (Figure 1). The Edgewood Area is to the west of the river, and the Aberdeen Area lies to the east. The Edgewood Area consists of the Edgewood peninsula, Pooles Island, Carroll Island, and Graces Quarters. The Aberdeen Area consists of the Aberdeen peninsula and Spesutie Island. Additionally, there are several small APG properties that are not connected to the main installation: Churchville Test Area, Atkisson Dam and Reservoir, Van Bibber Water Treatment Plant (WTP), Hanson Reservoir, and Eastern Shore Towers.

This ECP was developed by APG in coordination with the U.S. Fish and Wildlife Service (USFWS), in support of a programmatic permit for take of bald eagles at APG. The proposed activity is not defined as a single action, but rather all the activities that occur at APG that have the potential to disturb or take eagles. Incidental take of bald eagles



at APG is most likely to occur due to collisions with electrical and other man-made infrastructure, and disturbances to nesting eagles from air, land, and water mission activities. In accordance with its 2006 Endangered Species Act (ESA) Section 7 Biological Opinion for bald eagles, APG has implemented a number of conservation measures to reduce eagle mortalities and disturbances. However, due to the on-going military mission and the increasing population of bald eagles, it is unlikely that the incidence of eagle take at APG can be entirely eliminated despite the implementation of minimization measures. Therefore, APG is applying for a programmatic permit for take of eagles under the Bald and Golden Eagle Protection Act (BGEPA). The programmatic permit will authorize incidental eagle take (lethal and nest disturbance), and also potential removal of eagle nests under specific conditions. Therefore, APG's programmatic permit will be a combination permit authorized under Title 50 Code of Federal Regulations (CFR) Part 22.26 (incidental take) and Part 22.27 (nest removal). The programmatic permit will supersede APG's 2006 Biological Opinion, terms and conditions, and ESA incidental take allowance.

## **1.2 Site Characterization**

Located on the western shore of Maryland in the northern Chesapeake Bay, over half of APG is comprised of water or wetlands. With approximately 135 miles of shoreline, much of it forested, APG has played a significant role in the regional recovery of bald eagles. APG is located within the Upper Bay Bald Eagle Concentration Area, one of several concentration areas for bald eagles in the Chesapeake Bay (Watts and Mojica 2009a). This concentration area supports resident breeding and non-breeding eagles, and also migratory eagles from the northeastern and southeastern territories of the U.S. and Canada. At least 1,500 breeding pairs of eagles inhabit the Chesapeake Bay (Craig Koppie, USFWS, pers. comm.). APG attracts a disproportional number of eagles within the concentration area, because the installation has largely undeveloped forested shorelines with abundant food resources in the surrounding rivers and Bay. In addition, many of these shoreline areas have restricted access with little human activity. These shorelines provide optimal habitat for foraging, roosting, and nesting bald eagles. Eagles can be expected to utilize other small pockets of less developed areas in the northern Bay, such as the Sassafras River to the east of APG (3 miles from installation eastern boundary) and the lower Susquehanna River to the north of APG (5 miles from installation northern boundary). However, residential and commercial development of surrounding shorelines in the northern Chesapeake Bay continues to drive an increasing number of eagles to APG.

## **2 STAGE 2 – SITE SPECIFIC SURVEYS AND ASSESSMENTS**

Stage 2 of the ECP consists of the collection of site specific quantitative data through scientifically-based surveys and assessments. The data identify any important eagle use areas or migration concentration sites that fall within or close to the project footprint. In addition, the data allow for an estimation of the eagle exposure rate within the project footprint.

### **2.1 Important Eagle Use Areas**

APG has monitored the bald eagle population on the installation since the mid-1970s utilizing population surveys, roost surveys, and nest surveys. These surveys have been supplemented with an extensive three-year eagle movement study using satellite telemetry. These efforts have resulted in a comprehensive database of eagle movement, population dynamics, and productivity on APG that also provides a broader understanding of eagle dispersal/movement and roost behavior throughout the Chesapeake Bay.

#### **2.1.1 Foraging and Loafing Areas**

Bald eagles generally use shoreline areas with suitable trees for perching, as areas for daytime foraging and loafing. The size of a local eagle population can be roughly estimated by surveying the shorelines. To this end, APG conducts an annual Mid-Winter Bald Eagle Survey as a cooperative effort with the Maryland Department of Natural Resources (MDDNR). The mid-winter survey is part of a national survey, and is typically conducted during a two-week window in early January. APG's annual survey route is conducted by helicopter and includes the shoreline and tributaries of APG, and also the off-Post shoreline of the Susquehanna River north to the Exelon Peach Bottom (Pennsylvania) power plant. The data collected from the survey help to identify long-term population trends and distributions of eagles. This information is critical to effectively implementing APG's bald eagle management and compliance program. APG provides the annual data to the MDDNR, who then compiles all the data collected within the state to estimate the region-wide bald eagle population. These mid-winter counts are only a "snap shot" and are dependent on a number of factors including annual productivity, and local, regional, and broader weather conditions which can trigger earlier or later migrations of northern eagles from Canada and the northeastern U.S. In addition, the survey route is limited to the major shorelines and does not extend inland; therefore, eagles loafing along smaller inland creeks may not be counted.

APG developed a standardized protocol for the mid-winter count to allow for year-to-year comparisons of data. APG's database (1986-present) is one of only two historic collections of mid-winter bald eagle population data in Maryland. APG's data have indicated an increase in the population of eagles on APG and the surrounding areas since the early 1980s, but a general stabilization of numbers in recent years (Table 1). The mid-winter surveys continue to confirm large numbers of eagles utilizing

**Table 1: Cumulative Mid-Winter Bald Eagle Survey Data**

Year	Day	Number of Bald Eagles Counted						Total Number of Bald Eagles
		Aberdeen Proving Ground			Susquehanna River			
		Adult	Subadult	Total	Adult	Subadult	Total	
2013	6-Jan	144	59	203	24	1	25	228
2012	8-Jan	104	53	157	27	12	39	196
2011	9-Jan	88	51	139 (+1 GE)	13	10	23	162 (+1 GE)
2010	10-Jan	117	80	197	25	17	42	239
2009	Survey not conducted (helicopter not available)							
2008	12-Jan	93	39	132	20	7	27	159
2007	7-Jan	71	29	100	19	7	26	126
2006	8-Jan	106	58	164	45	19	64	228
2005	9-Jan	145	61	206	23	9	32	238
2004	11-Jan	73	54	127	33	21	54	181
2003	12-Jan	135	91	226	16	7	23	249
2002	13-Jan	60	14	74	27	16	43	117
2001	26-Jan	103	85	188	30	21	51	239
2000	9-Jan	57	25	82	40	31	71	153
1999	10-Jan	67	58	125	13	13	26	151
1998	11-Jan	60	19	79	30	29	59	138
1997	12-Jan	80	43	123	17	12	29	152
1996	21-Jan	92	47	139	19	8	27	166
1995	15-Jan	70	31	101	16	5	21	122
1994	9-Jan	26	36	62	22	9	31	93
1993	17-Jan	40	23	63	14	4	18	81
1992	12-Jan	49	40	89	15	8	23	112
1991	13-Jan	26	20	46 (+1 GE)	12	7	19	65 (+1 GE)
1990	14-Jan	111	67	178	2	2	4	182
1989	15-Jan	61	40	101	not surveyed due to fog			101
1988	10-Jan	27	24	51	18	18	36	87
1987	11-Jan	24	13	37	6	8	14	51
1986	11-Jan	35	29	64	0	0	0	64
1985	13-Jan	19	28	47	not surveyed			47
1984	7-Jan	30	62	92	not surveyed			92
1983	9-Jan	11	28	39	not surveyed			39

GE=Golden Eagle

nearly all forested shorelines of APG. The densest concentrations of eagles are routinely observed along the shorelines of the Bush River, Spesutie Island, and Pooles Island.

### **2.1.2 Roosting Areas**

Non-breeding eagles are typically gregarious and establish communal roosts (areas where eagles gather and perch overnight). Communal roosts are typically isolated from human disturbance, contain sustainable substrate for roosting, positioned in areas protected from harsh weather, and have a clear movement corridor between the roost and primary foraging areas. A number of communal roost areas have been identified on APG through ground surveys and satellite telemetry data. APG has identified several core (year-round) roosts as shown in Figure 2. These core roosts are located further inland than the shoreline foraging and loafing areas, and include Coopers Creek, Mosquito Creek, Woodrest Creek, and three roosts along Romney Creek. Numerous ancillary (seasonal) roosts also exist along the wooded shorelines of the installation. The satellite telemetry data indicated that eagles at APG move in and out of roost areas throughout the day, and may not utilize the same nighttime roost area from night to night (Watts and Mojica 2009b). This network of core and seasonal communal roost areas is dynamic and can change over time depending on factors such as distribution of prey, loss of perch trees, or other changes to the habitat.

### **2.1.3 Nesting Areas**

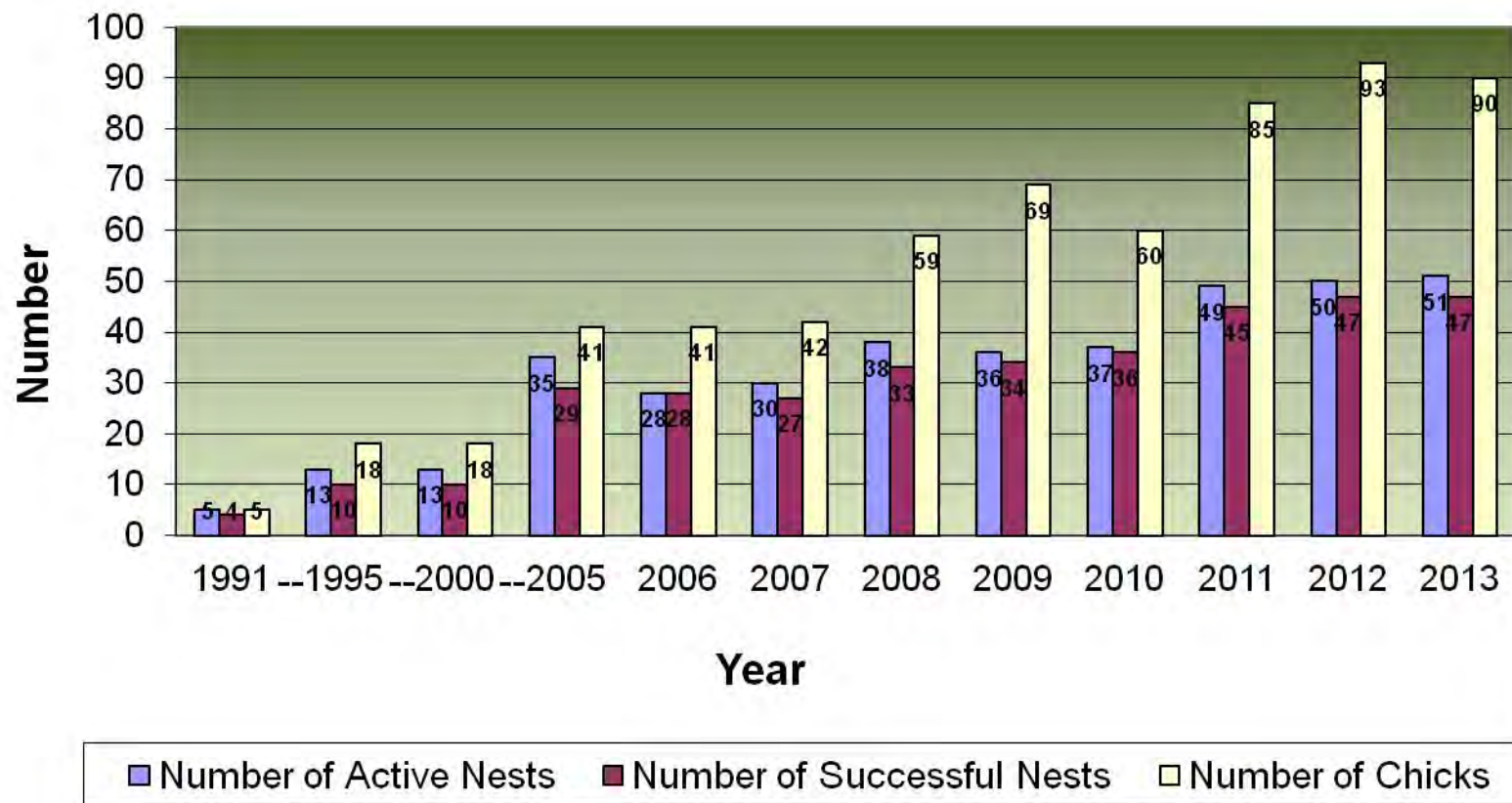
Bald eagles exhibit high nest fidelity and nesting territories are often used year after year. The majority of the nests on APG are located in large trees with a clear view of shoreline foraging areas, or if located further inland, within one mile of a suitable foraging area.

APG conducts a series of nest surveys by helicopter each breeding season. These surveys identify new nests, fallen nests, numbers of eggs and chicks, and confirm fledging. The aerial surveys are supplemented by ground observations. APG conducts the nest surveys in accordance with a standardized protocol developed by APG and following recommendations from the USFWS's Chesapeake Bay Field Office. The surveys have documented a tremendous increase in the number of breeding pairs of eagles on APG. In 1977, APG had only one known nesting pair of eagles. The number of breeding pairs increased to five by 1991. In 2013, APG had close to 50 active nests that fledged a total of 90 chicks (Figure 3). Since 2006, the APG nesting population (measured as number of active nests) has nearly doubled. The productivity (measured as total number of chicks fledged) has more than doubled in the same time period. Increased productivity is due in part to an increased frequency of "triplets" (three chicks in nest), from 0 percent in 2005 to an average of 19 percent of active nests in the past three years (2011-2013) (see Table 2 below). Overall, the number of chicks per active nest at APG has increased from 1.17 in 2005 to 1.76 in 2013. This increased fecundity is indicative of a robust breeding population at APG that is benefitting from the abundantly available food resources.



Figure 2 (APG Bald Eagle Nests and Roosts) is available for review at the office of:

DPW Environmental Division  
Natural Resources Branch  
Building E5183 Blackhawk Road, Room 213  
Aberdeen Proving Ground, Maryland 21010  
Phone: 410-436-0465



**Figure 3 APG Bald Eagle Nest Productivity**

Table 2: Number of Triplet Bald Eagle Nests Per Season at APG

Year:	2005	2006	2007	2008	2009	2010	2011	2012	2013
Active Nests:	35	28	30	38	36	37	49	50	51
Sets of Triplets <sup>(a)</sup> :	0	2	1	3	7	3	9	11	8
Triplet Frequency <sup>(b)</sup> :	0%	7%	3%	8%	19%	8%	18%	22%	16%
Chicks/Active Nest:	1.17	1.46	1.40	1.55	1.92	1.62	1.73	1.86	1.76

(a) Documented triplets, regardless if one or more chicks lost

(b) Triplet Rate = (# Sets of Triplets) / (# Active Nests)

On APG, nesting habitats which for many years contained only a single active nesting pair are now known to contain two or more pairs in very close proximity (USFWS 2006). In 2006, the mean inter-nest distance (that is, the mean nearest-neighbor distance between simultaneously occupied nests) was 1,560 meters (0.97 miles) (APG 2007). As of 2013, the mean distance for APG nests is 1,277 meters (0.79 miles). APG has several overlapping nesting territories each with a pair of nests only 300 to 600 meters apart (less than 0.5 miles). Inter-nest distances are likely much shorter at APG than for other nests in the region. With the establishment of more compressed territories, many eagle pairs at APG have developed a tolerance to routine and on-going mission activities and noise, with some pairs building nests and raising young within 200 meters of active range areas. Locations of eagle nests at APG for the 2013 nesting season are shown in Figure 2. APG currently tracks approximately 70 nests (active and inactive).

## 2.2 Eagle Exposure Rate

The available data indicate that APG supports a convergence of three populations of bald eagles: year-round residents, northern migrants, and southern migrants. It is estimated that a few hundred eagles are on APG at any one time, and that at least several hundred eagles utilize the installation throughout the year. The number of eagles on the installation is estimated to be highest during the winter months (January-March) and the summer months (June-July) due to influx of northern and southern migrants, respectively (Watts and Mojica 2009b). The downrange areas of the installation generally have the highest eagle activity. The downrange areas are less developed than the cantonment areas and support the majority of the nests and roosts. However, with the expanding population of eagles, there is potential for interactions between eagles and military mission throughout the installation. It is worthy to note that wintering golden eagles are seen in the northern Chesapeake Bay region, including APG, but not in any large numbers.

An eagle exposure rate is not readily calculable (or applicable) given the size of the installation, the varied land uses by the Army, and the dynamics of an expanding eagle population. It is expected that incidental take of eagles will continue at APG in the form of lethal take and nest disturbance, despite the implementation of conservation measures. The number of historic takes at APG will be used in Stage 3 of this ECP to predict an annual take level for the next five years.

Due to the expanding eagle population and limiting habitat, it is expected that new eagle pairs will continue to pursue less than optimal habitats (including man-made structures) to establish nest territories. Some of these new nests may directly conflict with mission operations and/or pose a risk to human or eagle safety. For this reason, it is likely that APG may require removal of a nest or nests within the next five years in accordance with Title 50 CFR Part 22.27.

Based on the information gathered in Stages 1 and 2, the mortality/disturbance risk to eagles at APG is considered to fall within Category 2. As defined by the USFWS, Category 2 is high or moderate risk to eagles with opportunity to minimize/mitigate impacts.

### 3 STAGE 3 – PREDICTED EAGLE FATALITIES AND DISTURBANCES

Stage 3 of the ECP uses the data from Stage 2 to predict eagle risk, as average number of fatalities per year, extrapolated for the duration of the permit. Risk of disturbances to eagles is also determined in Stage 3.

#### 3.1 Predicted Eagle Fatalities

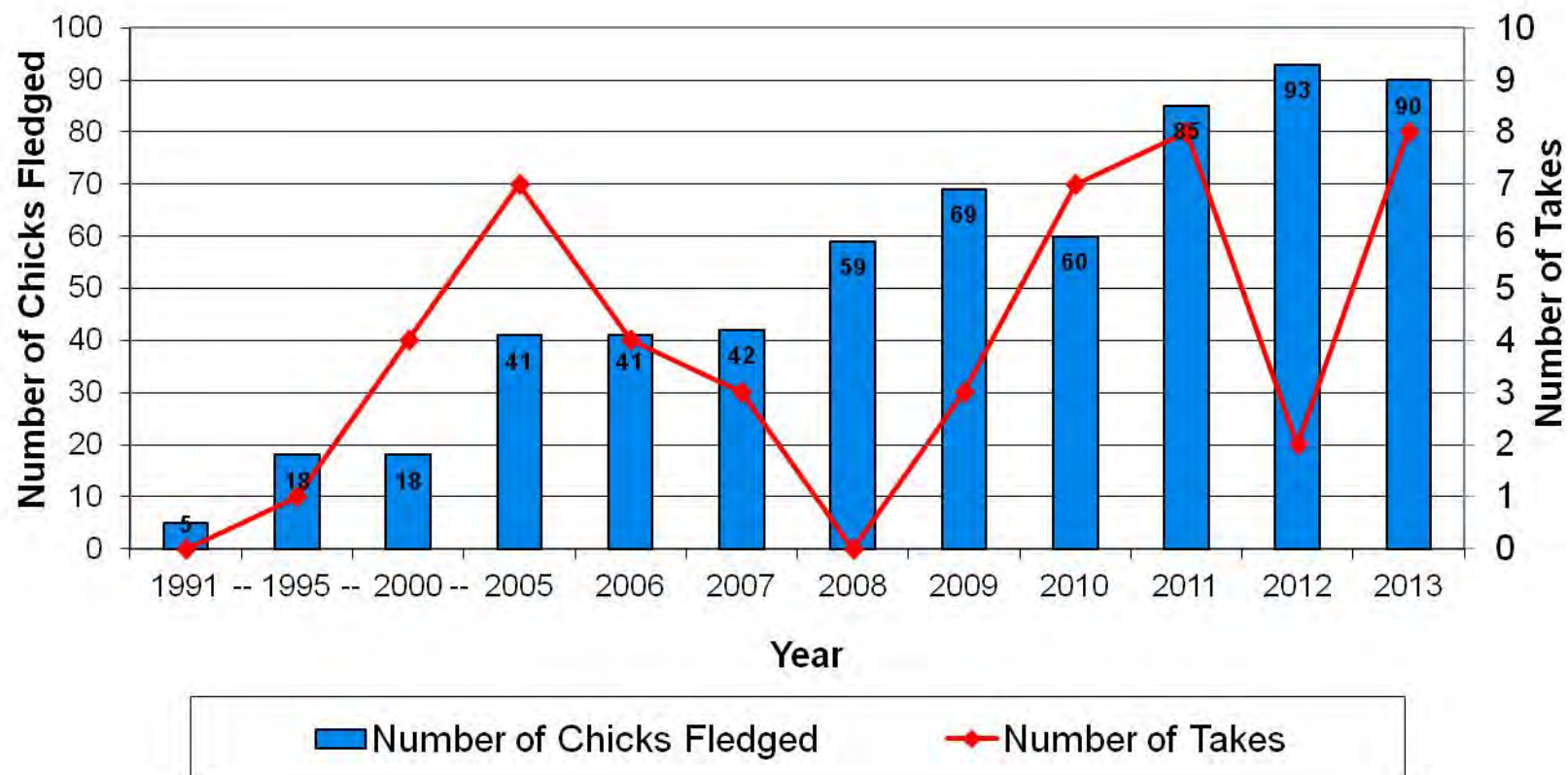
In compliance with APG's 2006 Biological Opinion, APG implemented a number of conservation measures to reduce eagle mortalities and disturbances (see discussion of existing conservation measures in Section 4). However, incidental take of eagles has not been entirely eliminated due to the on-going military mission and the increasing population of bald eagles at APG (Figure 4). Since issuance of the Biological Opinion, APG has had an average of 4.4 bald eagle takes (mortalities) per year (2006-2013). Nearly all of these takes (91 percent) were line strikes where the eagle flew into an overhead power line and was killed outright, or died later, due to electrocution and/or blunt force trauma. The remaining takes consisted of a collision with an aircraft, an impalement on a lightning rod, and a drowning in a containment structure/box.

Since 2009, the annual number of takes at APG has increased. There were three takes in 2009, seven takes in 2010, and eight takes in 2011. While the number of takes decreased to two in 2012, the number of takes increased again to eight in 2013.

The number of eagles removed from the population (takes) can be compared to the number of eagles added to the population (chicks fledged), by expressing takes as a percentage of the fledgling population. From 2006 to 2013, percentage of takes ranged from 0 percent in 2008 to 11.7 percent in 2010 (Figure 5). An extrapolation of this take data (2006-2013) estimates a gradual increase in takes, with an annual take of 7.2 percent by 2019 (80 percent confidence interval of 5.0-9.5 percent, see Appendix). Take data prior to 2006 was excluded from the prediction model, because APG had not fully implemented protective measures for eagles until 2006.

