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Silviculture Prescription
Erving Red Pine

Massachusetts Department of Conservation and Recreation
Bureau of Forestry

Eastern Connecticut Valley District
Erving State Forest
Erving, MA

Prepared by:

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Approved by:

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General Overview/Summary

Location: Erving State Forest, Route 2 in Erving MA

Project area size: 249.7 Acres

Silvicultural objectives: To encourage the regeneration of native species; while increasing species diversity, forest structure and complexity. Additionally, establishing early successional habitat by implementing patch cuts in non-native plantations.

Silvicultural systems and methods of regeneration: Even age: two stage shelterwood and patch clearcuts with reserves. Uneven age and mixed: expanding gap irregular shelterwood

Other Goals: Improvement of forest infrastructure by utilizing in-kind services, create and maintain interpretive/recreational/educational opportunities within the forest, increase wildlife habitat diversity by creating early successional forest conditions, manage and control invasive species present, among others.

The Erving Red Pine forest management project is located in the southern portion of Erving State Forest, which abuts the northern edge of Route 2 in the town of Erving. This site was the home to a prominent Civilian Conservation Corps (C.C.C) camp in the 1930s and 40s. The project area encompasses an estimated 249.7 acres containing 6 different forest stands. Some of these stands (red pine, white pine, Norway spruce, Scots pine) are a direct result of C.C.C. planting 70 to 80 years ago. Access is excellent, as the project area is located on route 2 and most of the interior forest roads are in good to great condition.

Inventory specifications: A grid was established over the 260+/- acre project area, with 1 plot for every 3 acres (some manipulation of this grid was necessary in order to accurately represent all stands present). Each plot included measurements of overstory, regeneration, ground cover, and coarse woody debris (CWD). The Big BAF sampling method was utilized for overstory estimates, with the two angle gauges used being 20 factor and 80 factor. Regeneration and ground cover data was gathered by establishing 0.030 acre plots, at the center of each overstory plot. The size classes utilized in regards to regeneration are as follows; size class 1 = 0-1’ in height, size class 2 = 1’ – 4.5’ in height, size class 3 = 4.5’ tall – 1” dbh, and size class 4 = 1” dbh – 5” dbh. CWD estimates are a result of a 100’ transect at each plot. Programs utilized to interpret data recorded in the field include, NH Fox DS Cruiser for overstory data and NED-3 for ground cover, regeneration, and CWD.

Site Data :

Geology/soils/landforms

The project area is dominated by a south facing slope, which varies in steepness throughout. The steeper areas are confined to the north eastern and south western portions of the project area. The steeper slopes exceed 60% and will not be subject to harvest operations. The slopes break towards the northern edge of the project area, which is relatively flat. The max elevation in the project area is approximately 1043ft which is located on the far northern edge, whereas the lower elevations (located along route 2) hover around 590ft.

Several different soil types are found within the project area, all of which are the result of glacial till or glaciofaluvial deposits. All soil descriptions and maps were derived using NRCS Web Soil Survey. Specific soil types include (See Soil Map in Appendix):

- Canton Fine Sandy Loam (421B/421C/421D): This a rocky, well-drained soil that ranges in depth from 18 to 36 inches to a restrictive layer and with a depth to water table that is estimated at +80" inches. This soil type is commonly found on hillslopes, valley sides, and ground moraines and is classified as moderately suited for harvest activities.
- Canton-Chatfield-Hollis Complex(112B/112C): This soil complex is a combination of three different soil types; Canton (see above description of Canton Fine Sandy Loam), Chatfield which is described as a rocky, well-drained soil, ranging in depths from 18 to 36 inches and is commonly found on hillslopes, valley sides, ground moraines, and Hollis which occurs most commonly on upland slopes, it is described as a rocky, somewhat excessively well drained soil, that ranges in depth from 20 to 40" to restrictive layer. This complex as a whole is considered to be moderately suited for harvest activity.
- Chatfield-Canton Complex (119F): This soil complex is a combination of two different soil types, both of which are described above and is stated to be poorly suited for timber harvest strictly due to the slopes present.
- Chatfield-Hollis Complex (109B): This soil complex is a combination of two different soil types; Chatfield and Hollis, both of which are described above and is reported to be moderately suited for harvest activities.
- Essex Sandy Loam (386B): This soil type is described as being a well-drained soil with a depth that ranges between 20 to 35 inches and is commonly found on drumlins and ground moraines. This soil is moderately suited for timber harvesting activities.
- Hinkley Sandy Loam (245B/245C): This is an excessively drained soil with depths to a restrictive layer being 80 or more inches, it is commonly found on eskers, kames, and outwash plains and is well suited for harvest activities.
- Gloucester Sandy Loam (441C/441F): This soil is somewhat excessively drained with depths to a restrictive layer reaching 80 inches or more. It commonly occurs on moraines and upland slopes. This soil, on less steep slopes is considered moderately suited for timber harvesting activities, in locations where slopes exceed 25% it is considered poorly suited.
- Merrimac Fine Sandy Loam (254B): This soil is described as being someone excessively drained and fairly deep (depths reaching 80 inches or more to a restrictive feature). It is a result of

glaciofaluvial deposits and is commonly found on moraines, eskers, kames, and outwash plains and terraces. This soil type is well suited for timber harvesting activities.

- Newfields Fine Sandy Loam (427B) – This is a moderately well drained soil that ranges in depth from 16 to 20 inches. It is commonly found in swales and depressions on ground moraines. This soil is moderately suited for timber harvesting activity.
- Sudbury Sandy Loam (260B) –This is a deep (80+ inches to a restrictive layer), moderately well drained soil that is commonly found in deltas, terraces, and outwash plains. This soil is described as being well suited for timber harvest activity.
- Windsor and Merrimac Soils (229F) – This is a complex of two different soil types; Merrimac (described above) and Windsor, which is an excessively drained soil reaching depths of 80 or more inches before reaching a restrictive layer. This Windsor soil type is commonly found on outwash plains and terraces and is described as being poorly suited for timber harvest activity due to the slopes exceeding 25%.

Climate

This region, specifically central Massachusetts, receives an average of 44.83" of precipitation annually. The highest average precipitation occurs in the month of March, with totals reaching 3.91"; with the least amount of precipitation falling in the month of February reaching a total of 3.17". The average annual temperature is estimated at 47.1 degrees Fahrenheit, with the maximum average temperature falling in the month of July at 81.9 degrees Fahrenheit and the minimum average temperature falling in the month of January at 14.0 degrees Fahrenheit. This data was obtained from the National Oceanic and Atmospheric Association (NOAA) and is specific to central Massachusetts. Averages are based on over 100 years of recorded data for this region.