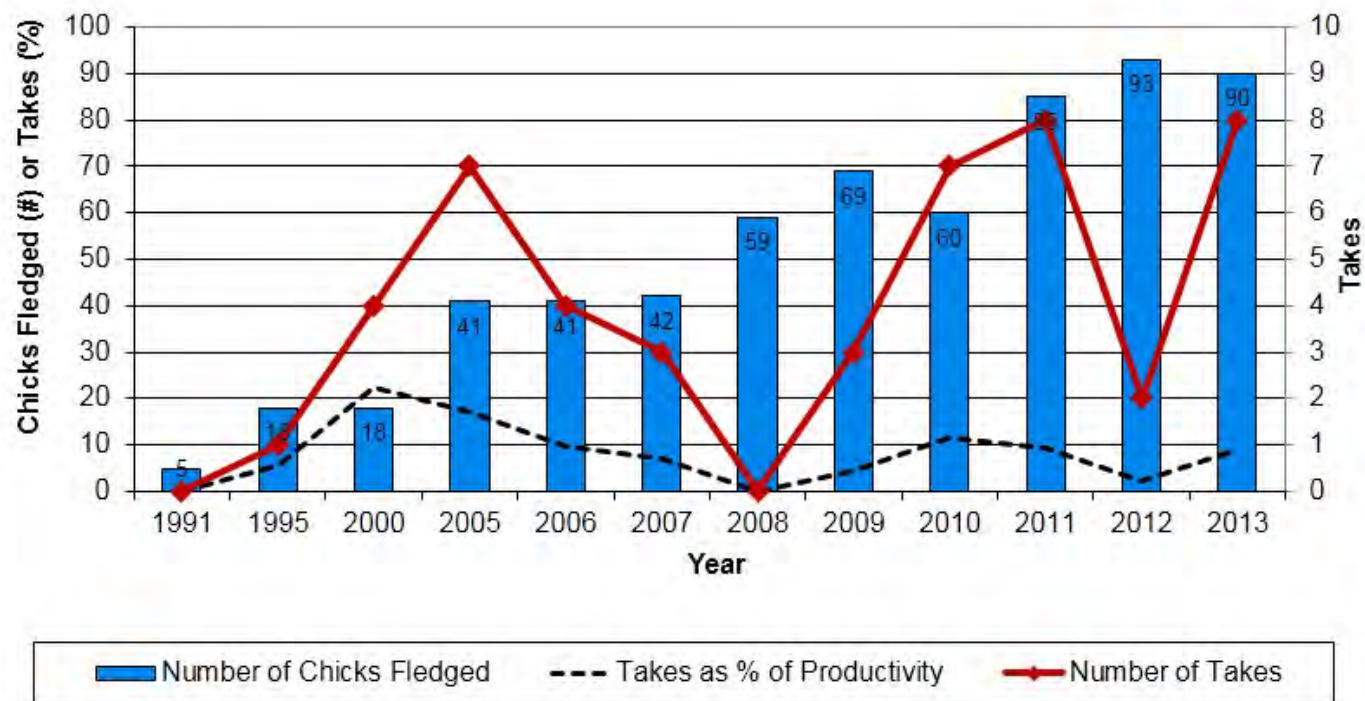
In order to predict the number of eagles equating to 7.2 percent of the population, a regression is performed on the population data. An extrapolation of the population data (expressed as number of chicks fledged) from 2006 to 2013 predicts 142 fledglings (80 percent confidence interval of 139-146, see Appendix) added to the population in 2019. A predicted take of 7.2 percent of 142 fledglings equates to 10.2 birds, or 13.9 birds as a worst case scenario using the 80 percent upper confidence limits (9.5 percent of 146 fledglings).

These extrapolations assume a linear increase in takes and productivity over the next five years. This may prove to be an over-estimation of predicted take/productivity, especially if the population of eagles at APG reaches a stable carrying capacity within the next five years. Currently, there is no evidence to support that APG has reached its carrying capacity for breeding bald eagles. While the population has appeared to



**Figure 4 APG Bald Eagle Productivity and Take**





**Figure 5 APG Bald Eagle Take as Percent of Fledgling Population**

plateau for the last 3 years (2011-2013), a similar plateau was observed in 2005-2007 and in 2008-2010, with each 3-year time period followed by a significant increase in the nesting population. Even if the number of nests does not substantially increase over the next five years, it is still possible that the number of chicks per nest will continue to increase.

An increasing number of line strikes is believed to have resulted from intraspecies interactions (fights between eagles over prey items or territory). For example in 2011, a dead immature eagle was found under an overhead power line. The eagle had puncture wounds on the toes and feet, and feathers clinging to one of the talons. Similarly in August 2013, two dead immature eagles were found under overhead power lines with the remains of a fish in the talons of one of the eagles. APG has also documented increased aggression between eagles and ospreys, which can result in one or both birds striking an overhead line. APG has an expanding population of ospreys. Ospreys are seasonal inhabitants of APG and the Chesapeake Bay area, returning to the region in early March and remaining into October when they begin their migration south for the winter. Though the breeding seasons of the two species are slightly off-set, APG has seen increasing frequencies of interspecies aggression related to nesting and foraging territories. APG has noted instances of ospreys harassing eagle pairs that have a nest in close proximity to an osprey nest. Additionally, ospreys often harass foraging eagles, swooping down to try to dislodge a prey item from the eagle's talons. In 2010, APG captured an injured eagle on the ground that was being harassed and chased by a nearby pair of nesting ospreys. The frequency of both intra and interspecies aggressive incidents will likely continue to increase as the two populations compete for eventually limiting food resources and territory.

### **3.2 Predicted Nest Disturbances**

Under the 2006 Biological Opinion, APG was granted a nest disturbance allowance of up to three nests per year, each nest containing up to three eggs or chicks, due to incidental disturbance. Since 2006, APG has had no nest disturbances. However, new eagle pairs continue to construct new nests in close proximity to installation activities. In addition, APG's military mission continues to evolve due to immediate in-theatre needs, BRAC, and other factors.

### **3.3 Summary of Proposed Incidental Take**

Based on the predicted levels of take discussed above, APG proposes the following incidental take allowance for the programmatic permit:

1. Incidental Lethal Take – Up to 12 bald eagles per calendar year due to collisions with electrical and other man-made infrastructure, collisions with ground and aerial vehicles (both manned and un-manned), and other unforeseen impacts resulting incidentally to mission activities, that result in death of the eagle or its permanent removal from the wild population
  - Proposed take is mid-point between predicted take (10 eagles) and worst case scenario (14 eagles) and is justified by the fluctuation of takes from year to year, continued competition with other raptors (ospreys), and the

uncertainty if the eagle population will continue to increase. Proposed take is higher than previous allowance under 2006 Biological Opinion, and is justified because APG's eagle population has nearly doubled since 2006.

2. Incidental Nest Disturbance – Up to 3 bald eagle nests per calendar year with minimization measures, due to incidental harassment of adults leading to abandonment of nest and loss of productivity for the given year, inclusive of eggs and young
  - Proposed take is unchanged from previous allowance under 2006 Biological Opinion.

Mortalities, injuries, and nest disturbances that are attributable to natural causes will not count against the permitted incidental take allowance. APG will report all eagle mortalities, injuries, and nest disturbances (incidental take and natural causes) to the USFWS, as discussed in Section 5.

### **3.4 Nest Removals**

No eagle nest has ever been removed at APG. However, due to the expanding eagle population and the on-going military mission, APG may have a need in the next five years to remove an eagle nest or nests. As eagle density continues to increase, eagle pairs are moving towards less optimal habitat to establish new nesting territories. In 2007, an eagle pair constructed a nest on the top of a man-made tower that was located in a near direct line of fire. In 2011, an eagle pair constructed a nest in the direct flight path utilized by an airfield. Both of these nests negatively impacted mission activities, and reduced mission capabilities. Both nests have since fallen from the trees naturally, and the eagle pairs have not returned to the sites. Should either of these sites become occupied again by an eagle pair, APG will coordinate with the USFWS for the removal of the nest. Other nests may arise in unforeseen locations which may also require removal in the next five years.

All nest removals will be coordinated in advance with the USFWS, and all removals will be in accordance with Title 50 CFR Part 22.27. A nest requested for removal will fall into one of the following categories (Title 50 CFR Part 22.27):

1. An active or inactive nest where removal is necessary to alleviate a safety emergency
  - For example, a nest located in a flight path that increases the risk of collision between aircraft and eagles, and jeopardizes the safety of aircraft, pilot, and crew
  - Chicks and viable eggs from an active nest must be immediately transported to a qualified rehabilitation facility permitted to care for eagles
2. An inactive nest where removal is necessary to ensure public health and safety

3. An inactive nest that is built on a man-made structure and creates a functional hazard that renders the structure inoperable for its intended use
4. An inactive nest where removal protects a local interest and the activity necessitating the removal, or the mitigation for the removal, with reasonable certainty provides a clear and substantial benefit to eagles
  - For example, removing a nest in order to bury overhead power lines, or removing a nest located in the only feasible site for a new testing or training range (with mitigation)
  - Mitigation measures could include securing an off-Post conservation easement in documented eagle nesting habitat

Each proposed nest removal will be evaluated by APG, in coordination with the USFWS, to ensure that all reasonable avoidance measures have been implemented and that the nest removal will not adversely impact the installation's breeding population. For the purpose of this discussion on nest removals, an "inactive" nest is defined as a nest not currently being used by eagles as determined by the continuing absence of any adult, egg, or dependent young at the nest for at least ten consecutive days immediately prior to, and including, at present. A nest removal action must include trimming of suitable nest supporting limbs in the nest tree, or altering of the man-made structure, to prevent attempts by eagles to re-build the nest. APG will report all eagle nest removals to the USFWS, as discussed in Section 5.

## **4 STAGE 4 – AVOIDANCE AND MINIMIZATION OF RISK AND COMPENSATORY MITIGATION**

Stage 4 of the ECP is development of proposed advanced conservation practices (ACPs) to avoid or minimize predicted eagle risks at the project site. A cumulative effects analysis is conducted by the USFWS in Stage 4 to determine if local and regional thresholds for eagle take are exceeded. The cumulative effects analysis is based on impacts from all permitted take within the locality/region. Compensatory mitigation may be warranted at the end of Stage 4, if projected take exceeds the local and/or regional thresholds.

### **4.1 Existing Conservation Measures**

As a requirement of APG's 2006 Biological Opinion, APG implemented a number of conservation measures to avoid and minimize eagle mortalities and disturbances. These measures included:

- Line Burial – APG spent \$11.6 million to bury nearly six miles of overhead power lines on Spesutie Island from 2006 to 2014. This portion of the installation had the highest frequency of eagle mortalities as a result of line strikes. Spesutie Island (located in the northeastern portion of APG, see Figure 1) is surrounded by the Chesapeake Bay and has dense eagle activity including foraging, nesting, and sheltering sites. Line burial has also been incorporated into new projects that are located close to shoreline foraging areas. Line burial has been the most effective measure to eliminate line strikes at APG, but also the most expensive. Due to the very high costs of implementation, it is not feasible to bury all overhead lines at APG.
- Avian Deterrents/Protective Devices – APG spent \$3.6 million to retrofit electrical infrastructure with avian deterrents and protective devices following the Avian Power Line Interaction Committee (APLIC) best practices guidelines (APLIC 1994; 2012). The retrofits included installing perch excluders on cross arms; insulating covers on wires, conductors, jumper wires, cutouts, and bushings; and spinning reflective flight diverters and high-visibility spheres on overhead power lines. Eagles are killed by exposed electrical lines in two functionally different ways. The first (pole electrocution) occurs when an eagle perches on a utility pole cross arm and is electrocuted when different body parts touch elements that complete the electrical circuit. The second (line strike) occurs when eagles fly into exposed wires and are either killed by the trauma of striking the wires or are electrocuted when their wings complete a circuit between two wires. The installation of avian deterrents and protective devices on electrical infrastructure has been a cost effective measure that significantly reduces the number of eagle mortalities on APG. The deterrents and devices are nearly maintenance-free, except for the spinning flight diverters which need periodic replacement as the swivel assemblies fail. Several versions of the diverters have been field tested at

APG, and the latest version (FireFly™ FF) with a large stainless steel ball bearing swivel has proven to be the most durable.

- Movement Study – APG spent \$2.2 million to conduct a three-year eagle movement study using satellite telemetry. Satellite transmitters were deployed on 63 bald eagles trapped on APG between 2007 and 2009. The transmitted data (collected between 2007 and 2011) were used to further understand movement patterns of eagles (including resident and migrating eagles) that utilize APG. Foraging areas and core and seasonal roost areas were delineated, along with movement corridors. This information is critical to a successful management program for bald eagles on APG. Telemetry data combined with traditional ground monitoring allows APG to evaluate effects of mission activities on eagle movement and behavioral patterns.
- Nest Cameras – APG spent \$200,000 on the installation of remote cameras on six bald eagle nests on APG. Video footage combined with ground observations is used to monitor the eagles during nesting season. The live-feed video footage is used to evaluate, in real-time, the effects of mission activities on the nesting eagles.
- Nest Study – APG conducts comprehensive annual bald eagle nest studies. A standardized protocol was developed by APG and is used to conduct nest surveys. The use of a standardized protocol ensures consistent collection of data that allows for year to year comparisons of nest productivity. The nest studies incorporate both aerial (overflight) and ground observations. The results of the nest studies confirmed a continued increase in the annual productivity of eagles at APG.
- Monitoring During Mission Activities – In addition to population and nest surveys, APG conducts ground observations to monitor eagles during mission activities. Biologists are able to observe eagle behavior, communicate directly with activity coordinators, and if needed, immediately halt potentially disturbing mission activities. Monitoring is an effective protective measure at APG that also ensures the success of various mission activities including range firing, shoreline training, and environmental remediation.
- Restrictive Buffers – APG implemented 500-meter protective buffers around bald eagle nests. Within these buffers, human activity is restricted during nesting season, and habitat altering activities (land clearing, construction, and/or development) are limited year-round. Similar buffers are also implemented around core communal roosts. Maintaining protective buffers minimizes direct impacts of mission activities on eagles.
- Revised Management Plan – APG revised the eagle management component of its Integrated Natural Resources Management Plan (INRMP) to incorporate the avoidance and minimization measures required by the 2006 Biological Opinion.



The plan outlines management strategies, coordination, reporting requirements, and employee training.

All of the above mentioned conservation measures have proven to be successful at reducing mortalities and minimizing disturbances to bald eagles at APG. These measures represent the best available management practices. The value of these conservation measures is evident in the thriving eagle population at APG.

Additionally, APG has an Army Compatible Use Buffer (ACUB) program. This program establishes buffer areas around Army installations to limit effects of encroachment and maximize land inside the installation that can be used to support the installation's mission. By working in partnership with conservation organizations, ACUBs can greatly enhance habitat conservation planning at the ecosystem level to ensure that greater benefits are realized towards species and habitat protection. APG's ACUB targets land conservation along shorelines of the northern Chesapeake Bay. These shorelines (particularly the eastern shorelines of Cecil and Kent Counties) are areas of high bald eagle activity, as supported by the data generated from the eagle movement study. APG is working with its conservation partners to encumber off-site land adjacent to, or ecologically adjacent to, the installation to limit development pressures, protect forested shoreline habitat, and ultimately benefit the bald eagle population.

#### **4.2 Proposed Conservation Measures (ACPs)**

ACPs are defined as scientifically supported conservation measures that avoid or minimize eagle risks to the maximum extent achievable, so that remaining take is unavoidable. Currently, the USFWS has no approved advanced conservation practices. Therefore, any advanced conservation practices proposed at this stage will be termed "experimental."

APG proposes a tiered application of experimental ACPs under the programmatic permit. The experimental ACPs would avoid or reduce eagle take to the maximum extent possible where remaining take is unavoidable, include adaptive management strategies, and promote conservation benefits. Tier 1 experimental ACPs are considered required measures to be implemented immediately. Tier 2 experimental ACPs are optionally implemented for proactive conservation benefits. The proposed experimental ACPs are listed below.

**TIER 1:** APG will implement the following five experimental ACPs immediately. Implementation of these measures is expected to reduce take to a level where remaining take is unavoidable.

**1. Management Plan – APG will continue to operate in accordance with its eagle management component of the INRMP.**

- APG will revise the eagle management component of its INRMP to reflect the programmatic permit and experimental ACPs.

2. **Adaptive Management** – APG will adaptively manage the eagle population on the installation to address allowable activities in the vicinity of eagle use areas.
  - Adaptive management promotes flexible decision making that can be evaluated and adjusted based on outcomes of management actions and other events. APG will utilize its standard operating procedures for environmental reviews of all installation projects and adaptively manage project details to address allowable activities based on information obtained from existing eagle monitoring measures.
3. **Avian Deterrents/Protective Devices** – APG will continue to periodically inspect and replace (if needed) the avian deterrents and protective devices on the electrical infrastructure.
  - Avian deterrents and protective devices include spinning reflective deterrents (FireFly™ FF) on wires; elevated perches or perch excluders on cross arms; and insulating covers on wires, conductors, cutouts, and bushings. Inspections and replacements (as needed) would occur at least annually as addressed in the eagle management component of the INRMP. Alternative marking devices for the power lines may be employed as long as the alternatives are as or more effective than the FireFly™ FF units in reducing line strikes.
4. **Line Burial** – APG will bury overhead power lines, where feasible and as funds allow, to reduce the potential of eagle mortalities due to line strikes.
  - Sections of existing overhead lines that can be feasibly buried will be prioritized for burial based on areas of densest eagle activity, occurrence of line strikes, and availability of funding. Additional eagle movement and mortality data have been collected by APG since 2006; therefore, the selected areas may not necessarily correspond to those areas identified in the 2006 Biological Opinion. Priority areas will be identified in the eagle management component of the INRMP. Given the very high costs associated with burying overhead lines, line burial will only be considered after other minimization measures such as avian deterrents/protective devices have proven ineffective.
5. **Biological Studies** – APG will continue to conduct annual population and seasonal nest surveys to monitor the stability and productivity of the installation's eagle population. Surveys will include a population overflight in early January (to coincide with the national Mid-Winter Eagle Count) and nest overflights in late January, early March, early April, and early May. If necessary, an additional nest overflight may be conducted in mid-May.

- Surveys will follow standardized protocols developed by APG to allow for year-to-year comparisons of data. These surveys will incorporate both ground and aerial observations. The data collected will contribute to the long-term research at APG to help identify regional and long-term population trends, distributions, and nesting success.

**TIER 2:** At the Army's discretion, APG would optionally implement the following two experimental ACPs for proactive conservation benefits.

**6. Forest Stand Improvements – APG will conduct forest stand improvements to help ensure the sustainability of habitat for bald eagles, while sustaining the testing and training landscape required by the military mission.**

- In 2012, APG lost over ten percent of the nest trees due to storms and natural degradation, occurrences indicative of declining forest health. It is important to the long-term sustainment of the breeding eagle population that these large canopy trees be replaced (either through natural re-generation or plantings). Unfortunately, deer pressure and invasive Japanese stiltgrass have limited the natural regeneration of oak, hickory, beech, and tulip poplar at APG.
- The forest stand improvements would target existing forest stands that show degraded habitat quality, that exhibit high eagle activity, and that do not directly conflict with existing range mission activities. The forestry work would not establish new habitat which could potentially attract even more eagles to APG. Improvements would be made in areas unlikely to create additional risk to eagles from potential line strikes or other mission conflicts. The forest stand improvements would be conducted in eagle use areas, defined as having a documented nesting, roosting, and/or foraging area. The forest stand improvements would enhance native species diversity (oak, hickory, beech, and tulip poplar), decrease invasive species, and provide for long-term forest sustainability.
- APG's forest management component of the INRMP outlines silvicultural prescriptions implementing forest improvement for each of its 580 forest stands. This landscape-level planning specifies annual actions designed for improving overall forest health, eagle habitat, and mission landscape by increasing natural regeneration, reducing the impact of invasive species, "jump starting" desired species composition through tree plantings, increasing biodiversity in existing monocultures, and moving towards uneven-aged forest structure. Silvicultural prescriptions include using tree planting in existing or created canopy gaps and/or individual tree planting within existing stands with no natural regeneration, mechanical removal of invasive species and vines in concert with pinpoint herbicide application, tree girdling, overstocked stand thinnings to increase crown size on mature trees, duff and soil disturbance to increase natural regeneration, and tubing natural regeneration of desirable species until above deer browse line.

- These proactive efforts to improve forest stands would be credited towards APG's conservation efforts for eagles. Potential conservation credit from a forest stand improvement effort will include: 1) enhancement of nesting habitat as mitigation for a nest removal, and 2) enhancement of roosting habitat as mitigation for a roost disturbance. APG would develop a Memorandum of Agreement (MOA) with the USFWS to specify how forest stand improvements would be credited towards eagle conservation. APG and the USFWS would work towards a MOA within the first year of the permit.

**7. ACUB Program – Through its ACUB program, APG will work with its conservation partners to encumber off-site land adjacent to, or ecologically adjacent to, the installation to limit development, protect forested shoreline habitat, and ultimately benefit the bald eagle population.**

- The implementation of the ACUB program is dependent on available Army/Department of Defense funding, available partner funding, and willing landowners. When funding and parcels become available, APG will contribute funds to the partner's purchase of easements or properties from willing landowners, without acquiring any new land for Army ownership. Further details on this ACUB program, including priority areas, are provided in APG's approved proposal (APG 2012).
- An ACUB conservation easement or purchase which is attained and which is associated with eagle habitat (as identified by a satellite telemetry study or confirmed by site investigation) will be credited towards APG's conservation efforts for eagles. Potential conservation credit from an ACUB easement or purchase will include: 1) off-site nest productivity counting towards APG's eagle productivity, 2) conservation of off-site nesting territory as mitigation for an on-site nest removal, and/or 3) conservation of off-site roosting territory as mitigation for an on-site roost disturbance. APG will develop a MOA with the USFWS to specify how ACUB efforts will be credited towards eagle conservation. APG and the USFWS will work towards a MOA within the first year of the permit. The MOA will serve as the vehicle for ensuring that mitigation credit is approved in encumbering the land parcel. Monitoring requirements of the ACUB parcel for meeting conservation and mitigation commitments will be addressed in the easement.

### **4.3 Cumulative Effects Analysis**

The purpose of a cumulative effects evaluation is to identify conditions where take of eagles is assessed at the individual project level in combination with other similar projects in a defined geographic area. As part of the permit application review process under Title 50 CFR Part 22.26 (f)(1) and Final Rule (USFWS 2009b), the USFWS must evaluate and consider effects of take permits on eagle populations at three levels. These levels are: (1) eagle management unit or regional area, (2) local area, and (3) project area. The cumulative effects analysis also incorporates other biological

resource information such as annual nest productivity and mortality levels for each of these areas.

#### **4.3.1 Geographic-Scope Take Thresholds**

##### **Regional Area Population**

To ensure that any authorized take of eagles does not exceed the BGEPA's preservation standard, the USFWS has set thresholds for take limits of eagles based on regional eagle management units. These thresholds were developed using past State nesting surveys. The USFWS also incorporated measures to ensure that local area eagle populations are not severely impacted or depleted by take that could be otherwise be acceptable at the regional (eagle management unit) scale. An eagle management unit-wide area population index was developed by the USFWS with an assumption that eagle numbers are equally distributed across the landscape. APG falls within the USFWS's Mid-Atlantic bald eagle management unit. The estimated population size for the Mid-Atlantic bald eagle management unit is 14,021 eagles encompassing 237,687 square miles of landscape (USFWS 2009a). As shown below, the unit density is approximately 0.059 eagles per square mile.

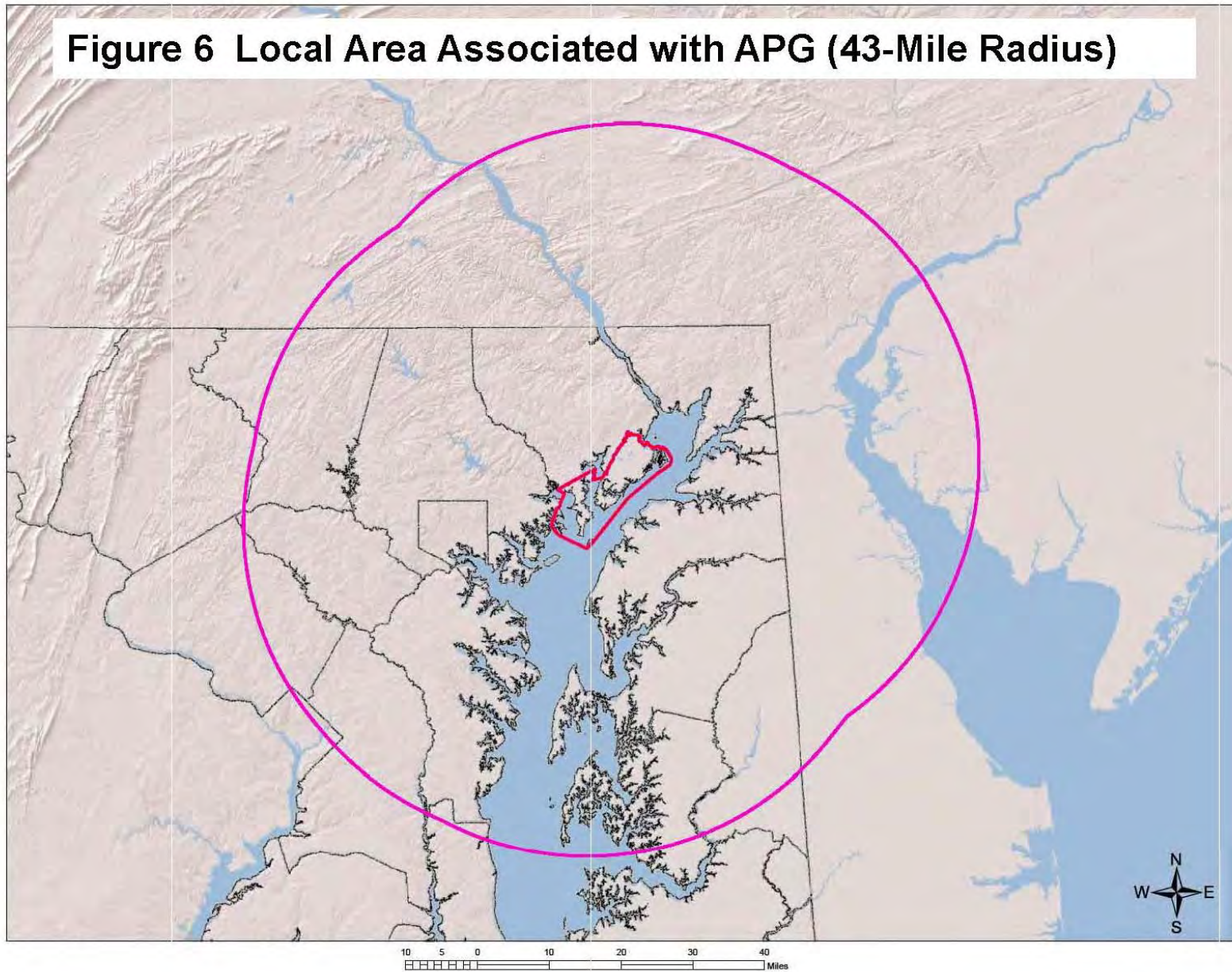
$$\begin{aligned}\text{Mid-Atlantic Management Unit Eagle Density} &= (\text{Population}) / (\text{Management Unit Size}) \\ &= (14,021 \text{ eagles}) / (237,687 \text{ square miles}) \\ &= 0.059 \text{ eagles per square mile}\end{aligned}$$

##### **Local Area Population**

The local area bald eagle population is calculated based on the regional eagle density and an area extending 43 miles outward of the project boundary. Forty-three miles is the mean natal dispersal range for bald eagles as determined by the USFWS. For APG, this defined local area encompasses the entire northern Chesapeake Bay area, the southern Susquehanna River area, and portions of the Delaware River and Delaware Bay (Figure 6). This local dispersal area is approximately 4,913 square miles of habitat (exclusive of open waters of the Gunpowder River, Bush River, and Chesapeake Bay). Therefore, as shown below, the local area bald eagle population is approximately 290 eagles.

$$\begin{aligned}\text{Local Eagle Population} &= (\text{Regional Eagle Density}) * (\text{Local Area Size}) \\ &= (0.059 \text{ eagles per square mile}) * (4,913 \text{ square miles}) \\ &= 289.9 \text{ eagles}\end{aligned}$$

**Figure 6 Local Area Associated with APG (43-Mile Radius)**





Based on data for the Mid-Atlantic bald eagle management unit and using the equation below (USFWS 2009a), the five percent benchmark for eagle take in this local area is 15 eagles per year.

$$\begin{aligned}\text{Local Area 5\% Threshold} &= (\text{Local Area}) * (\text{Regional Eagle Density}) * 0.05 \\ &= (4,913 \text{ square miles}) * (0.059 \text{ eagles per square mile}) * 0.05 \\ &= 14.5 \text{ eagles}\end{aligned}$$

The USFWS quantified take rates of between one and five percent of estimated local area eagle population as benchmarks, with five percent being at the upper end and still compatible with maintaining healthy local eagle populations. Under this methodology, permitting take of more than 15 eagles per year should be carefully considered to ensure that it is consistent with the BGEPA's preservation standard and the requirements of the regulations at Title 50 CFR Part 22.26.

#### **4.3.2 Environmental Baseline**

##### **Nest Surveys and Population Monitoring**

A comprehensive bald eagle nest monitoring survey in the Chesapeake Bay region was first conducted in the late 1970s and continued through 2004, by the Maryland Department of Natural Resources, the Delaware Division of Fish and Wildlife, and the Virginia Commission of Game and Inland Fisheries. The total number of occupied territories by the end of the 2004 nesting season was approximately 800 eagle pairs. In 2007, the USFWS delisted the bald eagle under ESA, and the States soon followed thereafter. Currently, only Virginia and Delaware continue to conduct annual nest surveys for their watershed areas.

Following the delisting of the bald eagle, smaller scale nest surveys resulted with only a portion of the population being sampled, making it difficult to quantify actual numbers of eagles for a local area population. Despite this reduced survey effort, nest monitoring continued, albeit as a necessity to meet ESA post-delisting requirements and eagle permit issuance criteria for development projects. Department of Defense installation managers, National Wildlife Refuges, and National Parks also continued to conduct annual nest monitoring. Proposed residential and commercial development projects, including land-based wind energy projects, were also required to assess potential impacts of their projects to nesting and wintering eagles.

##### **APG Population Assessment**

Since 1991, eagle nest surveys have been routinely conducted by APG environmental staff. Between 2005 and 2013, APG documented an increase in the breeding population to 51 pairs. Nest productivity also increased, with the highest yield occurring during the past consecutive three years (2011-2013). Nest production in 2011, 2012, and 2013, resulted in 85, 93, and 90 chicks, respectively.

### Local Area Population Assessment

Productivity and population data collected by APG were combined with other data sources to estimate the 2013 local area eagle population (43-mile radius from APG). Other data sources included State agency nest surveys and a limited number of nest surveys conducted by private project consultants. A total of 645 eagles were estimated in 2013 (Table 4). This total includes chicks fledged from APG nests; however, only 50 percent of the chicks produced at APG in 2013 were conservatively included, in order to account for potential naturally-occurring fledgling mortality. In addition, the total does not include chicks that fledged from other nests in Maryland, Pennsylvania, Delaware, and New Jersey. The population calculation also does not include the significant number of subadult eagles in the local area (except those counted by APG during the mid-winter count). Therefore, the total number of eagles (645) is an under-estimation of the actual local area population.

Table 3. Local Area Bald Eagle Population

2013 Surveys	Count
Maryland (northern Bay segment)	58 nests
Pennsylvania (southeastern border)	21 nests
Lower Susquehanna River	12 nests
Delaware (western border)	25 nests
New Jersey (western border)	19 nests
APG	51 nests
Total Nests:	186
Breeders (Total Nests x 2):	372
Mid-Winter Survey (APG plus Lower Susquehanna):	228
APG Nest Production (50% of 90 chicks):	45
Total Population:	645

### **4.3.3 Stressors**

Land clearing for commercial and residential construction activities has incrementally reduced natural habitat and land cover along rivers and Chesapeake Bay shorelines. Eagles have responded by either abandoning nest sites, adapting to fragmented territories with associated human activity, or relocating altogether to other forested areas with greater buffers such as those found at APG. APG's ACUB program (included as an experimental ACP under the proposed programmatic permit) would offset development pressures by conserving potential eagle habitat on adjacent off-post property, thereby contributing to long-term benefits to the APG, local, and regional populations of bald eagles. Additional analyses of environmental impacts of the ACUB

program will be performed in the future as exact locations of ACUB parcels are determined.

Although APG supports extensive habitat for foraging, nesting, and roosting eagles, the military testing and training operations have the potential to be disruptive to eagles either through habitat encroachment or noise. However, eagles at APG have become adjusted to reduced territories, and acclimated to military activities and associated noise from vehicular traffic, detonations, and various weapon firings.

Man-made infrastructure, particularly power lines and other electrical infrastructure, are of primary concern for risk of injury or death to eagles and other large birds. Commercial and residential development can increase the risk of power line collisions and electrocutions if the infrastructure is situated between eagle roosting areas and shoreline foraging areas. APG has an extensive electrical grid that connects power to many buildings through suspended pole-to-pole electrical lines. To minimize impacts to eagles, APG buried segments of overhead lines that posed the greatest risks to eagles from mid-line collisions. For the remaining overhead lines and electrical infrastructure, APG installed protective equipment to reduce the potential for avian electrocutions.

Other stressors to eagles in the local and regional area include poisoning, lead contamination, shooting, silt-pond entrapments, and collision with vehicles, aircraft, trains, towers, and wind turbines. Territorial fighting and competition between eagles and with ospreys have also led to injury or mortality. In 2013, over 39 eagles were recovered in the local area requiring treatment from a variety of injuries (Sallie Welte, Tri-State Bird Rescue and Research, pers. com.).

#### **4.3.4 APG Take Assessment**

From 2005 to 2013, APG documented 42 eagle mortalities (takes) due to line strike, electrocution, or other collision. It is probable that a greater proportion of mortalities affected non-breeding individuals from wintering and summering populations at APG and not the local resident eagles. This probability is based on the assumption that resident eagles are acclimated to routine mission activities and noise and are therefore, less likely to flush. Regardless, mortalities represented both adult and sub-adult age classes at a ratio of nearly 50:50 throughout all four seasons (Lynda Hartzell, APG, pers. com.).

Since 2005, eagle mortalities resulting in take have averaged 4.7 eagles per year at APG. The number of takes increased most recently to a high of eight eagles in both 2011 and 2013. A projection model was used to estimate potential take by APG into the near future (five years). A Linear Regression Model takes into account previous take and using mathematical variables can output a predictable annual take at the 80 percent confidence level (see Appendix A). Based on the model, approximately ten eagle mortalities are projected annually over the next five years (up to 14 eagles as a worst case scenario using the 80 percent confidence limit). At this level, APG's projected take would meet the USFWS's permit issuance criteria without exceeding the five percent local area population take threshold (5% of 645 eagles = 32 eagles).

#### **4.3.5 Other Permitted Take Within Local and Regional Populations**

To ensure that local and regional eagle populations remain stable or increasing, the USFWS requires an assessment of the effects of past authorized take, those projects currently under review, and all sources of documented eagle mortalities including those naturally occurring on the landscape. The assessment also considers the level of uncertainty when using models to predict future eagle take associated with mid-line strikes or large-scale commercial wind farms.

A commercial wind energy project consisting of up to 50 turbines is proposed approximately 15 miles southeast of APG, and will overlap APG's local area bald eagle population designation by approximately 70 percent. The proposed wind energy project and APG have an estimated combined projected take between 18 and 26 eagles. According to USFWS methodology (2009a), permitting multiple projects within the same local area population that will potentially take greater than five percent of the local area population should be given careful consideration. The 2013 eagle nest surveys indicate an increase in the number of eagles in the local area population from the 2009 population estimate developed by the USFWS (2009a). The overall increasing population trend suggests that the local area population in the vicinity of APG could withstand take greater than five percent of the local area population without negatively impacting stability of the local or regional (eagle management unit) bald eagle populations.

The take threshold for issuing permits in the Mid-Atlantic eagle management unit allows for take of up to 65 individuals and the loss of 45.5 individuals through nesting pair disturbances yearly. Each nest disturbance equates to the loss of 1.4 chicks per nest. Under the proposed programmatic take permit for APG, yearly take of up to 12 eagles through injury or mortality and 4.2 eagles as a result of three nest disturbances will be subtracted from the current threshold. The additional permitted take will not exceed the maximum threshold of 65 individuals or disturbance loss of 45.5 for the Mid-Atlantic eagle management unit.

Therefore, based on the current local area population trends, the USFWS believes that in the next five and possibly ten years, eagle populations will remain stable or with increasing numbers even with the combined stressors associated with APG, climate change, and other limited projects in the local area and regional eagle management unit that may be permitted for incidental take of bald eagles.

#### **4.3.6 Conclusion**

Before the USFWS may issue a bald eagle programmatic take permit under Title 50 CFR Part 22.26, it must be determined that: 1) the direct and indirect effects of the take and required mitigation, together with the cumulative effects of other permitted take and additional factors affecting eagle populations, are compatible with the preservation of bald eagles; 2) the taking is necessary to protect a legitimate interest in a particular locality; 3) the taking is associated with, but not the purpose of, the activity; 4) the taking is unavoidable; 5) the applicant has avoided and minimized impacts to eagles to the extent practicable, and the taking will occur despite application of advanced

conservation practices; and 6) issuance of the permit will not preclude issuance of another permit necessary to protect an interest of higher priority as set forth in paragraph (e)(4) of Title 50 CFR Part 22.26. Based on information provided in this ECP, APG's proposed programmatic take of bald eagles is consistent with these issuing criteria.

#### **4.4 Compensatory Mitigation**

Additional compensatory mitigation is not required, because APG's experimental ACPs sufficiently reduce the potential for take to the maximum extent possible, and the projected take does not exceed calculated thresholds for the regional and local populations.

## **5 STAGE 5 – MONITORING**

In Stage 5 of the ECP, a monitoring plan is developed to assess eagle mortalities and disturbances within the project area. The monitoring data are used to determine if conservation measures and/or compensatory mitigation are adequate, excessive, or deficient at reducing or off-setting observed take. The results of the monitoring may indicate if operational changes in the project are needed to reduce observed eagle mortality and/or disturbance.

### **5.1 Population Surveys**

APG will continue to conduct an annual Mid-Winter Bald Eagle Survey as a cooperative effort with the MDDNR. The survey will include two routes: APG shoreline and Susquehanna River shoreline (north to approximately the Pennsylvania state line). The Susquehanna River shoreline will continue to be included in the survey, because past satellite telemetry data have indicated that resident eagles of APG regularly utilize the southern portion of the Susquehanna River, especially in the area of the Conowingo Dam just south of the Pennsylvania state line. The mid-winter count is merely a snap shot of the installation's bald eagle population. However, by following APG's standardized protocol, data from the survey can be compared from year to year to identify long-term trends in the population size and high eagle use areas. The survey is an aerial survey conducted from a helicopter or small fixed-wing aircraft in early January. Data collected from the survey will include the number of adult and immature bald eagles observed on each survey route, general weather conditions, and prevalence/absence of ice on open water.

### **5.2 Productivity Surveys**

APG will continue to conduct seasonal nest surveys to monitor the productivity of the installation's resident bald eagles. These surveys will follow APG's standardized protocol, and will include aerial surveys supplemented by ground observations. Given the number of nests and the expanse of land to survey on APG, aerial surveys are a labor and cost efficient method to collect productivity data. Additionally, aerial surveys are necessary, because many nests are inaccessible on foot due to risks from unexploded ordnance. The aerial surveys will be conducted by helicopter or small fixed-wing aircraft in late January, early March, early April, and early May (an additional mid- to late-May survey may be added). Four to five flights per season promote efficiency in the surveys, because the results of each flight are used to guide the next flight. Specifically, the early January flight identifies new or fallen nests; the early March flight identifies early eggs and chicks; the early April flight determines "active" nest status; the early May flight generates initial productivity numbers and chick ages, and the last May flight confirms fledge dates for nests that are inaccessible to ground observations. Data collected from the surveys will include the condition of each nest, presence of adults in the nest or area, and number of eggs and/or chicks in each nest.



### **5.3 Mortality Monitoring**

APG will continue to investigate each eagle injury and mortality in order to determine if injury/mortality is attributable to incidental take or natural causes. The investigations will be conducted in accordance with APG's standardized protocol for field responses and post-mortem examinations. Information collected during the field response will include photographs, global positioning system coordinates, surrounding habitat characteristics, proximity of electrical and other infrastructure, physical description of eagle, and evidence of trauma. Post-mortem examinations, if needed, will be conducted by the U.S. Army Public Health Command at APG. Information collected during the necropsy will include basic external measurements, external body condition, internal body cavity inspection, estimated time of death, and likely cause of death. Eagle carcasses and remains will be frozen and shipped to the National Eagle Repository (Denver, Colorado) in accordance with APG's standardized protocol.

Injured eagles that can be safely captured will be transported by APG personnel to Tri-State Bird Rescue (Newark, Delaware) or to an appropriate wildlife veterinarian.

### **5.4 Disturbance Monitoring**

APG will continue to monitor, as necessary, mission activities that have the potential to disturb eagles, particularly nesting eagles. Monitoring of activities and observations from productivity surveys will be used together to determine if a nest disturbance has occurred. A summary of the monitoring will include type of activity monitored, number of eagles observed, type of eagle activity observed, minimization measures employed by activity to reduce eagle impacts, and any evidence of disturbance. Areas where a nest disturbance occurred will be monitored to document any new nest construction.

### **5.5 Habitat Conservation**

APG will summarize habitat conservation efforts that benefit bald eagles conducted through forest stand improvements and/or the ACUB program. Summarized information will include location of project site with map, total acreage, description of site, description of eagle habitat and usage, type of conservation activities, and dates of project work.

### **5.6 Nest Removal Monitoring**

For one year following the permitted removal of a nest, APG will monitor the area surrounding the affected nest tree for signs of nest re-building by eagles.

### **5.7 Reporting**

The results of the monitoring and habitat conservation efforts will be summarized and provided by APG to the USFWS's Chesapeake Bay Field Office (Annapolis, Maryland) and Migratory Bird Management Office (Hadley, Massachusetts) according to the following schedules:

- Annual population survey results will be reported by January 31
- Annual productivity survey results will be reported by August 31

- Eagle injury/mortality will be reported within one business day of incident
- Annual summary of eagle injuries/mortalities (USFWS Form 3-202-15) will be reported by February 28
- Annual summary of eagle nest disturbances (USFWS Form 3-202-15) will be reported by February 28
- Annual summary of habitat conservation efforts will be reported by March 31
- Permitted removal of an eagle nest will be summarized within ten days after the removal; annual summary of eagle nest removals (USFWS Form 3-202-16) will be reported by January 31

Prior to renewal of the programmatic permit, the results of the monitoring will be reviewed by APG and the USFWS to determine if adjustments to monitoring, implementation of additional ACPs and/or compensatory mitigation, or reduction in ACPs are warranted.

## 6 REFERENCES

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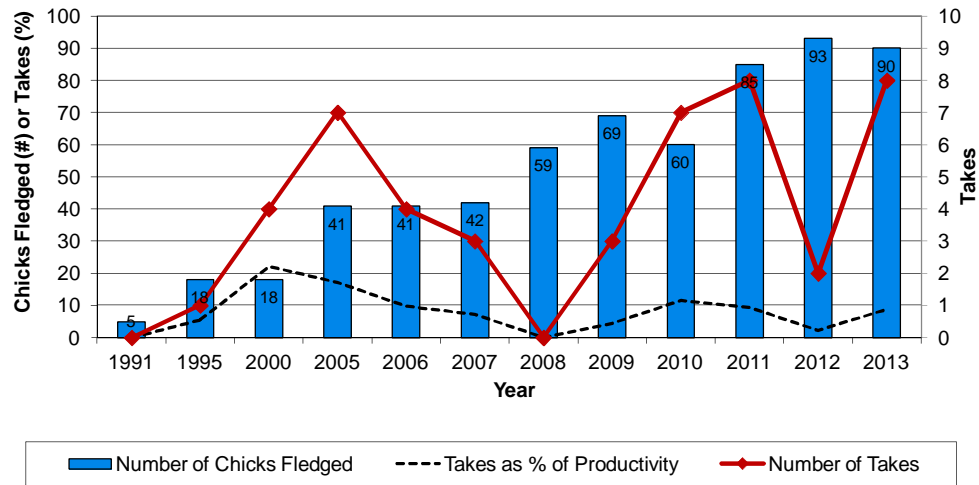
## **APPENDIX**

### APG Bald Eagle Cumulative Data

- Cumulative Raw Data
- Take Expressed as Percent of Population
- Regression (Take)
- Regression (Productivity)

Year	Number_Active_Nests	Number_Successful_Nests	Number_Chicks_Fledged	Number_Lethal_Takes	Number_Mortalities_Naturally_Caused
1991	5	4	5	0	0
1992	5	4	8	1	0
1993	8	7	11	1	0
1994	9	7	10	0	0
1995	13	10	18	1	0
1996	16	14	23	2	0
1997	13	5	9	0	1
1998	8	5	6	0	1
1999	19	11	20	2	1
2000	13	10	18	4	0
2001	20	19	32	0	1
2002	18	12	20	6	4
2003	23	23	35	15	2
2004	25	22	32	9	6
2005	35	29	41	7	0
2006	28	28	41	4	2
2007	30	27	42	3	3
2008	38	33	59	0	2
2009	36	34	69	3	2
2010	37	36	60	7	4
2011	49	45	85	8	4
2012	50	47	93	2	1
2013	51	47	90	8	0

Year	1991	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
Number of Chicks Fledged	5	18	18	41	41	42	59	69	60	85	93	90
Number of Takes	0	1	4	7	4	3	0	3	7	8	2	8
Takes as % of Productivity	0.0	5.6	22.2	17.1	9.8	7.1	0.0	4.3	11.7	9.4	2.2	8.9





Year	Lethal Takes*	Predicted Lethal Takes*	Lower 80% CI	Upper 80%CI
2006	9.8	6.48	4.22	8.73
2007	7.1	6.53	4.28	8.79
2008	0	6.59	4.34	8.84
2009	4.3	6.65	4.39	8.90
2010	11.7	6.70	4.45	8.96
2011	9.4	6.76	4.51	9.01
2012	2.2	6.82	4.56	9.07
2013	8.9	6.88	4.62	9.13
2014		6.93	4.68	9.19
2015		6.99	4.74	9.24
2016		7.05	4.79	9.30
2017		7.10	4.85	9.36
2018		7.16	4.91	9.41
2019		7.22	4.96	9.47

# REGRESSION:

slope	0.057142857	-108.1535714	b	t value	1.439756
SE (m)	0.683298074	1373.088373	SE (b)	delta m	0.983782
R2	0.00116425	4.42827764	SE (y predicted)	delta b	1976.912
	0.006993644		6 DF	delta y	2.254128
	0.137142857	117.6578571			
#N/A	#N/A				
#N/A	#N/A				
#N/A	#N/A				
#N/A	#N/A				
#N/A	#N/A				



\* Lethal takes expressed as percentage of same year's productivity (number of chicks fledged)

Year	Chicks Fledged	Predicted Chicks Fledged	Lower 80% CI	Upper 80%CI
2006	41	39.58	36.00	43.17
2007	42	47.52	43.94	51.11
2008	59	55.46	51.88	59.05
2009	69	63.40	59.82	66.99
2010	60	71.35	67.76	74.93
2011	85	79.29	75.70	82.87
2012	93	87.23	83.64	90.81
2013	90	95.17	91.58	98.75
2014		103.11	99.52	106.69
2015		111.05	107.46	114.63
2016		118.99	115.40	122.57
2017		126.93	123.34	130.51
2018		134.87	131.28	138.45
2019		142.81	139.22	146.40

# REGRESSION:

slope	7.94047619	-15889.0119	b	t value	1.439756
SE (m)	1.086946704	2184.220821	SE (b)	delta m	1.564938
R2	0.898934547	7.04421974	SE (y predicted)	delta b	3144.744
	53.36746771	6	DF	delta y	3.585723
	2648.14881	297.7261905			
	#N/A	#N/A			
	#N/A	#N/A			
	#N/A	#N/A			
	#N/A	#N/A			
	#N/A	#N/A			



## APG Standing Operating Procedures



Standing Operating Procedure  
EAGLE MONITORING SURVEYS

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**Summary.** This Standing Operating Procedure (SOP) describes the procedures for conducting bald eagle monitoring surveys.