Hydrology

This project area lies within the Millers River Watershed, and is home to two perennial streams, two intermittent streams, several small wet seeps, and at least one potential vernal pool. All of the stream channels found within the project area flow in a southerly direction, and drain directly into the Millers River. The Millers River watershed covers approximately 310 square miles and is located in north central Massachusetts, extending into southern New Hampshire. The head waters of the Millers River are located in Ashburnham, MA, from there it flows in a south easterly direction until reaching the Connecticut River at the tri-town junction of Gill, Erving, and Montague. As with many larger rivers in Massachusetts, the Millers River, was home to numerous industrial facilities which have been dwindling in the past several decades. There are several water treatment facilities located within the watershed, one of which is located directly on the Millers River in the town of Erving, with others scattered amongst the smaller tributaries located throughout the watershed.

Site productivity

Soil productivity varies throughout the project, with the majority of the soil types being suitable for the growth of upland species. The two most prominent soils Canton-Chatfield-Hollis complex (112B/C) and

the Windsor and Merrimac soil type (229F) together encompass nearly 50% of the entire project area. Both of these soil complexes exhibit well drained characteristics throughout. Upland species such as oak and white pine are expected to grow well on these sites, with site indices ranging from 47 to 70 for northern red oak and 55 to 66 for eastern white pine (USDA-NRCS).

The DCR Management Guidelines of 2012 state that forest stands will be "classed… and considered for silvicultural treatments that generally fit their productivity, structural complexity (or potential thereof) and diversity". Analysis this project area site history (land use; agriculture/logging) and conditions (soil types, productivity; vegetation cover) suggests that these even-age lower complexity stands on moderate soils lend themselves to even-age management (Goodwin and Hill, 2012). Whereas, the more complex and diverse stand oak stands lend themselves more toward an uneven aged system of management.

Cultural

The Commonwealth of Massachusetts acquired much of this tract of land in the early 1920's. This particular state forest now encompasses approximately 1,900 acres and abuts both Warwick State Forest and Orange State Forest. In the early days of Erving State Forest, the current headquarters building was once a nursery, which supplied nearby state forests with thousands of seedlings to aid in reforestation throughout the area. Some of the plantations on the southern portion of Erving State Forest date back to 1926 and are a direct result of the nursery which used to be in operation. In 1935, a C.C.C. camp was established and remained in operation until 1942. Projects undertaken by the C.C.C. in this area were tree planting, vegetation management, fire pond construction, and road construction and maintenance. The large majority of the plantations present today are a direct result of work done by the C.C.C. throughout the 1930's and into the early 1940's. The Laurel Lake campground was originally established during these years and remains in operation today.

Over the years the nursery operations faded, as well as the presence of the C.C.C. Nearly all of the buildings associated with the C.C.C. camp have been deconstructed, with the exception of a one small shed that is utilized for storage. Also present are a series of concrete slabs where buildings once stood, as well as a concrete staircase leading from the road into the field. The removal of some vegetation around this site with the intent of improving interpretive resources has been discussed and may occur around these structures.

Recreation

This project area is located within a large contiguous tract of state forest land containing numerous trails and roads which are utilized year round. Summer activities include numerous types of passive recreation, including hiking, walking, bicycling, equestrian use, bird watching, and hunting, among others. The project area is located just south of the Laurel Lake Campground, which is open during the summer months for camping and day use. In the winter months this area is heavily used by snowmobilers, with DCR staff actively grooming and maintaining a number of trails. Consideration will be taken in order to minimize negative impacts on recreation throughout the area, although some of the main forest roads will require plowing through the winter months.

Stand Data:

Red Pine (Stand 1)

Labeled as stand number 1, this red pine plantation is the result of tree planting in the early 1930's. This stand is estimated at approximately 80 years old and covers roughly 66 acres scattered throughout the project area. The original plantings varied, according to a 1933 forest stand map of Erving State Forest the north eastern section is a result of both white and red pine planted with a 1 to 1 ratio, the portion located to the southeast of Cross Road was planted with a 3 white pine to 1 red pine ratio, and the sections located in the western half of the project area where planted to only red pine. There are currently 7 separate portions of this stand, all of which seem to have been planted at approximately the same time.

This single story even aged stand is dominated by red pine with some scattered occurrences of white pine, white ash, red maple, paper birch and red oak present. The canopy is fairly consistent throughout the stand, with occasional small gaps occurring where natural mortality has taken place. The estimated basal area throughout this stand is approximately 225 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 257, and the estimated quadratic mean diameter is 12.7 inches. These numbers place this stand above the "A-line" in the red pine stocking guide (Benzie, 1977), meaning this stand is currently overstocked. As a result of being overstocked, many of the trees present exhibit very slow, stagnated growth, and small live crowns. These stressed growing conditions are a concern for overall health, specifically in this stand due to the limited species diversity. Over the last several years, monoculture red pine stands throughout the Southern New England region have been subject to large scale mortality due to stressed growing conditions and the introduction of red pine scale and the diplodia fungus.

Regeneration is present throughout the stand with a fairly even distribution, small areas of higher amounts regeneration are present where small gaps occur in the overstory. There is currently no anticipated concern with regenerating this stand naturally, as several native species have been observed through the stand. These species include eastern white pine, northern red oak, white oak, red maple, American beech, black cherry, and black birch. The most prominent of these species is eastern white pine with approximately 240 stems per acre, followed by northern red oak with an estimated 78 stems per acre (See table 2 in Appendix). Understory species present include an array of shrub and herbaceous species, notably checkered rattlesnake plantain, pink lady slipper, low-bush blueberry, and maple-leaved viburnum, among several others (See table 3 in Appendix). Along with these listed species, is the occurrence of glossy buckthorn, which is a non-native invasive shrub which is prevalent in the local area. Population density of this shrub is low and scattered throughout the stand, occurring more frequently along the main forest roads.

CWD recorded in this stand is estimated at approximately 343.9 cubic feet per acre, with the majority of this (nearly 75% of observations recorded) being in the <6" size class. The remaining observations fell in the 6"-12" size class. Snags recorded in this stand totaled approximately 8 per acre, the majority of which fell within the 6"-12" size class, with an occasional snag falling between 12"-15". Some rock outcrops are present on the steeper slopes, these are located in both the northern eastern and south western sections of project area.

White Pine (Stand 2)

As with stand 1, this white pine stand is the result of planting in the 1930's. Annotations on a 1933 forest stand map of Erving State Forest indicate that much of the area which is now dominated purely by white pine was originally planted with alternating white pine and red pine, only the north western portion of the stand was planted strictly as white pine. Old maps also indicate that "weeding" had taken place throughout this stand in 1933. Minimal forest management has been done since the days of the C.C.C., with the exception of trimming along roads and cutting fire lines.

This is an even aged single story stand, with small pockets of regeneration present where gaps have formed in the canopy as a result of natural mortality. White pine is the dominant overstory species, with scattered occurrences of red pine, red maple, paper birch, and red oak. The estimated basal area throughout this stand is approximately 214 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 325, and the estimated quadratic mean diameter is 11 inches. These numbers place this stand over the "A" line on the white pine stocking guide, meaning that this stand is currently overstocked (USDA Forest Service, 2008). These conditions generally result in overcrowding, small live crowns, and extreme competition for available resources, as well as stagnated growth and declined vigor and health. Stands such as this, lacking in diversity and in a stressed state, are more susceptible to mortality due to pest and diseases as well as natural disturbance.

Regeneration is scattered throughout the stand and is fairly evenly distributed, with the exception of areas where natural mortality has occurred in the overstory. These gaps in the canopy allow for increased sunlight and nutrients resulting in an abundance of regeneration. The most prevalent species found throughout this stand are white pine with nearly 180 stems per acre, followed by red maple with an estimated 100 stems per acre, and red oak with an estimated 89 stems per acre (See Table 5 in Appendix). Understory species include partridgeberry, lowbush blueberry, eastern teaberry, downy and checkered rattlesnake plantain, and glossy buckthorn, among others (See table 6 in Appendix). Glossy buckthorn, an invasive species, is present and of particularconcern. This species is very shade tolerant and can persist and reproduce effectively under closed canopy conditions. It is primarily located nearest existing forest roads; measures will be taken during harvesting operations in order to limit its spread through the project area.

CWD present in this stand was estimated at 407.9 cubic feet per acre, all of which is under 12" in diameter and a result of natural mortality. Approximately 15 snags/acre occur throughout the stand, all of which are softwood species. All of the snags measured were under 15" dbh, with the large majority being between 6"-12" dbh.

Red Oak (Stand 3)

This red oak stand is located in the eastern half of the project area and spans approximately 22.5 acres. It is adjacent to both the white and red pine stands, but was never planted. It is a result of natural regeneration in the early 1900's, with the 1926 forest stand map depicting it as a mix of oak, paper birch, red maple, and American chestnut, approximately 5" dbh and in fair condition. It now consists of predominately red oak, with smaller amounts of white pine, red pine, and red maple. The American chestnut component has been eliminated due to the chestnut blight, which is a fungus that decimated American chestnut populations throughout the eastern United States in the early 20th century. The paper birch component has been slowly declining over the years naturally, as this is a shade intolerant fairly short lived pioneer species.

Red oak is now the major component of this stand, with small occurrences of red pine, white pine, white oak, paper birch, black birch and red maple. The inclusions of red pine and white pine are almost exclusively the result of failed plantations, which boarder this stand to the north and west. Some of the white pine has seeded in naturally throughout the stand, but is not large component. Total basal for this stand is estimated at 126 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 173, and the estimated quadratic mean diameter is 11.5 inches. These numbers place this stand over the "A" line on the red oak stocking guide (MA DCR, 2014), meaning this stand is currently overstocked. Once a stand reaches and exceeds the "A" line, overall growth rates begin to decline and stagnate.

Regeneration is present throughout the stand and includes species such as eastern white pine, white oak, red oak, American beech, red maple, black cherry, black birch, and eastern hemlock. The most prevalent of these above listed species is white pine with an estimated 93 stems per acre, followed by white oak with 53 stems per acre and red oak with an estimated 50 stems per acre (See Table 8 in Appendix). Understory species include, eastern teaberry, lowbush blueberry, serviceberry, partridgeberry, mountain laurel, and glossy buckthorn, among others (See Table 9 in Appendix). Currently there are no problems anticipated in regenerating this stand, the mountain laurel that is present is scattered and scarce. Glossy buckthorn will be a threat for future regeneration, as this invasive persists in the understory, generally outcompeting native tree species. Glossy buckthorn populations are scarce and generally located near existing interior forest roads.

CWD in this stand is estimated at 446.6 cubic feet per acre, the majority of which being hardwood species under 12" in diameter. Approximately 4 snags/acre occur throughout the stand, all being between 6"-12" dbh.

Red Oak/White Pine (Stand 4)

This red oak/white pine stand is divided into four separate areas and encompasses approximately 92 acres. The majority of this stand is the result of failed softwood plantations. The north eastern portion of this stand was originally planted with a mixture of red and white pine, remnant white and red pine are still present throughout. The portion of this stand that is located along route 2, was originally described on a 1933 stand map of Erving State Forest as being a mix of oak, American chestnut, birch and maple; some of which was underplanted with Norway spruce and Scots pine. The western portion of this stand was also described as being a mix of oak, chestnut, birch and maple; large portions of this area were burned over in 1930, and subsequently planted with Norway spruce and Scots pine. The naturally occurring oak outcompeted the planted spruce and Scots pine, creating a stand dominated by red oak, with an understory of Norway spruce and scattered occurrences of Scots pine in the overstory.

This stand is dominated by a mix of northern red oak and eastern white pine, with scattered occurrences of white oak, Norway spruce, Scots pine, red pine, eastern hemlock, red maple, black birch, American beech, and paper birch. As stated above, much of this stand is the result of failed softwood plantations. Total basal for this stand is estimated at 156 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 218, and the estimated quadratic mean diameter is 11.5 inches. This stand is in fairly good health with variations in the density of oak and pine present throughout the stand.

Regeneration is scattered throughout the stand, with varying density depending on the amount of available light. Species observed throughout the stand include red maple, northern red oak, eastern white pine, American beech, black cherry, paper birch, white oak, white ash, and eastern hemlock. The most prominent species is red maple with a total of 86 stems per acre of varying size, next is northern red oak with approximately 45 stems per acre, most of which being under a foot in height. Total stems per acre across all recorded species is approximately 217, a large majority of this number being observed in size class 1 (<1' in height) (See Table 11 in Appendix). Understory species present include low bush blueberry, serviceberry, eastern teaberry, bracken fern, mountain laurel, Indian cucumber root, trillium, and glossy buckthorn (See Table 12 in Appendix). Of all of the species identified, glossy buckthorn, was the only nonnative species observed. There was only one recorded instance of this species which was located in the north eastern portion of the stand. It is presumed that small isolated populations exist throughout the stand.

CWD in this stand is estimated at 342.1 cubic feet per acre, the majority of which being hardwood species under 12" in diameter. Approximately 8 snags/acre occur throughout the stand, the majority of which being between 6"-12" dbh, with an occasional snag measuring between 12" and 15" diameter.

White Pine/Norway Spruce (Stand 5)

This stand encompasses approximately 13 acres and is located in the south eastern corner of the project area. According to a 1926 stand map, much of this area was at one time planted to Norway spruce, with some inclusions of white pine, as well as under plantings of Norway spruce and Scots pine. As, portions of the Norway spruce stand began to fail, eastern white pine began to take hold as an overstory species. At this point, much of this stand is overstocked, resulting in stagnated growth and low live crown ratios for the large majority of overstory trees present.