**Applicability.** The procedures described in this SOP apply to mid-winter bald eagle population surveys and seasonal bald eagle nest monitoring surveys conducted at Aberdeen Proving Ground (APG), exclusive of Adelphi Laboratory Center and Blossom Point Research Facility.

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**1. Purpose.** Adherence to this SOP will ensure: 1) consistent collection of data that will allow for year to year comparisons of bald eagle population size and nest productivity, and 2) monitoring is conducting in a manner that avoids incidental take or disturbance.

**2. References.**

- a. Integrated Natural Resources Management Plan (INRMP), U.S. Army APG, October 2020.
- b. Bald and Golden Eagle Protection Act (BGEPA), 16 USC 668-668c.

**3. Definitions.**

- |                    |   |
|--------------------|---|
| a. Bald Eagle      | <i>Haliaeetus leucocephalus</i> ; year-round species that utilizes APG lands and waters for nesting, foraging, and sheltering |
| b. Golden Eagle    | <i>Aquila chrysaetos</i> ; transient species that is infrequently sighted foraging and sheltering on APG lands during winter  |
| c. Incidental Take | any take that results from, but is not the purpose of, carrying out an otherwise lawful activity                              |

**4. Scope.** This SOP shall apply to mid-winter bald eagle population surveys and seasonal bald eagle nest monitoring surveys.

**5. General.** Monitoring is an essential component of wildlife management, and helps to identify population trends, distributions, and effectiveness of conservation measures. APG has a high density of bald eagles throughout the year. It is estimated that a few hundred eagles are on APG at any one time, and that at least several hundred eagles utilize the installation throughout the year, coming and going across the northern Chesapeake Bay region. Bald eagles remain protected by multiple federal laws, but specifically the BGEPA that is enforced through regulations written by the U.S. Fish and Wildlife Service (USFWS). The BGEPA prohibits take

of eagles (including but not limited to injuring and disturbing) without a permit issued by the USFWS. APG has a USFWS-issued permit that authorizes (under the BGEPA) take of bald eagles that occurs incidental to mission operations and activities. APG's permit includes requirements for monitoring of bald eagles as discussed in APG's INRMP. This SOP outlines the procedures for conducting bald eagle population and productivity surveys as part of the monitoring requirement.

**6. Responsibilities.** It is the responsibility of the U.S. Army Garrison APG to carry out this SOP. All bald eagle surveys are coordinated by the Directorate of Public Works (DPW) Environmental Division ("survey coordinator").

**7. Procedures.** The mid-winter population survey and seasonal nest monitoring surveys are aerial surveys usually conducted from a helicopter, but sometimes from a light plane. Currently, the helicopter and pilots are provided by the U.S. Army Aberdeen Test Center (ATC) through cooperation with Phillips Army Airfield (PAAF) Flight Operations. All eagle monitoring surveys require coordination with both PAAF Flight Operations and ATC Range Operations (scheduling and control tower) as detailed below in Section 4.a.

a. Flight Request and Coordination.

- (1) The survey coordinator shall complete a flight manifest (i.e., list of passengers) for the flight. This manifest is submitted to PAAF Flight Operations. All passengers must have valid permission to fly on U.S. Army aircraft.
- (2) The survey coordinator shall contact PAAF Flight Operations with the proposed flight date, at which time PAAF will identify any known pilot scheduling conflicts. Once a date is agreed to by PAAF, the survey coordinator shall submit a flight request to ATC Range Operations (scheduling). The survey coordinator must ensure the flight is confirmed by ATC Range Operations.
- (3) The survey coordinator shall notify the flight passengers of the scheduled flight date and time. This notification shall include the survey coordinator's after-hours phone number, in the event of passenger or flight cancellation.
- (4) The morning prior to the scheduled flight, the survey coordinator shall contact PAAF Flight Operations and ATC Range Operations (scheduling) to confirm the flight.
- (5) On the day of the flight, all passengers shall arrive at PAAF 30 minutes prior to the scheduled departure time to allow for a pre-flight briefing. The pre-flight briefing is conducted by the survey coordinator, the pilot, and/or the flight crew chief. The following are included in the briefing:
  - Survey route (map provided by survey coordinator)
  - Helicopter seating (assigned by pilot and/or flight crew chief)
  - Ear protection and headsets for communication (addressed by pilot and/or flight crew chief)
  - General safety (addressed by pilot and/or flight crew chief)



- (6) During flight, pilots maintain communication with ATC Range Operations (control tower). Flying over range areas is permissible only if ranges are cold (not firing), as directed by the range control tower operator.
- b. Mid-Winter Population Survey. A yearly mid-winter population survey is conducted to estimate the number of bald eagles on APG and the surrounding area. The date of this aerial survey is coordinated through the Maryland Department of Natural Resources (MDDNR). The MDDNR designates a time frame for conducting the bald eagle survey in order that the data collected by APG can be compiled with data collected by other observers within the state to estimate the regional bald eagle population. The mid-winter population survey is typically conducted in early January. After the flight is requested and coordinated (Section 4.a), the procedures listed below shall be followed for the mid-winter survey.
- (1) The helicopter shall maintain an altitude sufficient to accommodate counting of eagles while minimizing potential disturbance to the eagles. Other factors, including weather and discretion of the lead observer, may impact the flight altitude. Generally, an altitude of 300 to 500 feet is maintained.
  - (2) The survey route follows the shorelines of the installation and includes Spesutie Island, the Aberdeen and Edgewood Area peninsulas, Graces Quarters, Carroll Island, and Pooles Island. The flight also includes a survey of the Susquehanna River north to the Pennsylvania state line (just south of Exelon Peach Bottom power plant) and then back south to the mouth of the river.
  - (3) During the flight, the locations and age classes (adult, sub-adult, unknown) of bald eagles are noted on data sheets/maps. Any observations of golden eagles are also noted.
  - (4) The total numbers of eagles (by age class) are tallied for APG and the Susquehanna River.
  - (5) The survey coordinator shall report the results of the mid-winter survey to the MDDNR within seven business days of the survey. Survey results are reported to the USFWS as part of the annual reporting requirement under the BGEPA permit.
- c. Seasonal Nest Monitoring Surveys. Nest surveys are conducted periodically during nesting season to determine activity status of all known bald eagle nests, and to locate any new nests, on APG. These aerial nest surveys are conducted in late January, late February/early March, late March/early April, and late April/early May. After the flight is requested and coordinated (Section 4.a), the procedures listed below shall be followed for each nest monitoring survey.
- (1) The pilot shall maintain an altitude sufficient to accommodate nest observations while minimizing potential disturbance of the eagles. Other factors, including weather, location of the nest, and discretion of the lead observer, may impact the flight altitude. Generally, an altitude of 300 to 500 feet is maintained. Passes directly over the nest, as well as hovering over the nest, should be avoided.

- (2) Observations are recorded on datasheets provided by survey coordinator.
  - (3) For any new eagle nest discovered during the flight, the general location of the new nest is noted on the datasheet. Coordinates of the new nest are recorded from the air using a global positioning system (GPS) unit.
  - (4) The survey coordinator shall revise the installation nest map, and provide changes to nest locations and activity status to the DPW GIS Office within seven business days of the survey. Distribution of the nest map includes appropriate Garrison personnel, contractors, and relevant tenant organizations.
- d. Ground Observations. Aerial nest monitoring surveys are supplemented by ground observations, particularly for new nest confirmations and end of season fledge confirmations. Range operations, weather, eagle activity, vegetation and other complicating issues may hinder ground observations.
- (1) New Nest Confirmations.
    - (a) For a new nest discovered on an aerial survey, ground verification of the new nest (and recording of GPS coordinates) should be conducted as soon as possible after discovery of the nest. This verification may be accomplished by walking to the nest tree with coordination as needed through ATC Range Operations (scheduling and control tower), or by triangulating using known points.
    - (b) For a new active nest discovered between aerial nest surveys, the survey coordinator shall submit the new nest coordinates to DPW GIS Office, and revise and provide the installation nest map as soon as possible after discovery.
    - (c) At the conclusion of the nesting season, the survey coordinator shall coordinate with MDDNR to assign MDDNR nest designations to all new nests discovered during the nesting season.
  - (2) End of Season Fledge Confirmations.
    - (a) After the late April/early May aerial survey, ground observations are needed to confirm that young have fledged from the nests. In the event that ground observations are hindered, nests with young that are close to fledging at the time of last observation will be presumed to be successful, unless there is evidence to the contrary.
    - (b) Once all nests are confirmed or assumed fledged (inactive), the survey coordinator notifies the DPW GIS Office so that appropriate changes can be made to eagle nest status data layer. At the conclusion of the nesting season, the survey coordinator shall report the yearly nest productivity to the MDDNR. Nest productivity is reported to the USFWS as part of the annual reporting requirement under the BGEPA permit.

Standing Operating Procedure  
RESPONSE TO EAGLE INJURIES AND MORTALITIES

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**Summary.** This Standing Operating Procedure (SOP) describes the procedures for responding to an injured or dead eagle.

**Applicability.** The procedures described in this SOP apply to all incidents of injured or dead eagles at Aberdeen Proving Ground (APG), exclusive of Adelphi Laboratory Center and Blossom Point Research Facility. This SOP applies to both bald eagles and golden eagles.

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**1. Purpose.** Adherence to this SOP will ensure: 1) proper personnel notification, 2) collection of appropriate field and post-mortem data, and 3) reporting of information and data for eagle injuries and mortalities.

**2. References.**

- a. Integrated Natural Resources Management Plan (INRMP), U.S. Army APG, October 2020.
- b. Bald and Golden Eagle Protection Act (BGEPA), 16 USC 668-668c.

**3. Definitions.**

- a. Bald Eagle                      *Haliaeetus leucocephalus*; year-round species that utilizes APG lands and waters for nesting, foraging, and sheltering
- b. Golden Eagle                  *Aquila chrysaetos*; transient species that is infrequently sighted foraging and sheltering on APG lands during winter
- c. Incidental Take                any take that results from, but is not the purpose of, carrying out an otherwise lawful activity
- d. Necropsy                        a post-mortem examination on an animal

**4. Scope.** This SOP shall apply to all injured or dead eagles discovered on the installation.

**5. General.** APG has a high density of bald eagles throughout the year. It is estimated that a few hundred eagles are on APG at any one time, and that at least several hundred eagles utilize the installation throughout the year, coming and going across the northern Chesapeake Bay region. Bald eagles remain protected by multiple federal laws, but specifically the BGEPA that is enforced through regulations written by the U.S. Fish and Wildlife Service (USFWS). The BGEPA prohibits take of eagles (including, but not limited to, injuring and disturbing) without a permit issued by the USFWS. APG has a USFWS-issued permit that authorizes take of bald

eagles that occurs incidental to mission operations and activities. APG's permit includes requirements for investigating and reporting injured and dead bald eagles, in accordance with the USFWS Office of Law Enforcement protocols and as discussed in APG's INRMP. This SOP outlines the procedures for responding to injured or dead eagles discovered on the installation.

**6. Responsibilities.** It is the responsibility of the U.S. Army Garrison APG to carry out this SOP. Specific responsibilities are detailed below.

**7. Procedures for Responding to an Eagle Injury or Mortality.**

- a. Initial Notification. The person or organization that discovers the injured or dead eagle shall immediately notify by telephone the APG Police. The APG Police shall dispatch a Directorate of Emergency Services (DES) – Conservation Law Enforcement Officer (CLEO) to the site. The CLEO shall immediately notify the DPW Environmental Division – Eagle Program Subject Matter Expert (SME).
- b. Field Investigation. The CLE and SME shall report to the scene as soon as possible after notification. When possible, the eagle carcass should not be moved until all parties have arrived at the scene. However, certain circumstances (safety, roadway blockage, delays in reporting to the scene, etc.) may necessitate the moving of the carcass to a safe area. All personnel handling dead eagles should wear rubber or latex gloves.

(1) At the scene, the following shall be collected:

(a) Photographs to include at a minimum

- Broad angle of scene
- Power lines configuration (if applicable)
- Carcass with power lines in view (if applicable)
- Close up of carcass upon discovery (before moved)
- Close up of any trauma areas on carcass
- Identifying marks, traits for species/age determination

(b) GPS location

(c) Description of location and carcass to include at a minimum

- Date and time of discovery
- Surrounding landscape (habitat, buildings, roads)
- Distance to, and description of, nearby electrical infrastructure
- Physical description of carcass including rigor mortis, insects, obvious trauma, missing body parts, missing feathers, leg bands, age class

(2) The collection of the above data may be facilitated by the use of a standard data sheet developed by the SME. Additional data may be collected by the CLEO for the police report (e.g., name of person reporting incident, names of personnel present at scene, weather conditions, etc.).

(3) The CLEO or SME shall take possession of the injured or dead eagle. The SME shall make the determination of final disposition of the eagle.

- (a) Injured Eagles – Attempts to capture an injured eagle are made at the discretion of the CLEO and the SME. Injured eagles that can be safely captured are immediately transported by SME (or delegated person) to Tri-State Bird Rescue or to an appropriate wildlife veterinarian:

Tri-State Bird Rescue  
110 Possum Hollow Road  
Newark, DE 19711  
Phone 302-737-9543 (after hours 302-737-9513)

- (b) Dead Eagles – Depending on the condition of the carcass, the SME may collect basic biological data from the carcass:

- Weight
- Wing (chord) length
- Tail length
- Culmen length
- Tarsus length
- Talon (hallux) length

- i. If the SME determines that a necropsy is required, then the dead eagle is loosely bagged and placed immediately into refrigerated storage (if possible). If a necropsy is not required, then the dead eagle is carefully bagged and placed immediately into locked frozen storage for subsequent shipment to the USFWS National Eagle Repository. A shipping box and pre-paid label can be obtained from the Repository:

National Eagle Repository  
6550 Gateway Road, RMA, Bldg. 128  
Commerce City, CO 80022  
Phone 303-287-2110  
Email repository@fws.gov

- ii. When bagging the carcass and placing into refrigerator or freezer, care should be taken to avoid bending wing or tail feathers. An identification tag or label accompanies the bagged carcass. A USFWS toe tag shall be used on final disposition of the carcass to the National Eagle Repository.

- c. Necropsy. A necropsy may be conducted at the discretion of the SME. The necropsy shall be conducted and documented in accordance with the U.S. Army Public Health Command (USAPHC) SOP “Eagle Mortality Post Mortem Examination” which is on file at the USAPHC. Coordination and transfer of the eagle carcass to the USAPHC shall be conducted in accordance with the USAPHC SOP. The carcass shall be double-bagged when transported to the USAPHC.

- (1) Biological data (as permitted by condition of carcass) shall be collected to include:
- (a) External inspection
    - Missing parts, scavenger damage
    - Burns
    - Broken bones
    - Eye condition (clear, sunken, cloudy, missing)
    - Discharge from orifices
    - Abrasions
    - Missing feathers
    - Insects
    - Muscle mass condition
    - Other abnormalities or conditions
  - (b) Sample for DNA analysis (two breast contour feathers) if requested
  - (c) Body cavity inspection
    - Signs of internal hemorrhage
    - Contents of gizzard and crop
    - External appearance of organs
    - Presence of macro parasites
  - (d) Estimated time of death
  - (e) Tissue samples for histopathology (if requested)
    - Liver
    - Kidney
    - Brain
    - Eyes (both – whole)
    - Heart
    - Lungs
    - Spleen
    - Pancreas
    - Gonads
  - (f) Tissue samples for chemical analyses (if requested)
    - Muscle
    - Adipose
    - Liver
    - Kidney
    - Brain



- (2) All remains of the carcass shall be returned to the SME and placed in locked frozen storage for subsequent shipment to the USFWS National Eagle Repository (except tissue samples retained for analyses).
- (3) Tissue samples, if collected, shall be contracted out by DPW Environmental Division for analysis by an outside contractor or by the USAPHC.
- (4) The USAPHC shall prepare a summary report detailing the findings of the necropsy and forward to the SME.

d. Reporting.

- (1) The SME shall notify the USFWS within seven days of collection of an injured or dead eagle. Notification shall be made using the USFWS on-line Injury and Mortality Reporting (IMR) system.
- (2) The SME shall download from the IMR a yearly summary of injuries and mortalities and submit by email to the USFWS by 31 January of the following year, as part of annual reporting requirements under the BGEPA permit.



# **APPENDIX N**

Outdoor Recreation Plan



## Installation Outdoor Recreation Planning

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The purpose of the Installation Outdoor Recreation Planning document is primarily to promote and maintain outdoor recreation activity for the mental and physical well-being of Soldiers, Civilians, Families, and contractors, specifically active duty military personnel, while at the same time protecting and improving the installation's natural resources. To this aim, this document will provide general guidance regarding outdoor recreational opportunities and activities at Aberdeen Proving Ground (APG). This document includes:

- Objectives – Identify objectives of outdoor recreation
- Recreational Resources – Catalogue outdoor recreational resources
- Resource Management – Describe resource management
- Future Planning – Discuss the methodology for proposed outdoor recreation development

### 1. Objectives

The goal for outdoor recreational management is to provide sustaining DFMWR facilities, activities and programs to the Soldiers, Civilians, Families, and contractors of APG. The objectives of recreational management planning are:

- a. Assuring that planning for outdoor recreation is included as part of the Installation Master Plan
- b. Improving the quality and quantity of leisure experiences for the Soldier, his/her family and where possible, members of the Department of the Army (DA) work force and the public
- c. Providing an optimum variety, mix and location of recreational opportunities
- d. Preserving and developing outdoor recreation resources to serve their highest and best use
- e. Evaluating the effectiveness of existing and proposed outdoor recreation
- f. Relating outdoor recreation plans to other installation plans
- g. Promoting at all levels of the installation organization, understanding and support for more effective outdoor recreation planning
- h. Encourage Army personnel to use their time constructively and creatively by taking part in programs to develop and maintain talent and skills
- i. Promote and maintain the mental and physical fitness and well-being of DA personnel with emphasis on active duty military personnel
- j. Maintain a high level of spirit, job proficiency, military effectiveness, and educational achievement

- k. Assist in providing a community support environment to DA personnel and their families, especially important for military spouses' unaccompanied tours, missions or involved in conflicts
- l. Create a vital, self-sustaining military community
- m. Aid recruitment and retention by making service careers more attractive
- n. Assist new personnel in adjusting from civilian life to a military environment
- o. Provide programs that will appeal to the team work concept of the military
- p. Bear in mind at all times the importance of establishing, maintaining and improving community relations

## 2. Recreational Resources

The outdoor recreation program at APG offers a wide variety of facilities, activities and special programs. Programs are open to active duty military personnel and their families, all active duty APG civilian employees and their dependents, and DOD contractors.

### a. Facilities

Outdoor recreation facilities are located throughout both the Aberdeen Area (APG-AA) and Edgewood Area (APG-EA). Facilities include pools, golf courses, marinas, stables, picnic areas, and recreation centers (see Tables 1a and 1b). Facilities are either openly available to the APG community or obtainable by reservation.

### b. Activities and Services

DFMWR provides a selection of activities and services for both the betterment of the mind and body of the target populations. These activities and services are for the populations as a whole or targeted for youth or seniors. Routine activities planned may include:

- i) Physical education classes such as golf, kayaking, yoga, boot camp, etc.
- ii) Mental welfare and betterment classes, such as career workshops and finance classes
- iii) Trips to local destinations and discounted tickets to local venues
- iv) Outdoor activities such as golf outings, organized runs and other organized sports
- v) Equipment rentals for various activities are available (see Table 2)

### c. Programs

#### i) Hunting Program

Hunting has been a popular activity on what is now APG since the early 1800s. The hunting program at APG has evolved over the years and still



provides a popular source of recreation to the APG community. A successful program is run as a coordinated effort by DFMWR, tenant range control, Conservation Law Enforcement Officers, and DPW Environmental Division.

The installation has an abundant and diversified population of game, including deer, ducks, geese, and furbearers such as raccoon, fox, rabbit, and muskrat. Hunting is allowed using shotgun, muzzleloader, or bows. Trapping is allowed for nuisance pest control only, as determined by the DPW Biologist.

With a large game population and a large number of hunters, safety becomes a prime concern. There are mandatory hunter safety requirements, field of fire zone in the hunting areas, and strict enforcement of all regulations. The Conservation Law Enforcement Officers patrol the hunting areas to enforce the regulations.

The management of the wildlife natural resources at APG is administrated by the DPW Biologist.

Regulations and guidance on the Hunting Program can be found in APG DFMWR website.