Due to its artificial origin, this stand exhibits great variations in species composition depending on the original planting scheme. In the areas that were planted to Norway spruce, the overstory is dominated by Norway spruce, with scattered occurrences of eastern white pine. The areas that were planted to eastern white pine are dominated by eastern white pine, with the scattered occurrences of red oak and red maple present. Total basal for this stand is estimated at 205 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 343, and the estimated quadratic mean diameter is 10.5 inches. Due to the close proximity of the original planting scheme and minimal management over the years growth in this stand has stagnated and some mortality can be seen as result of extreme competition.

Regeneration amounts vary throughout the stand, with some areas being virtually barren of any understory vegetation, while others are teeming with plant life. The variations are due to the amount of available sunlight reaching the forest floor. Where the canopy is nearing 100% closure there is very little to almost no regeneration present, on the contrary, where gaps have formed in the canopy and sunlight is more available to the lower stratums of the forest, seedlings occurrence increases dramatically. Of all the regeneration present throughout the stand, eastern white pine is the most prevalent with an estimated 271 stems per acre (majority of which being tallied at size class 1), followed by Norway spruce with a total of 82 stems per acre (See Table 14 in Appendix). The distribution of ground dwelling species is also varied throughout the stand, some notable species recorded include eastern teaberry, low bush blueberry, and glossy buckthorn (See Table 15 in Appendix).

CWD in this stand is estimated at 523.5 cubic feet per acre, all of which was of a coniferous species ranging from 3” in diameter to 12” in diameter. No snags were recorded during sampling, despite some being observed throughout the stand.

White Pine/Scots Pine (Stand 6)

This stand encompasses approximately 6 acres and is located in the south eastern corner of the project area. It is the result of failed Scots pine plantations which were established in the early 1920's. The eastern portion of this stand was planted purely to Scots pine, which eventually gave way to native species such as eastern white pine and northern red oak as the Scots pine began to fail. The western portion of this stand was under planted with Scots pine, which resulted in sporadic populations of Scots pine mixed with native species such as eastern white pine and northern red oak.

This stand is dominated by a mix of Scots pine, eastern white pine and northern red oak. Other species present include, black birch, red maple and eastern hemlock. This stand has been slowly converting to a native mix of species as the Scots pine has been failing over the last few decades. Due to the small overall size of this stand, sampling was limited during initial inventory, resulting in a larger percent error. Total basal area for this stand is estimated at 160 ft^2/acre, total stems per acre (including all overstory species present) is estimated at 242.2 and the estimated quadratic mean diameter is 11 inches. This is a fairly uneven aged stand, with all age classes represented to some degree.

Regeneration is evenly distributed throughout the stand, with slight increases occurring where gaps in the canopy are more evident. Eastern white pine is the most prevalent with an estimated 111 stems per acre, followed closely by red maple with an estimated 100 stems per acre (See Table 17 in Appendix). The size distribution of regeneration present is more variable in this stand, when compared to the rest of the project area, with over a third of all recorded stems falling into size class 3 and/or 4. Ground dwelling species present include eastern teaberry, partridgeberry, Indian cucumber root, and trailing arbutus, among others (See Table 18 in Appendix). Although no invasive species were recorded during inventory, it is assumed that small populations of glossy buckthorn are present, especially in areas which lie in close proximity to interior forest roads.

Coarse woody debris in this stand is estimated at 454.1 cubic feet per acre, all of which was of a coniferous species ranging from 3" in diameter to 12" in diameter. No snags were recorded during the initial inventory, it is assumed that no more than 1 snag/acre is present throughout this stand.

Prescribed Management and Intended Goals:

This forest management project will have multiple intended results, all of which lend themselves to future management and long term goals for an inclusive management vision for this particular tract of land as well as the landscape in general. In conjunction with guidelines set forth in DCR's Management Guidelines document, goals for this project include but are not limited to, increasing species diversity as well as overall forest complexity, integrating a mix of native species into monoculture plantations while also increasing structural complexity with the creation of multiple age classes, establishment of early successional habitat, sustainable production of renewable forest products, and the demonstration of excellent silvicultural practices implemented on a larger scale, among others (Commonwealth of Massachusetts, 2012).

Red Pine (Stand 1)

As stated above, this red pine plantation is currently overstocked and dominated by primarily one species. Unfortunately, lack of management and species diversity have left many stands very similar to this one, susceptible to large scale decline. The major agents behind the mortality witnessed throughout the region is most likely the stressed state of these plantations along with the introduction of disease and insects, specifically red pine scale (*Matsucoccus resinosae*) and diplodia fungus (*Diplodia pinea*).

Management in this stand will utilize two even-aged methods of regeneration; the uniform shelterwood and patch clearcuts with reserves, both of which have different goals and intentions. The clearcuts, not exceeding 5 acres, will be irregularly shaped and distributed throughout the entire stand. The location of these clearcuts will be placed with the intention of maximizing benefits to wildlife habitat as well as maximizing forest regeneration. The remainder of the stand will be subject to a shelterwood harvest.

The intention of the clearcuts is not only to remove the non-native red pine plantations, but to establish larger areas of early successional habitat. The patches of young growth created through these openings will provide important habitat criteria for a wide array of wildlife species. These early successional conditions have been in decline throughout Massachusetts for a number of years (Alerich, 2000), resulting in a subsequent decline in specialist wildlife species which rely on and utilize this type of habitat. The large increase in sunlight to these areas will allow for an influx of vegetative growth, including a large increase in shade intolerant species. As stated in the current Massachusetts Forest Management Guidelines, a minimum retention of "1 to 3 live, large diameter (where possible < 18" dbh) trees per acre and 4 live, 12" to 18" dbh trees per acre…" as well as the retention of all snags which lie within the clearcut area is required (Commonwealth of Massachusetts, 2012). This level of retention will assure for a reasonable number of snags into the future, while incorporating some level of structural diversity and allowing for the regeneration of early successional species. The goal is to regenerate approximately 30% of the total stand with this method, resulting in approximately 18 acres of clearcutting throughout the entire stand (assuming 10 acres to be omitted from harvest due to slope), none of which said areas are to individually exceed 5 acres in size. Total number of clearcuts will range from a minimum of 4 to a maximum of 20. All clearcuts will be irregularly shaped and will be laid out with the intent of maximizing sunlight exposure throughout the day. Other restrictions to the location of these clearcuts will include presence of abundant advanced regeneration and slope. Areas where

advanced regeneration is abundant will be spared from clearcut operations, with the hope of preserving the existing regeneration (i.e. minimizing loss through harvesting operations).

The focus of the uniform shelterwood operation is to increase tree health and vigor for residual red pine, as well as to encourage the regeneration of native forest species over a series of entries. This first entry will allow for the residual trees to expand their crowns, provide an increase in sunlight availability to the forest floor, as well as capture the monetary value of these high risk trees. The current basal area, mean stand diameter, and trees per acre have placed this stand above the "A line" when looking at red pine stocking charts, meaning this stand is overstocked. Basal area will be reduced by approximately 50%-65%, from its current level of 224 ft^2 per acre to an average basal area ranging from 80 to 110 ft^2 per acre, with lower residual basal area immediately adjacent to clearcuts. Trees targeted for removal will primarily include individuals that exhibit poor form and vigor. This treatment will encompass approximately 38 acres (assuming approximately 10 acres to be omitted from harvest due to slope), effectively treating the remainder of the stand. Future entries will be implemented once regeneration is adequate throughout the stand. The next entry will focus on further removal of the overstory red pine with the intent of releasing the advanced regeneration established in the first entry and will occur in approximately 10-15 years, depending on the establishment of regeneration.