The prime objective of the program is to allow the hunters to maintain stable game populations in a safe manner without hindering the mission of APG.

## ii) Fishing Program

Being located in the northern Chesapeake Bay and the mouth of the Susquehanna River, APG offers ideal conditions and opportunities for fishing. Many species are found in the local waters including catfish, carp, perch, bass, and blue crabs.

Fishing at APG is controlled by two sets of regulation, APGR 210-26 "Recreational Fishing and Crabbing Rules" and APGR 210-10 "Use and Navigation of Restricted Waters of APG."

DFMWR is responsible for administering the fishing access at APG. They issue all permits, supply copies of regulations to fisherman, and maintain and rent boats and other equipment to fishermen. Two boat rental facilities are located on APG: the APG-AA issue point located at Swan Creek and the APG-EA rental facility located at the Sportsman Center on the Gunpowder River.

To take part in recreational fishing in restricted areas at APG, a fisherman must be an Installation Identification Card holder with an Installation restricted area access badge. Qualified anglers will apply for access for a specific area and date through DFMWR.

Non-Secured designated areas for fishing are:

- Swan Creek – easterly from installation perimeter to Building 2403
- Spesutie Island Marina – 100 feet from launch ramp, easterly to secure area
- Woodpecker Point – causeway to Dipper Creek
- Spesutie Island – west shore from causeway to 200 meters south
- Gunpowder River – east shore from northern installation boundary to secure area
- Lauderick Creek – southerly from Skippers Point to secure area

Fishing from DFMWR boat dock and piers is prohibited.

iii) Trap and Skeet (Shooting Sports)

The skeet and trap range has shotgun and muzzle loader shooting opportunities for all skill levels. The range is located at Building E4737 on Hoadley Road in the APG-EA. League and open shooting is available throughout the year. The Skeet and Trap Range may only be opened by a range control officer. Patrons must bring their own shotguns and ammunition.

iv) Hiking

There are very few hiking trails at APG due to the long history of testing and training on its ranges, minimizing the availability for hiking. The trails/nature walks in the cantonment areas for recreation in APG-AA are located behind the Maryland Gate Picnic Area. APG-EA trails are located on the southern shore of Lauderick Creek near the Skipper's Point Picnic Area.

v) Camping / Recreational Vehicle Park

There are camps site available in APG-EA, located at Skippers Point at the head of Lauderick Creek, and there is an RV park in APG-AA (see Table 3). For those desiring to camp but have limited equipment, DFMWR offers many items for rent (see Table 2).

vi) Intramural Sports

The Intramural Sports Program offers the opportunity to enhance individual morale and team esprit de corps through individual and team competition. Team sports have included softball, soccer, flag football, volleyball, basketball and ultimate frisbee. Tournaments are also offered throughout the year in sports such as dodge ball, kickball, tennis, racquetball, 3-on-3 basketball, and disc golf.

#### vii) Golfing

APG maintains two golf course – Ruggles Golf Course in APG-AA and Exton Golf Course in APG-EA. Outing and tournaments are offered throughout the year.

Amenities include:

- 9 and 18-hole Championship golf courses
- Driving Range with natural and artificial tees
- Putting Green
- Short Game Chipping Area
- Cart Rentals
- Fully Stocked Pro Shop
- Computerized Handicap System
- Golf Lessons
- Locker Rental
- Indoor and Outdoor Dining

### 3. Resources Management

APG occupies a prime portion of real estate at the northern section of the Chesapeake Bay. Included within its boundaries are numerous creeks, rivers, woodlands, wetlands and estuaries, and a large military and civilian work force. These resources must be managed thoughtfully and diligently to ensure that they continue to thrive while simultaneously providing optimal outdoor recreational opportunities for the APG community. Necessary action includes evaluation of existing conditions, identification of potential recreation areas, determination of outdoor recreation needs, selection of appropriate outdoor recreation activities, and implementation of physical improvements.

Natural resources will be maintained for recreation while not interfering with the mission of APG. Using appropriate management techniques, future generations will have equal or better areas for outdoor recreation.

#### a. Cooperative Agreement of Fish and Wildlife Resources

The Department of Defense, the Department of the Interior, and the state of Maryland in accordance with Title 10, US Code Section 2671, through their designated representatives have approved and implemented a cooperative plan for the protection, development, and management of the Fish and Wildlife Resources on APG. The purpose of the cooperative plan being to protect and enhance existing fish and wildlife at APG through land and water conservation programs and utilization of sound management practices. These practices will be conducive to healthy fish and wildlife populations. Assistance may be

obtained from either state or federal fish and wildlife biologists within their finding and personnel limits. The purpose of the cooperative plan also being to provide public recreational fishing, hunting and trapping opportunities and for commercial fishing operations, consistent with adequate military security and optimum public safety.

b. Surveys

Surveys will be made periodically to determine abundance and distribution of fish and wildlife populations. The information obtained from these surveys will be compared to existing data to determine population trends and manage the hunting and fishing programs accordingly.

c. Funds

Because of the high usage of many areas of the program, Outdoor Recreation becomes self-supporting for many programs. Significant funds are raised from the sale of hunting permits, which are deferred to the APG Conservation Subcommittee. This committee is responsible for administration and support of conservation efforts at APG.

#### 4. Future Planning

Outdoor Recreation program planning is dependent on planning of use of installation resources and management of natural resources. This is accomplished with a combination of efforts from the DPW Environmental, DFMWR, and Master Planning:

- DPW Environmental manages natural resources through the implementation of the Integrated Natural Resources Management Plan and its accompanying plans.
- DFMWR routinely evaluates all outdoor recreational facilities and opportunities within APG, planning for new recreational prospects.
- Master Planning, as part of the Installation Master Plan, identifies new areas to be available for use as outdoor recreational areas.

The outdoor recreation planning process has three principle steps:

a. Identification

This step involves the acquisition of data pertaining to on- and off-Post conditions which influence outdoor recreation use and development. This information is available in the Installation Master Plan (i.e., climate, geology, hydrology, land use, vegetation, wildlife, conservation areas, Installation Restoration Program areas, transportation systems, climate, etc.)

b. Evaluation

An evaluation is made by DFMWR of the potential effects of both on- and off-Post conditions upon outdoor recreation. The principle opportunities and

constraints are summarized and the recreation needs and requirements of the installation are determined. There are numerous approaches to analyzing recreation supply and demand. Data to consider include:

- Resources available
- Record of activity participation
- Fiscal resources available
- Behavioral indices

c. Implementation

Based upon information gathered and the determination of opportunities and constraints, needs and requirements evaluation, implementation begins. Conceptual alternatives for future development are presented. Selection of the most feasible alternative results in a long-range plan for future development.

**Tables.**

**Table 1a. Aberdeen Area Outdoor Recreation Facilities**

FACILITY NAME
COMMUNITY/CONFERENCE CENTER
PVT/ORG CLUB
UOQ MILITARY
EXCHANGE BRANCH
REC SHELTER
REC EQ CHECKOUT
BOWLING CENTER
AUTO SKILL CENTER
CHAPEL/CHILD CARE CENTER
CHILD DEVELOPMENT CENTER
YOUTH CENTER
AUDITORIUM GP
PHYSICAL FITNESS CENTER
OLYMPIC POOL - OD SWIM POOL
RECREATION CENTER
ENLISTED UPH
ENLISTED UPH
ENLISTED UPH
TRANS UPS AIT
REC SHELTER - WOODPECKER PT PARK
REC SHELTER - WOODPECKER PT PARK
REC SHELTER



**Table 1b. Edgewood Area Outdoor Recreation Facilities**

FACILITY NAME
REC SHELTER
REC SHELTER
CHILD DEVELOPMENT CENTER
YOUTH CENTER
RECREATIONAL SHELTER
PLAYGROUND
PLAYGROUND
BOAT HOUSE
BOAT HOUSE
STR SED GP INS
RECREATIONAL SHELTER
RANGE OPERATIONS BLDG
RECREATIONAL SHELTER - EA
EDGAR STARK SVC CLUB – RECREATIONAL CENTER
COURT AREA
ELI HOYLE GYM 6 FLD ART REG
BAYSIDE OD POOL
RECREATIONAL SHELTER
ROD/GUN TRAP SHOOTING
SKEET TRAP BLDG - PVT/ORG CLUB
SKEET STOR BLDG - PVT/ORG CLUB
SKEET STOR BLDG - PVT/ORG CLUB
EGBERT BULLENE BLDG - ARMY LODGING
RAY AVERY BLDG - ARMY LODGING
ARMY LODGING
EDGEWOOD AREA RECREATIONAL SHELTER
EDGEWOOD AREA RECREATIONAL SHELTER
EDGEWOOD AREA RIDING STABLES
SOFTBALL FIELDS - ABERDEEN
SOFTBALL FIELDS - EDGEWOOD
MULTI ATHLETIC FIELD - EDGEWOOD

**Table 2. Outdoor Recreation Rental Equipment**

PARTIES	GAMES	WATERCRAFT	CAMPING
BOUNCE HOUSES	BASKETBALL, FOOTBALL, SOCCER, VOLLEYBALL	CANOES	TENTS
CANOPIES		KAYAKS	SLEEPING BAGS
TABLES	RING TOSS	ALUMINUM BOATS	CAMPING COT
ICE CHESTS	TUG OF WAR ROPE	BOAT TRAILERS	CAMPING CHAIR
WATER COOLERS	CORNHOLE SET	BOAT MOTORS	COOK SET, CAMP STOVE
TOWABLE GRILLS	HORSESHOE SET	LIFE VESTS	GENERATOR
CANOPY	VOLLEYBALL SET	PADDLEBOARD	LANTERN
			VEHICLE LUGGAGE RACK
			BACKPACK
			UTILITY TRAILERS

**Table 3. Camping Facilities**

Aberdeen North Campground has 11 RV slots; each concrete pad has full utility service. Each site also includes fire pit and picnic table.

APG NORTH CAMPING FEES	DAILY	WEEKLY
ACTIVE DUTY	\$20	\$100
RETIRED	\$25	\$125
DOD CIVILIAN / CONTRACTOR	\$30	\$150

Aberdeen South Campground has tent camping. There are port-a-pots within walking distance of the facility.

APG SOUTH CAMPING FEES	DAILY
ALL SITES	\$5

## **Abbreviations.**

APG ..... Aberdeen Proving Ground  
APG-AA ..... Aberdeen Proving Ground-Aberdeen Area  
APG-EA ..... Aberdeen Proving Ground-Edgewood Area  
APGR ..... Aberdeen Proving Ground Regulation  
DA ..... Department of the Army  
DFMWR ..... Directorate of Families, Morale, Welfare and Recreation  
DOD ..... Department of Defense  
DPW ..... Directorate of Public Works

## **References.**

Installation Master Plan (2012).  
Technical Manual Planning of Outdoor Recreation Areas, TM-5-803-12, 3  
September 1986.  
Army Regulation 215-1, Military Morale, Welfare and Recreation Programs and  
Nonappropriated Fund Instrumentalities.  
APG Regulation 200-6 Hunting, Trapping and Wildlife Control on APG.  
APG DFMWR Hunting Program Policy Memo.  
APG Regulation 210-26, Recreational Fishing and Crabbing Rules.  
APG Regulation 210-10, Use and Navigation of Restricted Waters of APG.

# **APPENDIX O**

Project List





## **LIST OF INRMP PROJECTS**

The following is not an inclusive list of all projects. The projects are presented in no particular order. Costs are estimated.

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## **PROJECT: Unexploded Ordnance (UXO) Support for Environmental Field Work**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

### **Project Description:**

UXO avoidance support for execution of natural resources projects (including but not limited to habitat restorations, stream surveys, sediment and benthic sampling, wetlands regulatory site visits, shoreline post-storm surveys and clean-up efforts, and sign installation). Partial funding is acceptable.

### **Deliverable:**

UXO sweeps to include scans and avoidance. Letters of completion to include UXO swept GIS layer maps indicating UXO completion by specific contractor letter, technician, anomalies found and UXO work dates. Each site geographic area will be GPS captured for APG's GIS.

### **Cost and Cost Basis:**

\$75,000 (total)

30 days UXO support @ \$2,500 per day

### **Justification:**

Failure to fund prevents implementation of many INRMP projects. APG regulation requires UXO support for any intrusive operations.

### **Class:**

0 - Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Water Quality Monitoring**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

Approximately half of APG is open water of the Chesapeake Bay or tributaries of the Chesapeake Bay. This is a valuable resource deemed a "National Treasure" by President Obama in EO 13508. As the receiving water for all land based activities on APG, water quality monitoring is a significant aspect is determining the overall health of APG's ecosystems. Water quality monitoring is also important in determining viability of the water for survivability and restoration potential for submerged aquatic vegetation (SAV). SAV is important habitat for fish and blue crabs, while reducing the suspended sediment load and stabilizing shorelines. Monitoring water quality on a regular basis can also help identify the presence of Harmful Algal Blooms (HABs), so the appropriate notification can be given to people working or recreating on the Chesapeake Bay and its' tributaries. Candidate for Work Plan Integration through Public Health Command.

### **Deliverable:**

Monthly data analysis in spreadsheet form

### **Cost and Cost Basis:**

\$40,000

58 samples per month for Nitrogen series, Phosphorus series, Solids series, Other

### **Justification:**

If not funded approximately half of APG will continue to be unmonitored from an ecological perspective. Data gaps will continue to grow, between the outside community and APG and unsafe conditions could occur in the waters of APG without being identified.

### **Class:**

0 – Recurring

### **Legal Driver:**

EO 13508, Sikes Act

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## **PROJECT: Wetland Hydrologic Monitoring to Assess Impact of Sea Level Rise**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Dynamic changes in shallow groundwater elevations as a result of surface-water elevation changes and wetland vegetation loss will be a large factor in the impact of sea level rise (SLR) on bordering areas including upland forested habitat, buildings, roads, testing ranges and test facilities. As wetland inundation increases, increases in shallow groundwater levels will likely cause waterlogging and die-off in forested areas. Increases in salinity of shallow groundwater from surface-water encroachment can add to the stress and die-off in upland forested areas, adding to the threat to protected species, such as the bald eagle, that rely on the wetlands and forested areas. The scope of this study is to establish water-level monitoring transects in two wetlands with bordering forested areas to provide an assessment of their response and vulnerability to changes in surface-water levels. Both a disturbed and relatively undisturbed wetland will be assessed and compared.

Shallow ground-water wells (piezometers), nested with surface water-level monitors, will be installed manually, with at least one transect from shore to forested upland, consisting of about 10 piezometers (in nests of 2 to 3 piezometers at a site) in the Monks Creek wetland area. Surveying will be completed to obtain piezometer elevations and transducers will be used to continuously record water levels. Temperature, pH, and specific conductance (which will provide salinity) will be measured with hand-held tapes and probes in monthly synoptic events. In addition to the monthly samples, a pre- and post-storm event will be selected and data will be collected in an event in both winter and summer months. Measurements will provide data that will be critical to informing the relation between groundwater and surface-water dynamics and predicting future response and effects of SLR.

### **Deliverable:**

Data will be provided to environmental staff and stored in USGS supported databases. Available local tide and precipitation data will also be provided and used to interpret results. APG environmental staff will be briefed on results and application of data.

### **Cost and Cost Basis:**

\$99,580 (total)

\$67,645 for labor (includes administrative and technical support personnel)

\$17,000 for equipment and supplies

\$14,935 for indirect costs

**Justification:**

Accurate data are critical for planning to protect the wetlands that make up a significant portion of APG. Lack of place-based measurements will result in reliance on models not calibrated to site conditions, leaving habitat, mission assets, and restoration remedies in place at risk. This study will provide data to support DOD resiliency planning and to develop site-specific climate change vulnerability assessments.

**Class:**

3 – Best Management Practice

**Legal Driver:**

Sikes Act, Clean Water Act

## **PROJECT: Wetland Elevation Monitoring to Assess Potential for Sea Level Rise (SET Installation and Monitoring)**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

This project addresses priorities and needs outlined by the Army (USACE Climate Change Adaptation Plan, 2014) to prepare for changing sea levels and provides information for developing climate change vulnerability assessments as specified in the INRMP. This includes the collection of timely data, information, and decision support tools for climate preparedness and resilience by addressing sea level rise (SLR) and storm effects on wetlands and low-lying areas. Wetland ecosystems, and the forested areas that often border them, not only provide habitat for protected species but are important buffers for military testing facilities and ranges, historic waste disposal areas, buildings and roads at APG.

Project will install 3 additional permitted surface elevation tables (SETs) for a total of 6 SETs, and monitor SETs and co-located marker horizons at least 4 times at all locations during a 12 to 18-month period. Additional surveying may be initiated following storms. Continuous data downloads will be conducted at least every 2 months through the duration of the project. Monitoring data will be collected from tide gauge installed for previous USGS project.

### **Deliverable:**

Surface elevation, SET, and tide gauge data will be collected, quality assured, and maintained in electronic format and provided as data deliverable. Tide gage data will be maintained in the USGS National Water Information System (NWIS) database. Up to three meetings or briefings per year will be provided, as requested by APG staff.

### **Cost and Cost Basis:**

\$86,000 (total)

\$66,700 for 252 hours of one Senior Scientist (project management, planning, data compilation and interpretation) and 576 hours of two Technicians (field work and data processing); Labor estimate also includes administrative and technical support personnel

\$3,900 for UXO support

\$2,500 for equipment and supplies

\$12,900 for indirect costs

**Justification:**

Accurate predictive models are critical for planning to protect the wetlands that make up a significant portion of APG. Failure to plan for SLR impacts puts at risk the ability of wetlands to function as protection for important habitat (such as for the bald eagle, driving eagles further inland and more susceptible to disturbance) and the surrounding testing ranges and installation infrastructure. This study will provide data to support DOD resiliency planning and to develop site-specific climate change vulnerability assessments.

**Class:**

3 – Best Management Practice

**Legal Driver:**

Sikes Act, Clean Water Act

## **PROJECT: Extreme Event Monitoring to Assess Wetland Vulnerability**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Documenting the height, extent, and timing of storm surge and understanding how overland storm tide and waves evolve and dissipate when they move across natural and man-made landscapes is critical for storm preparedness and prediction. Up to four monitoring sites will be selected for bracket installation to measure differences from the Bay-frontage surge (near the river mouth) and surge potentially occurring in the upper river systems. Brackets will be deployed on existing infrastructure, such as a tide gate, sea wall, pier, or other structures. A survey of the bracket location will be conducted so that accurate water elevation can be determined when the data is downloaded from the sensor. When a severe storm is forecasted, water level sensors will be mounted to the installed brackets 24 to 48-hours in advance of the storm. Typically, the recording period lasts for 1 to 3 days depending on the magnitude of the storm and post-storm access to the sensor sites. In a typical year, sensors may be deployed on average three times. If more events occur, sensors will be deployed as many times as required to capture the event.

### **Deliverable:**

Site specific data will be provided within a week of each monitored storm (approximately 3 times per year). A summary briefing of the storm information will be delivered to environmental staff and those involved in emergency preparedness planning before the end of the project period.

### **Cost and Cost Basis:**

\$24,940 (total)

\$14,700 for labor (salary and benefits)

\$6,500 for equipment and supplies

\$3,740 for indirect costs

### **Justification:**

Data from this project will provide insight into coastal flooding during extreme events. In addition, the project will provide valuable information including duration and extent of inundation during flood or surge events that can be used for preparedness planning, increasing resilience of local coastal assets and to develop site-specific climate change vulnerability assessments.

**Class:**

3 – Best Management Practice

**Legal Driver:**

Sikes Act, Clean Water Act



## **PROJECT: Monitoring of SETS and Hydrology, Extreme Event Modeling and Synthesis, and Product Development**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Continued collection, interpretation, and synthesis of place-based measurements in two tidal creeks to better understand wetland elevation, sea level rise, vulnerability to extreme events, and near wetland hydrology and potential for sea level rise.

### **Deliverable:**

Surface elevation, SET, and tide gage data will be collected (at least 4 additional monitoring events), quality assured, and maintained in an electronic format and provided to the Army as a data deliverable (USGS data release).

Up to 3 meetings or briefings per year are expected, as requested by the Army.

In the case of a storm in which SWaTH monitoring will occur as part of the larger regional northeast corridor network, a web link will be provided to site-specific data within one week of storm. Otherwise, if a storm is assessed without regional network, a summary briefing of the storm information will be delivered before end of project period.

An interpretive product (e.g., story map, administrative report, interactive mapper), synthesizing the multiple monitoring efforts, is proposed to provide a tool to understand and visualize results of the study of wetland elevation, vulnerability, and connection to hydrology at APG.

### **Cost and Cost Basis:**

\$144,374 (total)

### **Justification:**

Accurate predictive models are critical for planning to protect the wetlands that make up a significant portion of APG, though effective place-based monitoring is required to inform these predictive models. Failure to plan for sea level rise impacts puts at risk the ability of wetlands to function as important habitat for protected species and as protective buffer for the surrounding military buildings and training areas. The care of wetlands at APG is also paramount to the military mission of environmental stewardship. Significant unexploded ordnance and environmental contamination exists at the installation at many sites in or near wetlands, where natural processes in the wetlands act to remediate contaminants and prevent their release to surface water, groundwater, and the air. This study will provide a complete monitoring program to evaluate sea level rise impacts at a range of spatial and temporal scales to support DoD

resiliency planning. Impacts of sea level rise have already been mentioned in 5-year reviews of sites with current RODs. Lack of place-based measurements will result in reliance on models not calibrated to site conditions, leaving habitat, mission assets, and restoration remedies in place at risk.

**Class:**

3 – Best Management Practice

**Legal Driver:**

Sikes Act

## **PROJECT: Wetlands Mitigation Monitoring**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

Annual monitoring of wetland mitigation sites, not currently under contract for initial 5 years of long-term monitoring to ensure compliance with the terms of the wetland permits. Candidate for Workplan Integration through USACE Baltimore District.

### **Deliverable:**

Report on the status of the mitigation sites

### **Cost and Cost Basis:**

\$7,972 (total)

\$4,372 for labor

\$3,600 for UXO support

### **Justification:**

Failure to fund will result in non-compliance with terms of wetland permits

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Clean Water Act

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## **PROJECT: Evaluation of C4ISR and ATEF Wetland Mitigation Sites**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

Evaluate current status of C4ISR and ATEF wetland mitigation sites. Assess success of each site and make recommendations for path forward to include planting plan and schedule for permit close-out.

### **Deliverable:**

Report on current status of mitigation site, planting plan, and recommendations for permit close-out and timeline.

### **Cost and Cost Basis:**

To be determined (estimated \$50,000)

### **Justification:**

Fifth and final year of monitoring under contract for C4ISR and ATEF wetland mitigation sites is complete. Due to circumstances beyond contractor's control, sites have not achieved permit required success criteria by 5<sup>th</sup> year of monitoring. Contracts have been closed out. In order to comply with terms of wetland permits, the sites need to meet success criteria and be evaluated for close-out. Failure to fund will result in non-compliance with terms of the wetland permit.

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Clean Water Act

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## **PROJECT: Wetlands Planning Level Survey**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

### **Project Description:**

Determine tidal reach (head of tide) by aerial photographic interpretation and conduct field delineation as needed on various creeks on APG to include Romney Creek. Candidate for Work Plan Integration through USACE Baltimore District.