This stand, as a result of this above prescribed management, will have two fairly different outcomes. The areas which are slated for patch clearcuts are expected to regenerate into a mix of early successional, shade intolerant species, such as paper birch, grey birch, and poplar, with inclusions of white pine, red maple, and red oak among others. These areas, separate from the larger stand, will essentially be small individual even aged stands. Conversly, the areas which are slated for shelterwood operations will result in the near future as being a predominantly two aged stand; with the older residual red pine dominating the overstory and a newly established age class of native species in the understory. Anticipated regenerated species include, white pine, red oak, red maple, white oak, black birch, and American beech, along with scattered occurrences of other native tree species. This type of harvest will allow for an increase in regeneration, but will limit the anticipated species distribution by inhibiting the establishment of shade intolerant species to some degree. Once the regeneration is established and ready for release, the second entry will be implemented. This second entry will effectively release the advanced regeneration, by further reducing the presence of red pine in the overstory.

White Pine (Stand 2)

As with stand 1, this 45 acre stand is a plantation that is approximately 80 years old and lack of management over the years have left it in a stressed, stagnated state. The risk of wide spread mortality in this stand is not as great as the red pine stand, but the possibility is there. The stressed state of the overstory and the limited species diversity present in this stand could allow for a precipitous decline in overall forest health if an insect, pest, or disease were to be introduced. Current possible threats to white pine are white pine blister rust (*Cronartium ribicola*), Canavergellia needle cast (*Canavergella banfieldii*), and brown spot needle blight (*Mycosphaerella deamessii*) (Munck, Ostrofksy, Burns 2012).

The silvicultural prescription for this stand will utilized both even age and uneven aged methods of regeneration by implementing the first entry of a two stage shelterwood along with clearcuts with reserves. The shelterwood treatment will focus on the removal of poorly formed white pine, allowing

for the release of advanced regeneration as well as encouraging growth in the residual overstory trees. The current basal area of this stand was estimated at approximately 214 ft^2/acre, which will be taken down to an average of 80 to 100 ft^2/acre throughout the stand, depending on the amount of regeneration present. This will effectively release advanced regeneration and encourage the establishment of a new age class of regeneration. The second entry, which will occur in 10-20 years, will focus on the further removal of the residual plantation white pine, while releasing advanced regeneration. The eventual goal is to slowly convert this even aged plantation to a more species rich, structurally complex forest, through a combination of even and uneven aged management techniques.

The clearcuts with reserves will be utilized where overstory trees exhibit poor form, health, and/or vigor and will be limited to areas where slopes do not exceed 30%. With regeneration being sparse and sporadic throughout the stand, advanced regeneration will not act as a requirement when locating these openings. Similarly to stand 1, the intent of the clearcuts is to remove the compromised overstory, while providing for early successional habitat and increasing species diversity amongst the residual white pine plantation. The implementation of clearcuts throughout this stand will closely mimic the prescription for the red pine stand listed above. Regeneration of approximately 20% of the total stand area utilizing this even-aged method approach is the goal. Total stand area is estimated at approximately 45 acres, assuming approximately 5 acres will be omitted from harvest due to slope, leaving a total of 40 harvestable acres. This will result in an estimated 8 acres of this stand being regenerated through the clearcut method of regeneration. Total number of individual clearcuts will be between 4 and 10, none of which are to exceed 5 acres in size. Specifics regarding reserves/retention are outlined in DCR's Management Guidelines document and are listed in stand 1 prescription.

The desired future condition of this stand is a predominantly two aged stand, with a conglomerate of smaller single even aged patches where clearcutting occurred. An overstory of white pine and understory consisting of a mix of native species, dominated by white pine is anticipated throughout the areas where the shelterwood harvest will be implemented. While the clearcut areas are anticipated to include a greater distribution of more shade intolerant species, such as cherry and paper birch, while still including species such as red oak, white oak, white pine and red maple, among others. These areas will be even aged and may eventually require a thinning treatment with the intent of favoring specific desirable species present, which would occur in a minimum of 20 years.

Red Oak & Red Oak/White Pine (Stands 3 & 4)

The silvicultural prescription that will be implemented in these stands is the expanding gap, irregular shelterwood method of regeneration. This method entails the creation of several openings or gaps scattered throughout the stand. These 'expanding' gaps will allow for the creation of several different age classes with each entry, resulting in a more structurally complex and resilient stand. The goal is to naturally regenerate a native mix of species, while improving the growth of overstory trees by incorporating an intermediate thinning between gaps. The majority of the anticipated regeneration will be a result of these newly created gaps, with lower amounts of regeneration anticipated where only thinning occurs. With this system of management, future entries will focus on the expansion of previously established gaps effectively creating new age classes with every entry.

Unlike the plantations, these stands are in fairly good condition, with many of the oak trees present reaching maturity. This entry will allow for an increase in regeneration, with the goal of regenerating approximately 20% of the total area. Total acreage to be included into this type of management is approximately 114 acres. This will result in the creation of approximately 68, 1/3 acre openings scattered throughout these two stands. Future entries will mimic this one and will occur at 20 year intervals.

White Pine/Norway Spruce (Stand 5)

Management prescribed for this stand will include the implementation an uneven aged method of regeneration, with the goal of establishing multiple age classes throughout the stand while also reducing the prevalence of nonnative Norway spruce. The expanding gap, irregular shelterwood system will be utilized. Small patch cuts not exceeding 1/3 acre in size will be implemented where advanced regeneration is present and will occur over 20% of the total acreage of this stand. This will result in approximately 2.7 of the total 13.4 acres to be regenerated via 1/3 acre openings. The remaining areas will be thinned, with emphasis being on the removal of Norway spruce. The intent of this thinning between openings is to allow for an increase of growing space for residual trees, reduce the presence of Norway spruce, and to establish favorable conditions for future regeneration. Reduction of the existing basal area by approximately 50-60% of their current levels or from the current basal area of 205 ft^2/acre to approximately 80-100 ft^2/acre. Species and both form and vigor will be taken into consideration for the selection of removal trees. Norway spruce will be targeted, with the intent of minimizing the presence on this nonnative species while favoring residual overstory white pine. Trees exhibiting good health and vigor will be retained with the intent of providing a healthy seed source for future regeneration.

The desired future condition of this stand, is a more structurally complex, species diverse stand containing a mix of native species and multiple age classes. Shortly following the above prescribed treatment, regeneration being predominately comprised of white pine will emerge throughout the stand, with some inclusions of red oak, black oak, red maple, black birch, and a limited number of Norway spruce and hemlock. Distribution of anticipated regeneration will vary, with the openings being host to the majority of said regeneration, which will taper off in abundance as less available light is available in the areas subject to thinning operations. The implementation of 1/3 acre openings will allow for the establishment of a new age class and will be implemented in 20 year intervals, effectively regenerating the entire stand on a 100 year rotation. Each entry will result in a new age class and retention of legacy trees scattered throughout will result in multiple age classes and increased structural complexity over the next century.

White Pine/Scots Pine (Stand 6)

This stand will see minimal management, the current stocking is generally low and the management that does occur will focus on the removal on nonnative overstory species, specifically the Scots pine. A thinning across all crown classes will result in the basal area to be lowered from 160 ft^2/acre to an average of 100 to 120 ft^2/acre throughout the stand. Scots pine will be the main focus for removal,

with some instances of poorly formed white pine and red oak being selected for removal as well. The intention of this thinning is to minimize the presence of nonnative Scots pine, while creating more favorable growing conditions for residual overstory trees and advanced regeneration. This stand currently exhibits moderate species diversity, as well as some structural complexity due to the sporadic failing of overstory trees. The anticipated result of this management aims to increase structural complexity and species diversity throughout the stand, by further releasing advanced regeneration and increasing light availability to the forest floor.

Operational Information

Logging Requirements

This harvest will be completed using a fully mechanized operation and will be open to the use of both whole tree and/or cut to length systems as determined by the forester to best meet all of the goals of the project. Currently, all of the stands well exceed the guidelines for minimum CWD retention (Commonwealth of Massachusetts, 2012) and will allow for whole tree removal in areas deemed appropriate. Skidding or dragging of logs will not be permitted on interior forests roads, with the exception of the use of a forwarder. All existing forest roads are to be restored to, at the minimum, pre-harvest conditions.

Steeper slopes will not be accessible for harvest, as some slopes exceed 60%. These areas will be designated by the forester and marked accordingly. All primary and secondary skid roads will require the implementation of erosion control measures, including but not limited to, the construction of water bars, installation of culverts, and slashing of roads. Culturally sensitive areas (C.C.C. structures, stone walls, etc…) will be protected and minimal disturbance will be tolerated in and around these areas.

Harvesting will be permitted year round, as long as ground conditions are stable and allow for harvesting operations. There are currently no NHESP restrictions to this site. Some interior forest roads will require plowing, therefore impacting snowmobile and other winter recreation opportunities. This will only affect a small portion of the state forest and will persist for no more than 2 winter seasons. During hours of operation, this portion of the state forest will be closed for recreational use due to hazards pertaining to harvest operations. Notifications will be sent to local snowmobile clubs to inform users of these temporary access restrictions.

General Guidelines

All wetland resources will be subject to variable width no cut filter strips and all potential vernal pools will be treated as ‘certified’ vernal pools. A 50’ buffer will be implemented along route 2, where no more than 50% basal area will be removed. All operations throughout this sale will adhere to the guidelines and restrictions set forth in the Massachusetts Best Management Practices Manual.

Timber Marking Guidelines

Different marking schemes will be utilized through the entire project area and will be as follows (See Marking Scheme Map in Appendix):

General:

- **Yellow = No Cut; Blue and Red = Cut**.
- Skid roads will be painted in red; all trees marked with red paint are to be tallied and shall be removed.
- Filter strips (no cut), vernal pool and wetland buffers and harvest boundaries will be marked with three horizontal yellow stripes, indicating an area where cutting is prohibited; these trees will remain uncut.

Stand 1 & 2:

- Areas where shelterwood treatments are utilized will be subject to leave tree marking; all trees marked with a yellow horizontal line will remain uncut, trees bearing no paint are slated for removal.
- Areas where patch clearcuts are utilized will be subject to leave tree marking as with the remainder of the stand; a clearcut perimeter will be established for layout purposes and will be delineated with orange flagging. All trees marked with yellow paint will remain on site.

Stand 5:

- This entire stand is subject to a shelterwood system, where leave tree marking will be implemented; all trees marked with a yellow horizontal line will remain on site, trees bearing no paint are slated for removal.

Stand 3 & 4 & 6

- All of these stands will be marked with a cut tree system; where all trees that are designated for removal will be painted and tallied. Blue horizontal stripe indicates the tree was tallied as sawtimber and a blue vertical slash indicates the tree was tallied as firewood or pulp. All trees marked with a single blue stripe or slash are slated for removal.

APPENDIX

Table 1. Red Pine (Stand 1) Overstory Data:

Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	% BA/acre	QMD	Rel Density
eastern white pine (*Pinus strobus*)	4,223	No Tally	52.5	60	27%	14.5	22.1
red pine (*Pinus resinosa*)	24,125	11.92	191.7	152.3	68%	12.1	73.7
red maple (*Acer rubrum*)	0	No Tally	1.8	1.5	1%	12.5	0
white ash (*Fraxinus americana)*	0	No Tally	1.8	1.5	1%	12.5	0
paper birch (*Betula papyrifera*)	0	No Tally	1.8	1.5	1%	12.5	0
northern red oak (*Quercus rubra*)	333	1.5	7.7	7.7	3%	13.5	6.8
Total	**28,681**	**13.42**	**257.4**	**224.6**	**100%**	**12.7**	**103**

Table 2. Red Pine (Stand 1) Regeneration Data (Stems/Acre):

	Size Class				
Species	**1**	**2**	**3**	**4**	**Total**
eastern white pine (*Pinus strobus*)	183.3	57.1	0	0	240.5
northern red oak (*Quercus rubra*)	64.2	14.3	0	0	78.6
red maple (*Acer rubrum)*	66.7	2.4	0	4.8	73.8
white oak (*Quercus alba*)	26.2	11.9	0	0	38.1
American beech (*Fagus grandifolia*)	0	11.9	16.7	2.4	30.9
black cherry (*Prunus serotina*)	16.7	7.1	0	0	23.8
black birch (*Betula lenta*)	7.1	0	2.4	0	9.5
Total	364.2	104.7	19.1	7.2	495.2

Table 3. Red Pine (Stand 1) Understory Data (% Cover):

Species	% Cover
lowbush blueberry (*Vaccinium angustifolium)*	8.64
mapleleaf viburnum (*Viburnum acerifolium*)	3.93
partridgeberry (*Mitchella repens)*	3.21
wild sarsaparilla (*Aralia nudicaulis)*	2.79
brackenfern (*Pteridium spp.)*	2.36
eastern teaberry (*Gaultheria procumbens)*	2.21
starflower (*Triantalis borealis*)	1.79
Canada mayflower (*Maianthemum canadense)*	1.71