### **Deliverable:**

Report and GIS data on the tidal reach.

### **Cost and Cost Basis:**

\$20,550

\$7,840 for field work (Environmental Scientist for 80 hours @ \$98 per hour)

\$7,840 for aerial photos and report (Environmental Scientist for 80 hours @ \$98 per hour)

\$800 for GIS support (16 hours @ \$50 per hour)

\$320 for administrative support (8 hours @ \$40 per hour)

\$3,750 for UXO support (40 hours @ \$93.75 per hour)

### **Justification:**

Determination of the tidal reach will define the tidal versus nontidal floodplain and provide more definitive data on the Maryland defined critical area boundary.

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act

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## **PROJECT: Wetland Delineation**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Wetland delineation and functional assessment of project areas on APG. Candidate for workplan integration through USACE Baltimore.

### **Deliverable:**

Wetland delineation report, functional assessment report, and GIS data for each project area.

### **Cost and Cost Basis:**

\$29,350 (total)

\$14,230 for labor

\$15,120 for UXO support

### **Justification:**

Failure to fund will result in potential delays in mission operations due to inability to support permit application for DPW projects.

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act, Clean Water Act

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## **PROJECT: Wetland Mitigation Site Development Under DoD Umbrella Mitigation Banking Instrument**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Using the established DoD Umbrella Mitigation Banking Instrument, establish a single user wetland mitigation bank site. This includes: mitigation site search; site selection; conceptual mitigation plan development; preliminary regulatory approval; NEPA coordination; baseline data collection; hydrologic and hydraulic (H&H) modeling and water budget; 65% design plan development; mitigation site plan development; state and federal permit applications and approvals; final bank site approvals; permits and authorizations; final design plan development; and mitigation site plan approval.

### **Deliverable:**

Environmental Assessment, Environmental Baseline Survey of proposed sites, baseline data collection, H&H Modeling & Water Budget, Conceptual Mitigation Plan, 65% Design Plan, Mitigation Site Plan, permit applications and approvals, 90% Design Plans and supporting documents. Final Bank Site approvals, permits and authorizations.

### **Cost and Cost Basis:**

To be determined (estimated \$1,360,000)

### **Justification:**

10 USC 2694 allows DoD installations to develop wetlands bank to pro-actively manage compensatory mitigation measures as required by Federal and State permits issued under the Clean Water Act. Developing an off-post bank will reduce internal encroachment caused by the permanent loss of mission landscape and will reduce the liability and risk to the Army due to the criteria used to measure success of the project. Currently in the State of Maryland, mitigation design and funding is required prior to a permit being issued for projects on the Installation.

Failure to fund will increase internal encroachment caused by permanent loss of mission landscape to mitigation and will increase liability and risk to Army due to criteria used to measure success of mitigation project

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act, Clean Water Act

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## **PROJECT: Wetland Restoration**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Implementation of the recommendations in the Wetland Functional Analysis: Romney Creek Watershed. Wetland restoration of 8 acres of forested wetland in Forest Stand 38-18.

### **Deliverable:**

Project will include invasive species removal and tree planting

### **Cost and Cost Basis:**

\$202,044.80 (total)

8 acres @ \$25,255.60 per acre

### **Justification:**

Failure to fund will perpetuate decline of wetlands in Romney Creek watershed due to invasive plants and heavy deer pressure. The forested wetlands are showing no signs of regeneration or future sustainability.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Sikes Act, Clean Water Act

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## **PROJECT: Wetlands Program Support**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

Wetland delineation, permit application development, meetings and site visits with the regulators.

### **Deliverable:**

Wetland delineation report and mapping

### **Cost and Cost Basis:**

\$17,520

4 acres @ \$4,380 per acre

### **Justification:**

Failure to fund could potentially result unauthorized wetland impacts that may result in non-compliance with Clean Water Act if sites are not field delineated.

### **Class:**

0 - Recurring

### **Legal Driver:**

Clean Water Act

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## **PROJECT: Wetlands Permit Database**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

This project is to develop a simple, shareable system (e.g., database) for managing and maintaining APG's wetlands permit data and records. An inventory/catalog will be made of all existing wetland data/reports, including subject, format, location, etc. This would include scanning paper reports, identifying spreadsheet formats that could be used to log raw/notational data, and designing a database into which scanned reports, spreadsheets, individual records, etc. could be uploaded.

### **Deliverable:**

Inventory of all wetlands data/reports and a database for wetlands permits/reports

### **Cost and Cost Basis:**

To be determined (estimated \$20,000)

### **Justification:**

APG will continue to have wetlands permit files in vulnerable paper formats, and in non-centralized locations. This information will continue to be unsearchable and virtually inaccessible to persons beyond the immediate individual with the data.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Sikes Act

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## **PROJECT: Culvert Inventory**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Locate and GPS all culverts and headwalls at APG to include all range areas, Churchville Test Area, Graces Quarters, and Carroll Island. Culverts will be located at all roadway, rail, driveway or sidewalk crossings. Headwalls will be identified and recorded in any instance where they are part of the culvert. Use GPS data to update and populate APG's existing "StormwaterUtilitySegment\_Clvrt" GIS layer and "StormwaterUtilitySegment\_Hdwll" GIS layers. Field check all data in the existing layers; gather and populate any missing data from the layers; identify any references to culverts and/or headwalls that no longer exist; locate and collect all culverts and headwalls that are not identified in the existing layer; and populate all required data as specified in the latest Army Geospatial Data Layer Quality Assurance Plans.

### **Deliverable:**

Geodatabase with fully compliant, complete data layers containing all required attributes. The horizontal accuracy of the data shall be less than or equal to 1 foot.

### **Cost and Cost Basis:**

To be determined (estimated \$25,000)

### **Justification:**

Culvert failure has been addressed on an emergency basis. In order to develop a programmatic wetland permit for culvert replacement and streamline the regulatory process, an inventory of the culverts is required.

### **Class:**

1 – Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act

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## **PROJECT: Beaver Management**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Identify locations where beaver activity (dams, culvert blockages) has the potential for causing negative impacts to built and natural infrastructure and identify future potential problem areas. Develop site-specific strategies for each of these locations to mitigate negative beaver impacts based on the most current research and techniques available. Clean and monitor existing flow devices to maintain function.

### **Deliverable:**

Maintenance and repair of existing flow devices and installation of additional flow devices and other beaver impact mitigation strategies as needed.

Report detailing maintenance activities, site-specific strategies undertaken to mitigate negative beaver impacts (e.g. flow device installation, tree protection). Spatial data for inclusion in the installation GIS should be part of the report.

### **Cost and Cost Basis:**

To be determined (estimated \$22,700)

### **Justification:**

The beaver population at APG has increased as suitable habitat surrounding the installation has diminished and participation in recreational trapping has declined. As a result, beavers are causing significant negative impacts to culverts, roads, test ranges, wetland and stream mitigation acreage, forest stands and other military assets.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Sikes Act

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## **PROJECT: Regulatory Credit Ratio Analysis**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

### **Project Description:**

This task is aimed at completing a small study to analyze the complexity of credit ratios for various mitigation types including streams, wetlands, and trees for compliance with multiple state and federal permitting requirements. Mixing mitigation types may prove more cost effective when mission requirements require regulatory mitigation.

### **Deliverable:**

The primary project deliverable associated with this activity is a report analyzing current state and federal regulations, types of regulatory mitigation and various methodologies of mixing mitigation types to meet permit requirements.

### **Cost and Cost Basis:**

To be determined (estimated \$50,000)

### **Justification:**

Construction projects on APG often affect various state and federal laws, regulations and policies. Often times, mitigation is required for each of these and sometimes mitigation requirements are contradictory. An in depth analysis of mitigation ratios and types would benefit planning and budgeting operations in order to maximize financial resources while also maximizing mitigation survivability.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Sikes Act

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## **PROJECT: Plant Community Map and Rare Plant Survey**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

AR 200-1 specifies that planning level surveys (PLSs) and data analyses shall be conducted as the foundation for effective planning and decision making. APG has not completed a PLS of vegetation communities, one of the baseline surveys required by AR 200-1.

The goal of the proposed project is to develop a detailed Federal Geographic Data Committee (FGDC) compliant vegetative communities map of APG and to identify and map the distribution of rare plants associated with these communities.

### **Deliverable:**

1. Three CDs containing an FGDC compliant vegetative communities map (ArcMap compatible) and all associated GIS layers used to develop the map. All layers will have appropriate metadata and be SDSFIE compliant.
2. Three large format hardcopy maps of the final product.
3. Five hardcopy and bound technical reports that describe in detail the methods used to produce the vegetation map. In addition, the technical report will have detailed descriptions of each association identified and used to develop the vegetation map of Aberdeen Proving Ground. A digital copy of the final product will be provided on CD in Microsoft word and PDF format.

### **Cost and Cost Basis:**

\$93,899.81 (total)

\$43,656.25 for 1,015 hours of project management, planning, data compilation and interpretation field work

\$43,656.25 for per diem, lodging, mileage, fuel, tolls

\$9,632 for CESU indirect costs

\$7,421.56 for USACE Fort Worth District fee

\$22,440 for UXO support

**Justification:**

Failure to fund will result in lack of required installation-wide data on vegetation communities and populations of RTE plants. Accurate, up-to-date data on RTE plants is necessary for project planning to support and sustain the mission. Lack of data on rare plant populations will limit the conservation management of sensitive and rare species to prevent future state and federal listings.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Spotted Turtle Population and Habitat Study**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

In order to effectively protect, manage, and monitor at-risk species, APG requires current information on where these species occur on the installation. This project will survey for spotted turtles and habitat at Carroll Island. Spotted turtle is currently under review for potential federal listing under ESA.

### **Deliverable:**

Project will collect, measure, sex, mark, age and release the Spotted Turtle population on Carroll Island and assess the habitat at the collection points.

### **Cost and Cost Basis:**

\$35,100 (total)

\$20,500 for labor

\$2,000 for supplies

\$12,600 for support

### **Justification:**

Failure to fund could result in restrictions on mission activities. If spotted turtles are listed under ESA and baseline data on species' occurrence are not available, APG will be required to implement appropriate spotted turtle protection guidance across the installation, even if the species is not present. Proactive conservation of species at risk and their habitats can help preclude the need for federal listing and protect significant biological diversity, while enabling APG to continue providing a high quality testing environment.

### **Class:**

1 – Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act

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## **PROJECT: Spotted Turtle Habitat Maintenance**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Maintain existing spotted turtle habitat by removing encroaching trees and other invasive vegetation while preserving the highbush blueberry tussocks and small wetland pools used by the turtles. Spotted turtle is currently under review for potential federal listing under ESA.

### **Deliverable:**

Project will maintain 2 acres of habitat with removal of small trees (1" to 4" dbh) and invasive vegetation removal.

### **Cost and Cost Basis:**

Prices specified in schedule for APG's Forestry Services Support contract.

\$4,138.20 total

2 acres of invasive tree removal (1" to 4" dbh) at \$2,069.10 per acre

### **Justification:**

Failure to fund may impact future mission and readiness if the spotted turtle is listed under the ESA. Habitat conservation will sustain a known population of spotted turtles with no impact to current mission activities and support the goal of preventing the listing of a species-at-risk.

### **Class:**

1 – Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act

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## **PROJECT: Spotted Turtle Signage**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.2** – Conserve threatened and endangered species in compliance with federal, DoD, and Army regulations and policies

### **Project Description:**

Design and purchase signs to mark spotted turtle habitat in areas where unmanned ground vehicles and other test activities have the potential to impact turtles, nests, and habitat.

### **Deliverable:**

10, 12" x 18" weatherproof signs with mounting hardware  
10, 6 ft U-channel sign posts

### **Cost and Cost Basis:**

\$497.50 (total)

### **Justification:**

Placement of spotted turtle signs will provide test planners easily visible markers for areas to avoid during test activities. This will facilitate test planning and execution while protecting a species-at-risk.

### **Class:**

1 – Statutory Requirement (Non-Recurring)

### **Legal Driver:**

ESA; Recommended BMPs for the Spotted Turtle on DoD Installations; Sikes Act



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## **PROJECT: Northern Long-eared, Tri-colored, and Little Brown Bat Acoustic Survey**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Conduct acoustic presence/absence survey for northern long-eared, tri-colored, and little brown bats on approximately 40,000 acres of the installation. Survey will consist of 60 stationary survey locations monitored for two nights each and 10 mobile survey transects to cover areas of the installation where it is not feasible to set up stationary monitors. Federal installations are required by law to have their properties surveyed for distribution and abundance of listed species. The northern long-eared bat is a federally listed species, and the tri-colored bat and little brown bat are currently under review for potential federal listing under Endangered Species Act (ESA).

### **Deliverable:**

Detailed report to include methodology, species detected at each sampling location/transect, total number of pulses recorded of each species, and comparisons to 2011 and 2017 survey results. Raw data, shape files, and analysis outputs will be provided for incorporation into APG's GIS.

### **Cost and Cost Basis:**

\$86,660 (total)

\$45,360 for 280 hours of sampling, 7 days in July, 7 days in September (USACE Senior Biologist @ \$162 per hour)

\$22,400 for 280 hours of sampling, 7 days in July, 7 days in September (USACE Junior Biologist @ \$80 per hour)

\$9,200 for travel (14 days)

\$2,480 for equipment

\$2,000 for materials and supplies

\$1,220 for report production

### **Justification:**

We are required to conduct ESA consultations with USFWS prior to mission activities that have potential to affect listed species or their habitats. Data from this project will minimize potential for delays that would occur if required individual surveys were conducted in potential bat habitat prior to each mission activity. Additionally, proactive

conservation of species at risk (tri-colored and little brown bats) can help preclude need for ESA federal listing.

**Class:**

1 – Statutory Requirement (Non-Recurring)

**Legal Driver:**

ESA; Sikes Act

## **PROJECT: Bald Eagle Aerial Surveys**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act (BGEPA)

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

Aerial surveys conducted by helicopter to monitor bald eagle population, identify new nests, count numbers of eggs and chicks, and confirm fledging. Eagle monitoring data are used to identify mission impacts on eagle population, as required by BGEPA and APG's Bald Eagle Incidental Take Permit.

### **Deliverable:**

1. Mid-Winter Bald Eagle Count report
2. Annual Bald Eagle Productivity report
3. Annual Bald Eagle Take report

### **Cost and Cost Basis:**

\$17,822.52 (total)

27 flight hours for UH-60 Blackhawk aircraft

Flight rate = \$802.51 for first hour + \$546.16 per each additional hour

One (1) 4-hr flight =  $\$802.51 + 3(\$546.16) = \$2,440.99$

Ten (10) 2-hr flights =  $10(\$802.51 + \$546.16) = \$13,486.70$

One (1) 3-hr flight =  $\$802.51 + 2(\$546.16) = \$1,894.83$

Direct charge to Aberdeen Test Center

### **Justification:**

Permit compliance. Knowing and willful failure to comply with conditions of permit is cause for suspension of permit, denial of permit renewal, restrictions on mission operations, fines and imprisonment. Fines of \$100,000 (\$200,000 for organizations), imprisonment for 1 year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation is a felony.

**Class:**

0 – Recurring

**Legal Driver:**

BGEPA (16 USC 668; 50 CFR 22.26)

## **PROJECT: Eagle Protection Devices for Power Lines**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act (BGEPA)

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Replacement of failed avian protection devices (including flight diverters/flappers and insulating covers) on overhead power lines to reduce bald eagle mortalities due to line strikes, as required by APG's Bald Eagle Incidental Take Permit. These efforts will reduce the potential for power outages caused by eagles colliding with power lines, causing mission delays. Partial funding is acceptable.

### **Deliverable:**

Removal and replacement of avian protective devices

### **Cost and Cost Basis:**

\$52,500 (total)

Replacement of 700 flappers @ \$75 ea

Modification to existing contract with City Light & Power with MIPR to DLA

### **Justification:**

Permit compliance. Knowing and willful failure to comply with conditions of permit is cause for suspension of permit, denial of permit renewal, restrictions on mission operations, fines and imprisonment. Fines of \$100,000 (\$200,000 for organizations), imprisonment for 1 year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation is a felony.

### **Class:**

1 – Statutory Requirement (Non-Recurring)

### **Legal Driver:**

BGEPA (16 USC 668, 50 CFR 22.26)

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## **PROJECT: Fatality Monitoring for Eagle Incidental Take Permit**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act (BGEPA)

### **Project Description:**

Develop and implement a bald eagle fatality monitoring protocol that includes: 1) quantification of incidental carcass finds through a standardized carcass detection (searcher efficiency) trial, and 2) carcass persistency trial. Data collected from implementation of protocol will support creation of a legally and scientifically defensible take estimate in support of issuance of eagle permit, and verify compliance with terms of BGEPA take authorization. This project will be developed and implemented with input from the U.S. Fish and Wildlife Service.

### **Deliverable:**

Protocol for incorporation into APG Integrated Natural Resources Management Plan.

Data sheets for collecting monitoring data.

Data report that meets requirements of U.S. Fish and Wildlife Service.

### **Cost and Cost Basis:**

To be developed and implemented in-house (labor only)

### **Justification:**

APG must demonstrate compliance with the terms of the BGEPA take authorization. Compliance with the take authorization requires periodic monitoring in order to provide data needed by the U.S. Fish and Wildlife Service regarding the impacts of the activity on eagles for purposes of adaptive management. APG must coordinate with the U.S. Fish and Wildlife Service to develop specific monitoring protocols.

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

BGEPA (16 USC 668, 50 CFR 22.26)

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## **PROJECT: Fisheries Planning Level Survey**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

APG has a large commercial and recreational fishery as well as the highest graded waters in the Chesapeake Bay. At this time, we know very little about the populations and abundances of fish in our waters. We rely on catch reports from commercial fishermen and receive no data from recreational fishermen. A comprehensive survey is needed to better regulate and manage our fisheries. With an influx of BRAC personnel, an even greater recreational fishery pressure is expected. Furthermore, recent poaching activity in the Chesapeake Bay and changes in fishing regulations have put the spotlight on fishing activity in Maryland. We need to determine an accurate estimation of health of our fisheries. Magnuson-Stevens Fishery Conservation and Management Act requires fisheries to be sustainably managed. We currently have very little reliable data to be used for management purposes. Recreational and commercial fisheries heavily impact various fish populations in APG's waters. Rebounds and changes in fish and crab population in the Chesapeake Bay have sparked changes on State regulations and we need data to support changing APG regulations.

### **Deliverable:**

A comprehensive report detailing the current populations and abundances of important commercial and recreational finfish and shellfish in APG waters.

### **Cost and Cost Basis:**

\$81,287 (total)

\$32,400 for UXO support (3 locations to be sampled 3 seasons, 3 days per location @ \$1,200 per day)

\$46,487.52 for sample collection, identification, and data analysis (one 2012 GSA Biologist III @ \$102 per hour and one 2012 GSA Biologist IV @ \$113.22 per hour; 8 hours per day for 27 days)

\$2,400 for supplies (3 nets @ \$800 each)

### **Justification:**

Maryland's Coastal Management Program's Enforceable policies state that fisheries shall be sustainably harvested. APG has regulatory jurisdiction over its waters and its fisheries (APGR 210-10) but limited knowledge on the value of its resource. If this project is not funded, APG would be inconsistent with Maryland's enforceable coastal policy and would not have a scientifically defensible position for APGR 210-10.

**Class:**

3 – Best Management Practice

**Legal Driver:**

Sikes Act

## **PROJECT: MBTA Avian Management for Nesting Raptors**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Install artificial nesting structures to encourage raptors such as ospreys and barn owls to nest in locations that will not impact installation infrastructure and constrain mission activities. Nesting platforms for ospreys will reduce the potential for power outages which significantly impact mission due to power interruptions to range areas and surety buildings. Nesting boxes for barn owls will minimize the potential for mission interruptions/delays caused by birds nesting in structures used for test programs.

### **Deliverable:**

Installation of nesting platforms and boxes

### **Cost and Cost Basis:**

\$16,500 (total)

\$15,300 for 9 osprey platforms installed @ \$1,700 per platform

\$1,200 for 3 barn owl boxes installed @ \$400 per box

### **Justification:**

Failure to fund will result in continued potential for mission delays due to power outages when birds and and/or their nesting material contact electrified equipment. Continued potential for mission interruptions due to birds nesting in active test structures. Potential for incidental take of eggs/nestlings/fledglings during mission activities.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Migratory Bird Treaty Act, Sikes Act

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## **PROJECT: Habitat Management for Migratory Waterbirds**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Replacement of two non-working water control structures to maintain water levels for migrating and wintering waterfowl. Project includes design, permitting (as required), UXO support, and construction.

### **Deliverable:**

Replacement of water control structures

### **Cost and Cost Basis:**

\$150,000 (total)

2 water control structures @ \$75,000 each

### **Justification:**

If the water control structures are not replaced, upstream areas will continue to flood, reducing the amount of shallow water habitat available to migrating and wintering waterfowl, encroaching on upland forested areas, and killing trees. Additionally, the current water control structures are not in compliance with a Memorandum of Agreement with Ducks Unlimited to provide routine rehabilitation, annual operation and maintenance necessary to maintain the continuing viability and functioning of the waterfowl management ponds

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Migratory Bird Treaty Act, Sikes Act



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## **PROJECT: Mute Swan Aerial Surveys**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Conduct aerial surveys for mute swans, an invasive species managed under Maryland law. The Maryland Department of Natural Resources (DNR) tracks the numbers and locations of wild mute swans in the state for targeted control efforts. APG's extensive wetlands provide ideal mute swan breeding habitat while its restricted access limits the ability of the DNR to count and control mute swans on APG. Aerial surveys coordinated with DNR biologists will allow location of active mute swan nests for egg addling in the spring and location of adult swans during the summer molt for population control.

### **Deliverable:**

Numbers and locations of mute swans and mute swan nests in APG wetlands identified on two flights (spring and mid-summer).

### **Cost and Cost Basis:**

\$3,243.50 (total)

5 flight hours for UH-60 Blackhawk aircraft

Flight rate = \$802.51 for first hour + \$546.16 per each additional hour

Two (2) 2.5-hr flights = 2(\$802.51 + \$546.16 + \$273.08)

Direct charge to Aberdeen Test Center

### **Justification:**

If mute swan numbers and locations are not tracked for targeted control efforts, APG has the potential to become a source for mute swans in the upper Chesapeake Bay. This would negatively affect coordination with the State Wildlife Action Plan and Chesapeake Bay Program goals of managing populations of waterbirds through understanding the impacts of exotic species.

### **Class:**

0 – Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Prescribed Burn for Wildland Fire Management**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Prescribe burn to reduce fuel load, sustain mission, and promote habitat for species diversity

### **Deliverable:**

Reduced fuel load for 16 acres

### **Cost and Cost Basis:**

\$32,000 (total)

16 acres @ \$2,000 per acre

### **Justification:**

Loss of missionscape and habitat due to uncontrolled fires from high fuel load

### **Class:**

0 - Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Riparian Buffer Forest Management**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Project targets rehabilitation of 30 acres of unhealthy riparian areas along Romney Creek and Canal Creek. Maintenance of these riparian buffer forest stands is critical to sustaining the necessary APG testing and training natural infrastructure. Healthy forest riparian buffers are critical to the overall health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Inspection and maintenance of riparian buffer forest stands in the Aberdeen and Edgewood areas in a manner that sustains 80% survivability of the original stand establishment with the species.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$246,000 (total)

\$136,000 for UXO support, site prep, tree planting (8 acres @ \$17,000 per acre)

\$110,000 for UXO support, forest scrub removal (22 acres @ \$5,000 per acre)

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forests and mission testing/training landscape.

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act

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## **PROJECT: Forest Stand 6-11 Timber Stand Improvement**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

The ongoing decline of APG's overall forest health is impacting the required testing mission buffer and wildlife habitat. APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement and timber stand improvement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Timber stand and habitat improvement on 25 acres (forest stand 6-11) in the Edgewood Area. Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal. Planned timber stand and habitat improvement projects are in the Forest Management component plan of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining testing and training natural infrastructure and improving the health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$176,041 (total, FY16)

25 acres at \$7,041.64 per acre

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Not funding this project will only further increase wildland fire fuel load and the rapid decline of APG's forests and mission testing/training landscape.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Stand 6-12 Timber Stand Improvement**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

The ongoing decline of APG's overall forest health is impacting the required testing mission buffer and wildlife habitat. APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement and timber stand improvement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Timber stand and habitat improvement on 23 acres (forest stand 6-12) in the Edgewood Area. Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal. Planned timber stand and habitat improvement projects are in the Forest Management component plan of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining testing and training natural infrastructure and improving the health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$161,958 (total, FY16)

23 acres at \$7,041.64 per acre

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Not funding this project will only further increase wildland fire fuel load and the rapid decline of APG's forests and mission testing/training landscape.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Stand 6-13 Timber Stand Improvement**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

The ongoing decline of APG's overall forest health is impacting the required testing mission buffer and wildlife habitat. APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement and timber stand improvement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Timber stand and habitat improvement on 13 acres (forest stand 6-13) in the Edgewood Area. Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal. Planned timber stand and habitat improvement projects are in the Forest Management component plan of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining testing and training natural infrastructure and improving the health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$91,541 (total, FY16)

13 acres at \$7,041.64 per acre

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Not funding this project will only further increase wildland fire fuel load and the rapid decline of APG's forests and mission testing/training landscape.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Stand 6-14 Timber Stand Improvement**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

The ongoing decline of APG's overall forest health is impacting the required testing mission buffer and wildlife habitat. APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement and timber stand improvement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Timber stand and habitat improvement on 37 acres (forest stand 6-14) in the Edgewood Area. Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal. Planned timber stand and habitat improvement projects are in the Forest Management component plan of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining testing and training natural infrastructure and improving the health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$260,541 (total, FY16)

37 acres at \$7,041.64 per acre

ARA Forestry and Ag/Grazing Funding Eligible



**Justification:**

Not funding this project will only further increase wildland fire fuel load and the rapid decline of APG's forests and mission testing/training landscape.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Stand 37-9 Timber Stand Improvement**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

The ongoing decline of APG's overall forest health is impacting the required testing mission buffer and wildlife habitat. APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement and timber stand improvement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Timber stand and habitat improvement on 27.9 acres (forest stand 37-9) in the Edgewood Area. Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal. Planned timber stand and habitat improvement projects are in the Forest Management component plan of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining testing and training natural infrastructure and improving the health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$196,462 (total, FY16)

27.9 acres at \$7,041.64 per acre

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Not funding this project will only further increase wildland fire fuel load and the rapid decline of APG's forests and mission testing/training landscape.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Stand 37-10 Timber Stand Improvement**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

The ongoing decline of APG's overall forest health is impacting the required testing mission buffer and wildlife habitat. APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement and timber stand improvement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Timber stand and habitat improvement on 35.2 acres (forest stand 37-10) in the Edgewood Area. Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal. Planned timber stand and habitat improvement projects are in the Forest Management component plan of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining testing and training natural infrastructure and improving the health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$247,866 (total, FY16)

35.2 acres at \$7,041.64 per acre

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Not funding this project will only further increase wildland fire fuel load and the rapid decline of APG's forests and mission testing/training landscape.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Stand 37-11 Timber Stand Improvement**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

The ongoing decline of APG's overall forest health is impacting the required testing mission buffer and wildlife habitat. APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement and timber stand improvement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Timber stand and habitat improvement on 42.6 acres (forest stand 37-11) in the Edgewood Area. Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal. Planned timber stand and habitat improvement projects are in the Forest Management component plan of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining testing and training natural infrastructure and improving the health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$299,974 (total, FY16)

42.6 acres at \$7,041.64 per acre

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Not funding this project will only further increase wildland fire fuel load and the rapid decline of APG's forests and mission testing/training landscape.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act



## **PROJECT: Forest Stand 40-7 Timber Stand Improvement**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

The ongoing decline of APG's overall forest health is impacting the required testing mission buffer and wildlife habitat. APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement and timber stand improvement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Timber stand and habitat improvement on 34 acres (forest stand 40-7) in the Edgewood Area. Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal. Planned timber stand and habitat improvement projects are in the Forest Management component plan of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining testing and training natural infrastructure and improving the health of the Chesapeake Bay. Project will also reduce wildland fire fuel load. Partial funding is acceptable.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$239,416 (total, FY16)

34 acres at \$7,041.64 per acre

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Not funding this project will only further increase wildland fire fuel load and the rapid decline of APG's forests and mission testing/training landscape.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 3-5**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 15.56 acres (forest stand 3-5). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$96,481.31 (total)

15.56 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 3-6**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 14.5 acres (forest stand 3-6). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$89,908.70 (total)

14.5 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 3-9**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 56.86 acres (forest stand 3-9). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions that will implement requirements in the Forest Management Plan component of the INRMP that improves testing and training landscape required to sustain the military mission at APG. The ongoing decline of APG's overall forest health is impacting the required testing mission buffer. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest management that will reverse the current trend.

### **Cost and Cost Basis:**

All project costs bases on projected new forestry contract currently in development for award (costs based on historical pricing plus). See pricing per acre used for FY21 project costs.

\$404,521.38 (total)



Forest enhancement and invasive removal:  
56.86 acres @ \$2,009.03 per acre=\$114,233.45

UXO:  
56.86 acres @ \$5,105.31 per acre=\$290,287.93

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Failure to fund will only further the degradation of APG's overall forest health required for APG's testing and training mission and increase wildland fire fuel load.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 12-3**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 42.3 acres (forest stand 12-3). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$251,017 (total)

42.3 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 12-5**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 57.19 acres (forest stand 12-5). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$354,612.32 (total)

57.19 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 13-4**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 5.36 acres (forest stand 13-4). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$33,235.22 (total)

5.36 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act



## **PROJECT: Forest Enhancement, Stand 14-3**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 30.71 acres (forest stand 14-3). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions that will implement requirements in the Forest Management Plan component of the INRMP that improves testing and training landscape required to sustain the military mission at APG. The ongoing decline of APG's overall forest health is impacting the required testing mission buffer. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest management that will reverse the current trend.

### **Cost and Cost Basis:**

All project costs bases on projected new forestry contract currently in development for award (costs based on historical pricing plus). See pricing per acre used for FY21 project costs.

\$218,481.38 (total)

Forest enhancement and invasive removal:  
30.71 acres @ \$2,009.03/acre = \$61,697.31

UXO:  
30.71 acres @ \$5,105.31/acre=\$156,784.07

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Failure to fund will only further the degradation of APG's overall forest health required for APG's testing and training mission and increase wildland fire fuel load.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 15-21**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 14.25 acres (forest stand 15-21). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$88,494 (total)

14.25 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 17-7**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 56.9 acres (forest stand 17-7). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$369,555.76 (total)

56.9 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 18-3**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 46.43 acres (forest stand 18-3). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$287,893.86 (total)

46.43 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.



**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 18-5**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 47.37 acres (forest stand 18-5). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions that will implement requirements in the Forest Management Plan component of the INRMP that improves testing and training landscape required to sustain the military mission at APG. The ongoing decline of APG's overall forest health is impacting the required testing mission buffer. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest management that will reverse the current trend.

### **Cost and Cost Basis:**

All project costs bases on projected new forestry contract currently in development for award (costs based on historical pricing plus). See pricing per acre used for FY21 project costs.

\$337,006.29 (total)

Forest enhancement and invasive removal:  
47.37 acres @ \$2,009.03/acre = \$95,167.75

UXO:  
47.37 acres @ \$5,105.31/acre=\$241,838.54

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Failure to fund will further degrade the overall health of APG's forests required for APG's testing and training mission and increase wildland fire fuel load.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 18-7**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 89.35 acres (forest stand 18-7). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions that will implement requirements in the Forest Management Plan component of the INRMP that improves testing and training landscape required to sustain the military mission at APG. The ongoing decline of APG's overall forest health is impacting the required testing mission buffer. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest management that will reverse the current trend.

### **Cost and Cost Basis:**

All project costs bases on projected new forestry contract currently in development for award (costs based on historical pricing plus). See pricing per acre used for FY21 project costs.

\$635,666.28 (total)

Forest enhancement and invasive removal:  
89.35 acres @ \$2,009.03/acre = \$179,506.83

UXO:  
89.35 acres @ \$5,105.31/acre=\$456,159.45

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Failure to fund will further degrade the overall health of APG's forests required for APG's testing and training mission and increase wildland fire fuel load.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 29-11**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 31.12 acres (forest stand 29-11). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$192,962.67 (total)

31.12 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act



## **PROJECT: Forest Enhancement, Stand 41-2**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 21.1 acres (forest stand 41-2). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$169,703.53 (total)

21.1 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Enhancement, Stand 41-13**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

APG's overall forest health and adequate natural regeneration continue to decline because of intense deer pressure and invasive species such as Japanese stilt grass. APG military mission and ecosystem sustainability requirements drive the need for aggressive forest enhancement that will reverse the current trend while developing and maintaining desirable future forest conditions.

Forest enhancement on 45.9 acres (forest stand 41-13). Enhancement requirements include UXO sweep on the entire area prior to forest scrub and invasive species removal as outlined in the APG forest management plan. Planned timber stand and habitat improvement projects are in the Forest Management Plan component of the APG INRMP and focus on improving the forest ecosystem while creating and sustaining the testing and training natural infrastructure and improving the health of the Chesapeake Bay. Partial funding is acceptable. Project will also reduce wildland fire fuel load.

### **Deliverable:**

Develop, map, and mark silvicultural prescriptions as required in the Forest Management component of the INRMP.

Reduction of wildland fire fuel load.

### **Cost and Cost Basis:**

\$323,211.27 (total)

45.9 acres

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Not funding this project will only increase wildland fire fuel load and further the rapid decline of APG's forested resources necessary for testing and training.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Forest Stand 2-4 MS4 Permit & TMDL Implementation**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

In support of continued forest management of Army mission landscape at APG and wildlife habitat on both the Aberdeen and Edgewood Areas, 54 acres of unhealthy forest in APG forest stand 2-4 will be rehabilitated. Maintenance of these forest stands is critical to sustaining necessary APG testing and training natural infrastructure as outlined in the APG Forest Management Plan component of the APG Integrated Natural Resources Management Plan (INRMP). Contractor will perform a minimum of 54 acres of forest enhancement and wildlife habitat improvement as specified in the APG Forest Management Plan. Contractor will tube and stake natural regeneration in conjunction with COR and based on canopy gaps and future basal area requirements in accordance with the APG Forest Management Plan. This project generates credits for Coastal Zone Management Act, Section 307 offsets and supports Chesapeake Bay Total Daily Load (TMDL) and MS4 permit.

### **Deliverable:**

Forest enhancement and wildlife habitat improvement.

Reduction of wildland fire fuel load.

Credits for Coastal Zone Management Act, Section 307 offsets

### **Cost and Cost Basis:**

\$377,002.42 (total)

54 acres

### **Justification:**

Failure to fund will increase wildland fire fuel load and potential for extensive wildland fires leading to delays in mission testing, and further lead to rapid decline of APG's forested resources necessary for testing and training landscapes. Regulatory credits are necessary to offset impacts to forest resources from mission activities, as identified through Coastal Zone Management Act, Section 307 determinations.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act; E.O. 13508 Chesapeake Bay Protection and Restoration; COMAR 26.08 Water Pollution; COMAR 26.08.02 Water Quality; CWA Sections 401-404; State Discharge Permit 13-SF-5501/NPDES Permit MDR055501

## **PROJECT: Forest Stand 30-18 MS4 Permit & TMDL Implementation**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

In support of continued forest management of Army mission landscape at APG and wildlife habitat on both the Aberdeen and Edgewood Areas, 18.7 acres of unhealthy forest in APG forest stand 30-18 will be rehabilitated. Maintenance of these forest stands is critical to sustaining necessary APG testing and training natural infrastructure as outlined in the APG Forest Management Plan component of the APG Integrated Natural Resources Management Plan (INRMP). Contractor will perform a minimum of 18.7 acres of forest enhancement and wildlife habitat improvement as specified in the APG Forest Management Plan. Contractor will tube and stake natural regeneration in conjunction with COR and based on canopy gaps and future basal area requirements in accordance with the APG Forest Management Plan. This project generates credits for Coastal Zone Management Act, Section 307 offsets and supports Chesapeake Bay Total Daily Load (TMDL) and MS4 permit.

### **Deliverable:**

Forest enhancement and wildlife habitat improvement.

Reduction of wildland fire fuel load.

Credits for Coastal Zone Management Act, Section 307 offsets

### **Cost and Cost Basis:**

\$130,554.42 (total)

18.7 acres

### **Justification:**

Failure to fund will increase wildland fire fuel load and potential for extensive wildland fires leading to delays in mission testing, and further lead to rapid decline of APG's forested resources necessary for testing and training landscapes. Regulatory credits are necessary to offset impacts to forest resources from mission activities, as identified through Coastal Zone Management Act, Section 307 determinations.



**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act; E.O. 13508 Chesapeake Bay Protection and Restoration; COMAR 26.08 Water Pollution; COMAR 26.08.02 Water Quality; CWA Sections 401-404; State Discharge Permit 13-SF-5501/NPDES Permit MDR055501

## **PROJECT: Forest Stand 38-23 MS4 Permit & TMDL Implementation**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

In support of continued forest management of Army mission landscape at APG and wildlife habitat on both the Aberdeen and Edgewood Areas, 73.8 acres of unhealthy forest in APG forest stand 38-23 will be rehabilitated. Maintenance of these forest stands is critical to sustaining necessary APG testing and training natural infrastructure as outlined in the APG Forest Management Plan component of the APG Integrated Natural Resources Management Plan (INRMP). Contractor will perform a minimum of 73.8 acres of forest enhancement and wildlife habitat improvement as specified in the APG Forest Management Plan. Contractor will tube and stake natural regeneration in conjunction with COR and based on canopy gaps and future basal area requirements in accordance with the APG Forest Management Plan. This project generates credits for Coastal Zone Management Act, Section 307 offsets and supports Chesapeake Bay Total Daily Load (TMDL) and MS4 permit.

### **Deliverable:**

Forest enhancement and wildlife habitat improvement.

Reduction of wildland fire fuel load.

Credits for Coastal Zone Management Act, Section 307 offsets

### **Cost and Cost Basis:**

\$515,236.18 (total)

73.8 acres

### **Justification:**

Failure to fund will increase wildland fire fuel load and potential for extensive wildland fires leading to delays in mission testing, and further lead to rapid decline of APG's forested resources necessary for testing and training landscapes. Regulatory credits are necessary to offset impacts to forest resources from mission activities, as identified through Coastal Zone Management Act, Section 307 determinations.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act; E.O. 13508 Chesapeake Bay Protection and Restoration; COMAR 26.08 Water Pollution; COMAR 26.08.02 Water Quality; CWA Sections 401-404; State Discharge Permit 13-SF-5501/NPDES Permit MDR055501

## **PROJECT: Forest Stand 38-18 Tree Planting**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

This project will restore a degraded forest stand with 8 acre canopy gap located in riparian buffer. Project will remove invasive species taking over the forest floor, plant 8 acres of native trees species within the canopy gap and provide 5 years of tree maintenance to restore forest health and generate Coastal Zone Management Act, Section 307 regulatory offsets for mission activities. This project will also support Chesapeake Bay Total Daily Load (TMDL) and APG's MS4 permit. This project is adjacent to a test track and will support long-term mission sustainability.

### **Deliverable:**

8 acres of native trees planted in existing canopy gap located in riparian buffer.

Credits for Coastal Zone Management Act, Section 307 offsets

Long-term mission sustainability as site is adjacent to test track.

### **Cost and Cost Basis:**

\$206,336 (total)

8 acres

### **Justification:**

Failure to fund will increase wildland fire fuel load and potential for extensive wildland fires leading to delays in mission testing, and lead to rapid decline of APG's forested resources necessary for testing and training. Regulatory credits are necessary to offset impacts to forest resources from mission activities, as identified through Coastal Zone Management Act, Section 307 determinations.

### **Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act; E.O. 13508 Chesapeake Bay Protection and Restoration; COMAR 26.08 Water Pollution; COMAR 26.08.02 Water Quality; CWA Sections 401-404; State Discharge Permit 13-SF-5501/NPDES Permit MDR055501

## **PROJECT: Forest Inventory**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Forest inventory on a minimum of 600 acres. Forest inventory will document existing species, stocking levels, disease/damage, forest type, regeneration, understory vegetation, stand age, site index, and opportunity for forest scrub removal.

### **Deliverable:**

Updated forest inventory data sheets to incorporate into Installation Forest Management Plan

### **Cost and Cost Basis:**

\$85,086 (total)

600 acres @ \$141.81 per acre

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Failure to fund will lead to further degradation of overall forest health required for mission to include continued testing and training.

### **Class:**

0 - Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Tree Planting Maintenance**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

In support of continued forest management, wildland fire fuel load reduction, range maintenance, tenant and Garrison project regulatory offsets and integrated pest / invasive species management of Army mission landscape and wildlife habitat on all areas of APG, 55 acres of previously planted mitigation and forest tree planting areas on APG as outlined by COR, shall be rehabilitated through forest enhancement and invasive species removal. Included in this project is the Living Legacy Forest for Gold Star families totaling over 12 acres. Maintenance of these forest stands is critical to sustaining necessary APG testing and training natural infrastructure as outlined in the APG Forest Management Plan portion of the APG Integrated Natural Resources Management Plan.

### **Deliverable:**

Maintenance of existing 55 acres of tree planting already credited as regulatory offsets for mission projects.

Invasive species removal, reduced wildland fire fuel load, and improved wildlife habitat.

Living Legacy Forest maintained to standards appropriate for public ceremonies.

### **Cost and Cost Basis:**

\$109,423.60 (total)

Forest enhancement and invasive removal:  
55 acres @ \$1,989.52/acre = \$109,423.60

### **Justification:**

Failure to fund will result in degraded tree planting sites already credited as mitigation for sustainable ranges and other mission-related projects needed for APG's testing and training mission. Portion of project includes 12 acres dedicated as Living Legacy Forest for Gold Star families. This project supports TMDL implementation.

**Class:**

0 - Recurring

**Legal Driver:**

Sikes Act

## **PROJECT: Timber Marking at CTA**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 3** – Manage natural resources for multiple uses when appropriate, including sustainable yield of renewable resources, scientific research, education, and recreation

**Objective 3.1** – Provide renewable natural resource products when such products can be produced in a manner that sustains the military mission and natural resources

### **Project Description:**

Timber Marking at Churchville Test Area (CTA) for shelterwood thinning. This project will mark up to 80 acres of timber needed to improve the productivity of the stands located in the CTA area of APG. These stands are severely overstocked and timber marking and appraisal by Maryland Licensed Forester is required to move forward on this shelterwood thinning. This project will provide the tools that enable the APG Forester to thin and remove timber which will enhance forest lands productivity and sustain the long-range testing mission. All timber will be marked by a Maryland Licensed Forester within this non-UXO area of APG. This project support's goals within the APG INRMP and APG IWFMP. All proceeds from shelterwood thinning will be deposited into Army Forestry Account.

### **Deliverable:**

Up to 80 acres of marked and appraised timber to sell and deposit proceeds into Army Forestry Account

### **Cost and Cost Basis:**

\$16,889.60 (total)

### **Justification:**

Generates funds for Army Forestry while improving long-term sustainability of testing mission.

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act

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## **PROJECT: Unexploded Ordnance (UXO) Support for Forest Management Plan Implementation**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

### **Project Description:**

Contract provides for local APG approved UXO support in advance of the execution of biological forest management projects that mitigate for Army testing, training, and construction at APG. The purpose of a programmatic contract vehicle for UXO support of forest management and compliance is to centralize and streamline forest natural resources management for the Garrison and its 92 tenant organizations' mission execution. Contractor will complete UXO support on 25 acres of the Aberdeen Area and Edgewood Area of APG in support of forest management and CZMA forestry compliance mitigation execution. Partial funding is acceptable.

### **Deliverable:**

UXO sweeps to include scans and avoidance. Letters of completion to include UXO swept GIS layer maps indicating UXO completion by specific contractor letter, technician, anomalies found and UXO work dates. Each site geographic area will be GPS captured for APG's GIS.

### **Cost and Cost Basis:**

\$127,632.75 (total)

25 acres @ \$5,105.31 per acre

ARA Forestry and Ag/Grazing Funding Eligible

### **Justification:**

Failure to fund this contract will delay mission critical construction projects and/or required mitigation in support of testing and training.

### **Class:**

0 - Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Integrated Pest Management Plan**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

### **Project Description:**

Comprehensive revision of APG Integrated Pest Management Plan (IPMP) to ensure that it is fully up to date and compliant with current standards (e.g., AR 200-1; DoDM 4150.07). The IPMP establishes a protocol to maintain safe, effective, and environmentally sound integrated pest management programs to prevent or control pests and disease vectors that may adversely impact readiness or military operations by affecting the health of personnel or damaging structures, material, or property.

### **Deliverable:**

Draft and Final versions of updated IPMP.

### **Cost and Cost Basis:**

\$45,000 (total)

### **Justification:**

Not having current, signed IPMP will impact military readiness and operations by restricting ability to maintain range vegetation with aerially-applied herbicides. If an existing pest management plan is not available, a separate Pesticide Discharge Management Plan will have to be written to obtain the necessary State permits, resulting in significant time delays for test missions.

### **Class:**

1 - Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act



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## **PROJECT: BESS IV Contract Award**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources in compliance with environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

**Objective 2.2** – Conserve threatened and endangered species in compliance with federal, DoD, and Army regulations and policies

**Objective 2.3** – Use adaptive management strategies to conserve and enhance native fauna and flora, and manage or eliminate invasive species

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

**Objective 2.5** – Comply with National Environmental Policy Act to make informed decisions

### **Project Description:**

This project supports contract award of the Base Environmental Support Services (IV) IDIQ contract which directly supports mission sustainment and environmental compliance at APG, including Adelphi Laboratory Center and Blossom Point Research Facility. Project is required for the minimum guarantee required for contract award and will support kick-off meeting(s) and contractor development of Key Management Plan for contract award and any associated documents for the anticipated 5-7 awardees.

### **Deliverable:**

Contract vehicle for Garrison and tenants to execute environmental compliance and mission sustainability in direct support of Warfighter.

Multi-program contract management.

### **Cost and Cost Basis:**

\$17,500 (total)

\$2,500 per awardee, up to 7 awardees

**Justification:**

This project is required for contract award of BESS IV IDIQ contract which directly supports mission sustainment and environmental compliance for Garrison and over 70 plus tenants.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Multiple compliance drivers for natural resources and other environmental programs

## **PROJECT: Aviation Support for Other Natural Resources Surveys**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

Aviation support for surveys and/or monitoring of natural resources. Scope includes but is not limited to labor, fuel, aircraft, airfield support, and photography support for pre- and post-burn surveys, pre- and post-spray surveys, beaver impact surveys, white-tailed deer FLIR surveys, great blue heron rookery surveys, other encroachment surveys, and shoreline resiliency surveys.

### **Deliverable:**

Impact evaluations including estimation of controlled burn and herbicide spraying successes (acres), estimation of white-tailed deer and great blue heron populations, photographic interpretation of beaver impacts, other encroachment issues, and shoreline resiliency.

### **Cost and Cost Basis:**

\$2,500.00 (total)

3 flight hours for UH-60 Blackhawk aircraft

Flight rate = \$802.51 for first hour, \$546.16 per each additional hour

Flights:

Three (3) 1-hr flights =  $3(\$802.51) = \$2,407.53$

Photography:

0.5 hour @ \$184.94 per hour = \$92.47

Direct charge to Aberdeen Test Center

### **Justification:**

Supports multiple INRMP implementation projects as required under Sikes Act.

**Class:**

1 - Statutory Requirement (Non-Recurring)

**Legal Driver:**

Sikes Act

## **PROJECT: Aerial Spraying to Control Common Reed Dominated Wetlands**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Common reed (*Phragmites australis*) is a native species that has colonized wetlands on APG. Full eradication of the plant is impossible and unnecessary, but selective eradication in specific areas is required for ecological and wetland management reasons, permit compliance, and for light-of-sight at several range areas. The technique for its eradication utilizing a combination of aerial herbicidal spraying (53.8 percent glyphosate) and controlled burning. Ideally, the common reed is sprayed with herbicide at the end of the growing season in October (effective for maximum kill). The dead biomass is then burned off in the December-February time frame. Finally, the reed is sprayed again at the end of the next growing season. This project addresses the aerial spraying portion.

### **Deliverable:**

Selective eradication in specific range areas (e.g., Carroll Island, Henry Field, Mulberry Point, Mosquito Creek, Delph Creek, Stony Point, Little Romney Creek, Taylor Island). Areas prioritized based on wetland permit compliance.

### **Cost and Cost Basis:**

To be determined

### **Justification:**

Failure to fund will result in non-compliance with wetland permits, impeded sight lines, and increased wildland fire fuel loads.

### **Class:**

0 - Recurring

### **Legal Driver:**

Clean Water Act

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**PROJECT: Vegetation Management for Range Line of Sight  
Mission Sustainability**

**INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

**Project Description:**

Conduct herbicide application for vegetation management and range line of sight mission sustainability on up to 500 acres.

**Deliverable:**

Mission sustainability of ranges, proactive management and offsets meeting federal and state requirements.

**Cost and Cost Basis:**

\$250,000 (total)

500 acres @ \$500 per acre

ARA Forestry and Ag/Grazing Funding Eligible

**Justification:**

Failure to fund will worsen existing line-of-sight obstructions and impact target functionality within existing range boxes. These areas are not conducive to normal range mowing operations and require periodic vegetation maintenance. Failure to fund will cause delays in testing missions due to permitting/compliance requirements.

**Class:**

0 – Recurring

**Legal Driver:**

Sikes Act

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## **PROJECT: Coastal Zone Management Act (CZMA) Mitigation Maintenance**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.1** – Manage natural resources within the spirit and intent of environmental laws such as the Sikes Act, Endangered Species Act, Clean Water Act, Coastal Zone Management Act, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act

### **Project Description:**

Maintenance of forest stands planted specifically for APG compliance with CZMA and Maryland's Coastal Zone Program. Trees planted over the past 10 years have had an initial maintenance of two years, but require additional periodic maintenance to ensure survivability and resiliency for future Army training and/or testing mission. The majority of these forest stands are in riparian areas of the installation.

### **Deliverable:**

Maintenance on up to 30 acres

### **Cost and Cost Basis:**

\$186,018 (total)

\$133,488 for UXO support (30 acres @ \$4,449.60 per acre)

\$52,530 for forest enhancement (30 acres @ \$1,751 per acre)

Costs based on existing APG FFP requirements contract

### **Justification:**

Failure to fund will result in continued degradation of forest health conditions at APG.

### **Class:**

0 - Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Public-Public Partnerships**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

### **Project Description:**

Develop business case analysis for using public-public partnerships that APG is currently pursuing with Harford County, USACE, NGOs, and other federal, state, and local government entities. Specifically, these partnerships are to meet the new TMDL requirements for stormwater and to address the stabilization of Pooles Island on APG. Analysis shall identify benchmarks of existing partnerships; capabilities and resources of public partners to meet mutual goals; opportunities for shared services arrangements; savings or cost avoidance for the APG; and innovative approaches to meet regulatory mandates.

### **Deliverable:**

Business case analysis

### **Cost and Cost Basis:**

\$75,000

2080 hours @ \$36.06 per hour

### **Justification:**

Failure to fund will result in failure to meet TMDL requirements and loss of mission capabilities on Pooles Island due to sea level rise resulting from climate change.

### **Class:**

0 - Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Coastal Resilience Strategy Assessment**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

### **Project Description:**

This activity includes a study aimed at building off recent baseline modeling efforts to identify the most cost effective installation resilience measures to be implemented in the most cost effective geographic areas. With a goal of identifying multiple funding streams, partnership opportunities and co-benefits, including meeting regulatory requirements.

### **Deliverable:**

Deliverables associated with this project include GIS layers, GIS models, and a report to identify areas around and on APG where actions taken to increase installation resiliency can be undertaken.

### **Cost and Cost Basis:**

To be determined (estimated \$35,000)

### **Justification:**

Recent changes in NDAA authority has increased use of various funding streams (REPI, OEA, etc), to be used to sustain and expand the resiliency of military installations in light of changing climates, rising sea levels and increased development. This project would identify ways and means to merge the goals of these various programs and authorities.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Sikes Act



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## **PROJECT: ATC Range Shoreline Stabilization Design**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

Aberdeen Test Center (ATC) previously funded partial design for shoreline stabilization at three ranges on APG: Henry Field; C Field; and Underwater Explosion Test Facility (UTF). These ranges are extremely susceptible to shoreline erosion and other impacts of climate change. This is a multi-year request in order to complete data collection, design, and permitting required for a buildable project. This activity includes the costs needed to comply with the requirements for the Chesapeake Bay watershed.

ATC previously funded portions of the design up to 35% for each of the sites. This project would advance the projects to 100% design and permit stage.

### **Deliverable:**

Contract award and management.

Multi-year data collection, design, and permitting actions.

### **Cost and Cost Basis:**

To be determined (estimated \$35,000)

### **Justification:**

DoD has documented climate change and sea level rise as a threat to national security. In support of both The National Defense Strategy and the Army Strategy, ATC focuses on maintaining readiness, while ensuring the modernization of DoD assets and equipment. Considered a “national asset” as a Major Range and Test Facility Base (MRTFB), ATC provides the infrastructure and workforce needed to deliver test capabilities to support the DoD acquisition system and plays a key role in the Army Modernization enterprise. ATC operates multiple ranges on APG, three of which are immediately adjacent to the Bush River: Henry Field, C Field, and UTF. All three of these facilities are experiencing shoreline erosion and are in danger of significant loss of mission capabilities.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Sikes Act

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## **PROJECT: Unexploded Ordnance (UXO) Support for Coastal Resilience Projects**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

### **Project Description:**

UXO avoidance support for execution of partner funded projects at APG. Projects include data collection, geotechnical work, design, planning, and construction of coastal resilience and shoreline stabilization projects.

### **Deliverable:**

UXO sweeps to include scans and avoidance. Letters of completion to include UXO swept GIS layer maps indicating UXO completion by specific contractor letter, technician, anomalies found and UXO work dates. Each site geographic area will be GPS captured for APG's GIS.

### **Cost and Cost Basis:**

\$50,000 (total)

20 days UXO support @ \$2,500 per day

### **Justification:**

Failure to fund prevents implementation of coastal resilience projects. APG regulation requires UXO support for any intrusive operations. Partner funded projects will not be able to safely access areas impacted by climate change, shoreline erosion, and sea level rise in order to collect data for analysis and design. Coastal resilience projects will protect critical mission infrastructure on APG.

### **Class:**

0 - Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Imagery Analysis to Evaluate Changes to Shoreline and Wetland Extent**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

### **Project Description:**

A comprehensive analysis of past aerial imagery to identify changes in the coastline and wetland extent and composition. This task will document installation-wide changes from 1932 to 2020, identify areas of greatest coastline change, and identify changes in wetland extent and composition.

### **Deliverable:**

Quarterly briefings on project status and final briefing presentation of results and interpretations.

Modeling analysis.

Geodatabase of shoreline extent and extent of vegetation classes over time; Released using USGS ScienceBase platform and will include metadata describing methods.

Interpretations with identifying regions of greatest change and placing results in context of previously published reports and regional studies.

Interactive online mapping viewer or story map to display results and interpretations of study; Enabling viewer to zoom, view, interact, and download results.

### **Cost and Cost Basis:**

To be determined (estimated \$129,967)

### **Justification:**

DoD has documented climate change and sea level rise as a threat to national security. Accurate predictive models are critical for planning to protect the wetlands that make up a significant portion of APG, though effective place-based monitoring is required to inform these predictive models. Failure to plan for sea level rise impacts puts at risk the ability of wetlands to function as important habitat for protected and at risk wildlife species, and as protective buffer for surrounding military buildings and training areas. The care of wetlands at APG is also paramount to the military mission of environmental stewardship. Significant unexploded ordnance and environmental contamination exists at the installation at many sites in or near wetlands, where natural processes in the wetlands act to remediate contaminants and prevent their release to surface water, groundwater, and the air. This study will provide a complete monitoring program to evaluate sea level rise impacts at a range of spatial and temporal scales to support DOD resiliency planning. Impacts of sea level rise have already been mentioned in 5-

year reviews of sites with current RODs. Lack of place-based measurements will result in reliance on models not calibrated to site conditions, leaving habitat, mission assets, and restoration remedies in place at risk.

**Class:**

3 – Best Management Practice

**Legal Driver:**

Sikes Act



## **PROJECT: Pooles Island Stabilization**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

### **Project Description:**

This project would stabilize erosion rates along the shores of Poole's Island and restore the island to its previous historical acreage, preserving real estate that contains unique environmental, geographic, and situational characteristics essential to current and future Army missions. This task will generate a final biddable and constructible product, to include permits, design analysis, plans, specifications, and construction cost estimate.

### **Deliverable:**

35% and 65% designs, economic cost benefit analysis, completion of required NEPA documents and refined construction cost.

### **Cost and Cost Basis:**

\$500,000 (estimated), multi-year request

Costs were developed as part of Plan of Study provided by USACE Baltimore District

### **Justification:**

Failure to fund will result in continued erosion of Pooles Island shorelines and loss of mission land, historic lighthouse that is listed on National Register of Historic Places, habitat for protected wildlife species, and other unique natural resources. Project has potential to generate a mitigation bank for environmental resource credits, such as forestry, wetlands and stormwater (MS4 permit). These credits are needed to offset and/or mitigate mission-essential projects that have environmental impacts, such as Phillips Army Air Field vegetation maintenance.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Sikes Act

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## **PROJECT: Army Compatible Use Buffer – Chesapeake Bay**

### **INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.1** – Conduct comprehensive planning and risk management to avoid or mitigate constraints and restrictions from encroachment

### **Project Description:**

APG has an approved Army Compatible Use Buffer (ACUB) that targets encroachment along the Chesapeake Bay within APG's noise contours. APG's ACUB allows the Army to work with partners to encumber off-post land to protect habitat and buffer military operations without acquiring any new land for Army ownership. Through ACUB, the Army reaches out to partners to identify mutual objectives of land conservation and to prevent development of critical open areas adjacent to, or ecologically adjacent to, the installation. The Army can contribute funds to the partner's purchase of easements or properties from willing landowners. These partnerships preserve high-value habitat and limit incompatible development in the vicinity of military installations. Establishing buffer areas around Army installations limits the effects of encroachment and maximizes land inside the installation that can be used to support the installation's mission.

### **Deliverable:**

Parcel secured by conservation easement or fee-simple purchase by APG partner.

### **Cost and Cost Basis:**

To be determined per parcel

### **Justification:**

Failure to fund ACUB efforts could result in increased incompatible land development within APG's noise contours, leading to increased noise complaints. ACUB provides the potential for APG to secure off-Post conservation credits for water quality and bald eagles, off-post mitigation for critical area and wetlands, and to assist in protection and restoration of the health of the Chesapeake Bay.

### **Class:**

2 - Pending Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act

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**PROJECT: Stormwater Management Best Management Practice (BMP)  
on Army Compatible Use Buffer (ACUB) Parcel**

**INRMP Goal and Objective:**

**Goal 1** – Manage the natural resources to sustain realistic testing and training environments for APG's military mission

**Objective 1.2** – Sustain mission lands through management, monitoring, research, and rehabilitation

**Project Description:**

Contractor shall design and restore a stormwater management BMP in order to meet current state regulatory standards and in accordance with APG's MS4 permit and TMDL allocations. Design, restoration and monitoring shall be conducted in accordance with all applicable State and Federal laws and regulations. Restoration of this BMP will help APG meet its TMDL pollutant load reduction requirement through the requirements set forth in the MS4 permit. Conducting this effort on a parcel of land, conserved under the Army Compatible Use Buffer (ACUB) program, allows maximum use of mission lands for mission activities.

**Deliverable:**

Provide all site design, permit approvals, and construction services required to retrofit existing stormwater management BMP on Welzenbach Farm in Edgewood, Maryland.

**Cost and Cost Basis:**

\$900,000 (total)

This project is proposed to cost share total cost with local government and potentially bring in other outside funding sources. Estimates based on USACE and NOAA data.

\$550,000 for hard construction

\$350,000 for soft construction

**Justification:**

If unable to complete BMP off-post, on-post locations will need to be identified.

**Class:**

2 – Pending Statutory Requirement

**Legal Driver:**

Clean Water Act, Sikes Act

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## **PROJECT: Annual APG Arbor Day / Earth Day Celebration**

### **INRMP Goal and Objective:**

**Goal 3** – Manage natural resources for multiple uses when appropriate, including sustainable yield of renewable resources, scientific research, education, and recreation

**Objective 3.3** – Provide educational outreach activities for installation users and the surrounding community

### **Project Description:**

Annual combined Arbor Day / Earth Day celebration held on APG. Ideally, this annual celebration involves local schools with essay contests, child development centers, DPW Environmental staff, and Garrison Command staff. Funding restrictions have recently limited the full execution of the celebration. Celebration is usually coordinated with Tree City event (tree planting, etc.).

### **Deliverable:**

Community outreach event to promote awareness of environmental stewardship and protection.

### **Cost and Cost Basis:**

To be determined

### **Justification:**

Failure to fund will deny APG opportunity to engage community in environmental stewardship awareness.

### **Class:**

3 – Best Management Practice

### **Legal Driver:**

Sikes Act



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## **PROJECT: Public Awareness Brochure for Riparian Buffers and Shoreline Sustainment**

### **INRMP Goal and Objective:**

**Goal 3** – Manage natural resources for multiple uses when appropriate, including sustainable yield of renewable resources, scientific research, education, and recreation

**Objective 3.3** – Provide educational outreach activities for installation users and the surrounding community

### **Project Description:**

Develop, produce, and distribute brochure to promote public awareness of importance of riparian buffers and shoreline sustainment. Target audience is on-Post residents.

### **Deliverable:**

Brochure (tri-fold)

### **Cost and Cost Basis:**

Minimal (in-house costs to reproduce brochures)

### **Justification:**

Failure to fund may result in continued decline of shoreline vegetation, shoreline stability, and increase in sediment run-off due to actions undertaken by un-informed persons in clearing vegetation close to shorelines.

### **Class:**

3 - Best Management Practice

### **Legal Driver:**

Sikes Act

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## **PROJECT: Public Awareness Brochure for Purple Loosestrife**

### **INRMP Goal and Objective:**

**Goal 3** – Manage natural resources for multiple uses when appropriate, including sustainable yield of renewable resources, scientific research, education, and recreation

**Objective 3.3** – Provide educational outreach activities for installation users and the surrounding community

### **Project Description:**

Develop, produce, and distribute brochure to promote on-Post worker awareness of the invasive species purple loosestrife (*Lythrum salicaria*). Distribution of brochures will encourage reporting of sightings of this species to supplement monitoring efforts.

### **Deliverable:**

Brochure (tri-fold)

### **Cost and Cost Basis:**

Minimal (in-house costs to reproduce brochures)

### **Justification:**

Project will supplement monitoring efforts to identify sites of the invasive species. Control of invasives species benefits biodiversity.

### **Class:**

3 - Best Management Practice

### **Legal Driver:**

Sikes Act

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## **PROJECT: Public Awareness Brochure for Sturgeon**

### **INRMP Goal and Objective:**

**Goal 3** – Manage natural resources for multiple uses when appropriate, including sustainable yield of renewable resources, scientific research, education, and recreation

**Objective 3.3** – Provide educational outreach activities for installation users and the surrounding community

### **Project Description:**

Develop, produce, and distribute brochure to promote awareness among recreational anglers of the endangered species of sturgeon that are likely present in APG waters. Distribution of brochures will encourage reporting of sightings of these species to supplement monitoring efforts.

### **Deliverable:**

Brochure (tri-fold)

### **Cost and Cost Basis:**

Minimal (in-house costs to reproduce brochures)

### **Justification:**

Project will supplement monitoring efforts for both species of sturgeon, educate public on proper handling of species if caught, and promote reporting of sightings.

### **Class:**

3 - Best Management Practice

### **Legal Driver:**

Endangered Species Act, Sikes Act

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## **PROJECT: Public Awareness Brochure for Zebra Mussels**

### **INRMP Goal and Objective:**

**Goal 3** – Manage natural resources for multiple uses when appropriate, including sustainable yield of renewable resources, scientific research, education, and recreation

**Objective 3.3** – Provide educational outreach activities for installation users and the surrounding community

### **Project Description:**

Develop, produce, and distribute brochure to promote public awareness of the invasive species zebra mussel (*Dreissena polymorpha*). Distribution of brochures will encourage reporting of sightings of this species to supplement monitoring efforts.

### **Deliverable:**

Brochure (tri-fold)

### **Cost and Cost Basis:**

Minimal (in-house costs to reproduce brochures)

### **Justification:**

Project will supplement monitoring efforts to identify sites of the invasive species within APG waters. Sightings will be reported to Maryland Department of Natural Resources to add to state-wide database.

### **Class:**

3 - Best Management Practice

### **Legal Driver:**

Sikes Act

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## **PROJECT: iSportsman Maintenance**

### **INRMP Goal and Objective:**

**Goal 3** – Manage natural resources for multiple uses when appropriate, including sustainable yield of renewable resources, scientific research, education, and recreation

**Objective 3.2** – Provide outdoor recreational opportunities such as hunting, fishing, trapping, crabbing, etc. when compatible with military mission and management of natural resources

### **Project Description:**

Option Year 1 of iSportsman contract. Maintenance of system deployed in FY21.

### **Deliverable:**

Maintenance of online services within a certified FedRAMP environment capable of providing customized web based content management interface; online permit sales; safety briefings; online check-in/out; integration of payment acceptance service for permits; online help documentation and training videos; training on all services; and ongoing support for the new and existing systems. Contractor shall provide support to government administrators and managers responsible for SAPRMS with application\ interface training, documentation and warranty support. Additionally, provide critical services that support the full functionality of the automated recreation tracking and access system.

### **Cost and Cost Basis:**

\$22,600 (total)

Eligible for Conservation Reimbursable and Fee Collection Program (CRFCP) funding

### **Justification:**

Annual support is required to maintain the capabilities of the Hunting, Fishing and Outdoor recreation programs and to facilitate issuance and management of Sikes Act (16 U.S.C.670 et seq.) permits issued to individuals for access to installations for the purpose of hunting, fishing, trapping, firewood, and other dispersed outdoor activities.

### **Class:**

0 - Recurring

### **Legal Driver:**

Sikes Act

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## **PROJECT: Conservation Supplies and Equipment**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

Funding for specialized tools and equipment to be used in the conduct of fish and wildlife conservation and management projects.

### **Deliverable:**

Purchase of binoculars (standard and image stabilizer) and animal crate for use in Bald Eagle management program. Purchase of replacement lithium battery and buoys for acoustic receivers used in Sturgeon management program.

### **Cost and Cost Basis:**

\$2,500 (total)

Eligible for Conservation Reimbursable and Fee Collection Program (CRFCP) funding

### **Justification:**

Bald and Golden Eagle Protection Act; Bald Eagle Incidental Take Permit; Endangered Species Act – Supplies and equipment required for compliance monitoring of federally protected species.

### **Class:**

1 – Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Sikes Act

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## **PROJECT: Natural Resources Supplies, Equipment, and Training**

### **INRMP Goal and Objective:**

**Goal 2** – Demonstrate sustainable stewardship of natural resources by protecting and enhancing those resources in compliance with legal requirements

**Objective 2.4** – Monitor soils, waters, wetlands, vegetation, and wildlife and apply ecosystem-based management principles

### **Project Description:**

Supplies, equipment, and training to support Natural Resource program areas to include Bald Eagle management, Endangered Species management, Wetlands management, Chesapeake Bay program, and Forestry.

### **Deliverable:**

Supplies including but not limited to batteries for field GPS unit and image stabilizer binoculars (\$40), packing tape (\$60), battery for Sturgeon acoustic receiver (\$40), buoys for Sturgeon acoustic receiver (\$300), boat fuel (\$300), and ADC map (\$25).

Training needs (\$5,000) for natural resources staff to maintain professional knowledge and proficiency in military natural resources management, to include but not limited to National Military Fish and Wildlife Association annual workshop; Maryland Arboriculture Chapter International Society of Arborists annual workshop (required to maintain Certified Arborist credentials); Forever Maryland annual workshop; Chesapeake Bay Commander's Conference; Army Environmental and Range Readiness Training Symposium; and Sustaining Military Readiness Conference

### **Cost and Cost Basis:**

\$5,765 (total)

### **Justification:**

Supplies, equipment, and training include requirements to ensure field safety, program compliance, and sustainment of military mission.

### **Class:**

1 – Statutory Requirement (Non-Recurring)

### **Legal Driver:**

Bald and Golden Eagle Protection Act; Bald Eagle Incidental Take Permit; Endangered Species Act; Clean Water Act; Sikes Act



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