Species	% Cover
striped maple (*Acer pensylvanicum)*	1.07
sessileleaf bellwort (*Uvularia sessilifolia)*	0.5
clubmoss (*Lycopodium spp.)*	0.43
aster *(Aster spp.)*	0.14
serviceberry (*Amelanchier spp.)*	0.07
hophornbeam (*Ostrya virginiana)*	0.07
glossy buckthorn (*Frangula alnus)*	0.07
checkered rattlesnake plantain (*Goodyera tesselata)*	0.07

Table 4. White Pine (Stand 2) Overstory Data:

SPECIES	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	% BA/Acre	QMD	Rel. Density
eastern white pine (*Pinus strobus)*	14,724	20.83	284.2	191.4	89%	11.1	77.5
red pine (*Pinus resinosa)*	980	No Tally	13.3	8.6	4%	10.9	0
red maple (*Acer rubrum)*	0	1.19	18.8	5.7	3%	7.5	5
paper birch (*Betula papyrifera)*	0	No Tally	2.2	1.4	1%	10.9	0
northern red oak (*Quercus rubra)*	297	No Tally	7.1	7.1	3%	13.5	6.3
Total	**16,000**	**22.02**	**325.7**	**214.3**	**100%**	**11**	**89**

Table 5. White Pine (Stand 2) Regeneration Data (Stems/Acre):

	SIZE CLASS				
Species	**1**	**2**	**3**	**4**	**Total**
eastern white pine ***(Pinus strobus)***	159	17.9	0	0	176.9
red maple ***(Acer rubrum)***	82.1	2.6	0	15.4	100
northern red oak ***(Quercus rubra)***	87.2	2.6	0	0	89.7
American beech ***(Fagus grandifolia)***	2.6	7.7	12.8	12.8	35.9
black cherry ***(Prunus serotina)***	10.3	0	0	0	10.3
black birch ***(Betula lenta)***	5.1	0	2.6	0	7.7
eastern hemlock ***(Tsugas canadensis)***	2.6	5.1	0	0	7.7
white oak ***(Quercus alba)***	0	5.1	0	0	5.1
Total	348.7	41	15.4	28.2	433.3

Table 6. White Pine (Stand 2) Understory Data (% Cover):

Species	% Cover
partridgeberry ***(Mitchella repens)***	18.46
lowbush blueberry ***(Vaccinium angustifolium)***	12.69
eastern teaberry ***(Gaultheria procumbens)***	10.92
brackenfern ***(Pteridium spp.)***	5.15
mapleleaf viburnum ***(Viburnum acerifolia)***	3.46
black huckleberry ***(Gaylussacia baccata)***	2.69
wild sarsaparilla ***(Arelia nudicaulis)***	1.31
serviceberry ***(Amalanchier spp.)***	1.23
glossy buckthorn ***(Frangula alnus)***	1.08

Species	% Cover
northern dewberry ***(Rubus flagellaris)***	0.77
American witchhazel ***(Hamamelis virginiana)***	0.77
Canada mayflower ***(Maianthemum canadense)***	0.62
starflower ***(Triantalis borealis)***	0.54
clubmoss ***(Lycopodium spp.)***	0.54
downy rattlesnake plantain ***(Goodyera pubescens)***	0.38
Indian cucumber ***(Medeola virginiana)***	0.23
checkered rattlesnake plantain ***(Goodyera tesselata)***	0.23
hophornbeam ***(Ostrya virginiana)***	0.08

Table 7. Red Oak (Stand 3) Overstory Data:

Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	% BA/ac	QMD	Rel. Density
eastern white pine *(Pinus strobus)*	928	1.72	33.6	16	13%	9.3	7
red pine *(Pinus resinosa)*	557	No tally	8.7	6	5%	11.2	0
eastern hemlock *(Tsugas canadensis)*	0	No tally	2.9	2	2%	11.2	0
red maple *(Acer rubrum)*	0	6.9	45.5	22	17%	9.4	18.4
Paper birch *(Betula papyrifera)*	0	0.22	14.5	4	3%	7.1	3.6
black birch *(Betula lenta)*	0	No tally	2.9	2	2%	11.2	0
northern red oak *(Quercus rubra)*	7,049	2.18	48.5	64	51%	15.6	55.7
white oak *(Quercus alba)*	371	1.11	13.8	8	6%	10.3	6.9
Scots pine (Pinus sylvestris)	0	No tally	2.9	2	2%	11.2	0
Total	**8,905**	**12.13**	**173.4**	**126**	**100%**	**11.5**	**92**

Table 8. Red Oak (Stand 3) Regeneration Data (Stems/Acre):

	Size Class				
Species	**1**	**2**	**3**	**4**	**Total**
eastern white pine *(Pinus strobus)*	26.7	33.3	30	3.3	93.3
white oak *(Quercus alba)*	23.3	30	0	0	53.3
northern red oak *(Quercus rubra)*	50	0	0	0	50
American beech *(Fagus grandifolia)*	0	20	10	10	40
red maple *(Acer rubrum)*	28.3	0	0	0	28.3
black cherry *(Prunus serotina)*	16.7	0	0	0	16.7
black birch *(Betula lenta)*	0	0	0	6.7	6.7
eastern hemlock *(Tsugas canadensis)*	6.7	0	0	0	6.7
Total	151.7	83.3	40	20	295

Table 9. Red Oak (Stand 3) Understory Data (% Cover):

Species	% Cover
eastern teaberry ***(Gaultheria procumbens)***	11.25
lowbush blueberry ***(Vaccinium angustifolium)***	9.6
serviceberry ***(Amelanchier spp.)***	5.5
brackenfern ***(Pteridium spp.)***	2.65
partridgeberry ***(Mitchella repens)***	2.1
mountain laurel ***(Kalmia latifolia)***	2
clubmoss ***(Lycopodium spp.)***	2
wild sarsaparilla ***(Aurelia nudicaulis)***	1.2

Species	% Cover
mapleleaf viburnum ***(Viburnum acerifolium)***	0.9
starflower ***(Triantalis borealis)***	0.5
sessileleaf bellwort ***(Uvularia sessilifolia)***	0.3
withe-rod ***(Viburunum nudum* var. *cassinoides)***	0.2
goldthread ***(Coptis trifolia)***	0.2
hawthorn ***(Crataegus spp.)***	0.1
glossy buckthorn ***(Frangula alnus)***	0.1

Table 10. Red Oak/White Pine (Stand 4) Overstory Data:

Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	% BA/ac	QMD	Rel. Density
eastern white pine (*Pinus strobus)*	3,247	4.86	70.6	36	23%	9.7	15.6
red pine *(Pinus resinosa)*	1,340	0.29	9.1	8.8	6%	13.3	4.2
eastern hemlock *(tsugas canadensis)*	1,117	2.26	16.9	14.4	9%	12.5	6.6
Norway spruce *(Picea abies)*	0	No tally	1.1	0.8	1%	11.8	0
red maple *(Acer rubrum)*	211	5.36	39.6	19.2	12%	9.4	16.2
white ash *(Fraxinus americana)*	0	No tally	3.2	2.4	2%	11.8	0
paper birch (*Betula papyrifera)*	0	0.61	4.3	2.4	2%	10.1	2.2
American beech *(Fagus grandifolia)*	0	No tally	12.7	9.6	6%	11.8	0
northern red oak *(Quercus rubra)*	4,944	4.61	55.7	59.2	38%	14	52.2
white oak *(Quercus alba)*	105	No tally	5.3	4	3%	11.8	0
Total	**10,964**	**18**	**218.4**	**156.8**	**100%**	**11.5**	**97**

Table 11. Red Oak/White Pine (Stand 4) Regeneration Data (Stems/Acre):

	Size Class				
Species	**1**	**2**	**3**	**4**	**Total**
red maple (*Acer rubrum*)	76	1.3	2.7	6.7	86.7
northern red oak (*Quercus rubra*)	44	0	0	1.3	45.3
eastern white pine (*Pinus strobus*)	21.3	6.7	0	0	28
American beech (*Fagus grandifolia*)	9.3	2.7	4	5.3	21.3
eastern hemlock (*Tsugas canadensis*)	1.3	0	5.3	5.3	12
black cherry *(Prunus serotina)*	6.7	0	0	0	6.7
paper birch (*Betula papyrifera*)	6.7	0	0	0	6.7
white oak (*Quercus alba*)	1.3	0	0	2.7	4
American chestnut *(Castanea dentata)*	0	0	0	1.3	1.3
white ash (*Fraxinus americana*)	1.3	0	0	0	1.3
Total	172	10.7	12	22.7	217.3

Table 12: Red Oak/White Pine (Stand 4) Understory Data (% Cover):

Species	% Cover
lowbush blueberry *(Vaccinium angustifolium)*	5.24
serviceberry *(Amalanchier spp.)*	3.12
eastern teaberry *(Gaultheria procumbens)*	2.4
partridgeberry *(Mitchella repens)*	1.92
brackenfern *(Pteridium spp.)*	1.64
mountain laurel *(Kalmia latifolia)*	1.6
wild sarsaparilla *(Arelia nudicaulis)*	1.48
hayscented fern *(Dennstaedtia punctilobula)*	1.2
mapleleaf viburnum *(Viburnum acerifolia)*	1
starflower *(Triantalis borealis)*	0.92

Species	% Cover
striped maple *(Acer pensylvanicum)*	0.8
American witchhazel *(Hamamelis virginiana)*	0.4
Canada mayflower *(Maianthemum canadense)*	0.28
aster *(Aster spp.)*	0.28
clubmoss *(Lycopodium)*	0.24
Indian cucumber *(Medeola virginiana)*	0.08
grape *(Vitis spp.)*	0.08
trillium *(Trillium spp.)*	0.04
glossy buckthorn *(Frangula alnus)*	0.04

Table 13. White Pine/Norway Spruce (Stand 5) Overstory Data:

Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	% BA/Acre	QMD	Rel. Density
eastern white pine (*Pinus strobus*)	3,709	8.91	84.7	65.7	32%	11.9	26
Norway spruce (*Picies abies)*	4,649	20.1	225.2	117.1	57%	9.8	48.6
red maple (*Acer rubrum*)	0	no tally	18.8	11.4	6%	10.6	0
white oak (*Quercus alba*)	0	no tally	4.7	2.9	1%	10.6	0
pitch pine (*Pinus rigida*)	448	no tally	5.6	5.7	3%	13.7	6
Scots pine (*Pinus sylvestris*)	0	no tally	4.7	2.9	1%	10.6	0
Total	**8,806**	**29.01**	**343.7**	**205.7**	**100%**	**10.5**	**81**

Table 14. White Pine/Norway Spruce (Stand 5) Regeneration Data (Stems/Acre):

	Size Class				
Species	**1**	**2**	**3**	**4**	**Totals**
eastern white pine (*Pinus strobus)*	242.9	28.6	0	0	271.4
Norway spruce (*Picea abies)*	76.2	9.5	0	0	85.7
black birch (*Betula lenta*)	23.8	9.5	4.8	0	38.1
eastern hemlock (*Tsugas canadensis*)	9.5	14.3	0	0	23.8
red maple (*Acer rubrum*)	23.8	0	0	0	23.8
northern red oak (*Quercus rubra*)	9.5	0	0	0	9.5
American beech (*Fagus grandifolia)*	0	9.5	0	0	9.5
Totals	395.2	71.4	4.8	0	471.4

Table 15. White Pine/Norway Spruce (Stand 5) Understory Data (% Cover):

Species	% Cover
eastern teaberry (*Gaultheria procumbens*)	6.43
brackenfern (*Ptreidium spp.)*	3
lowbush blueberry (*Vaccinium angustifolium)*	2.14
Canada mayflower *(Maianthamum canadense)*	1.29

Species	% Cover
glossy buckthorn *(Frangula alnus)*	0.57
American hornbeam (*Ostrya virginiana*)	0.3
partridgeberry *(Mitchella repens)*	0.14

Table 16. White Pine/Scots Pine (Stand 6) Overstory Data:

Species	Bf/Acre	Cords/Acre	Trees/Acre	BA/Acre	% BA/Acre	QMD	Rel. Density
eastern white pine (*Pinus strobus*)	7,806	no tally	24.4	33.3	21%	15.8	12
eastern hemlock (*Tsugas canadensis*)	0	no tally	22.4	13.3	8%	10.4	0
red maple (*Acer rubrum*)	0	no tally	11.2	6.7	4%	10.4	0
black birch (*Betula lenta*)	0	no tally	11.2	6.7	4%	10.4	0
northern red oak (*Quercus rubra*)	935	no tally	11.2	6.7	4%	10.4	0
Scots pine (*Pinus sylvestris)*	3,419	13.16	161.9	73.3	46%	9.1	88
Total	**12,160**	**13.16**	**242.2**	**160**	**88%**	**11**	**100**

Table 17. White Pine/Scots Pine (Stand 6) Regeneration Data (Stems/Acre)

	Size Class				
Species	**1**	**2**	**3**	**4**	**Total**
eastern white pine (*Pinus strobus*)	66.7	44.4	0	0	111.1
red maple (*Acer rubrum*)	22.2	0	55.6	22.2	100
white oak (*Quercus alba*)	22.2	22.2	0	11.1	55.6
northern red oak (*Quercus rubra*)	22.2	0	0	22.2	44.4
American beech (*Fagus grandifolia*)	0	22.2	0	11.1	33.3
black oak (*Quercus velutina*)	0	0	0	22.2	22.2
Norway spruce (*Picea abies*)	11.1	0	0	0	11.1
black birch (*Betula lenta*)	11.1	0	0	0	11.1
Totals	155.6	88.9	55.6	88.9	388.9

Table 18. White Pine/Scots Pine (Stand 6) Understory Data (% Cover)

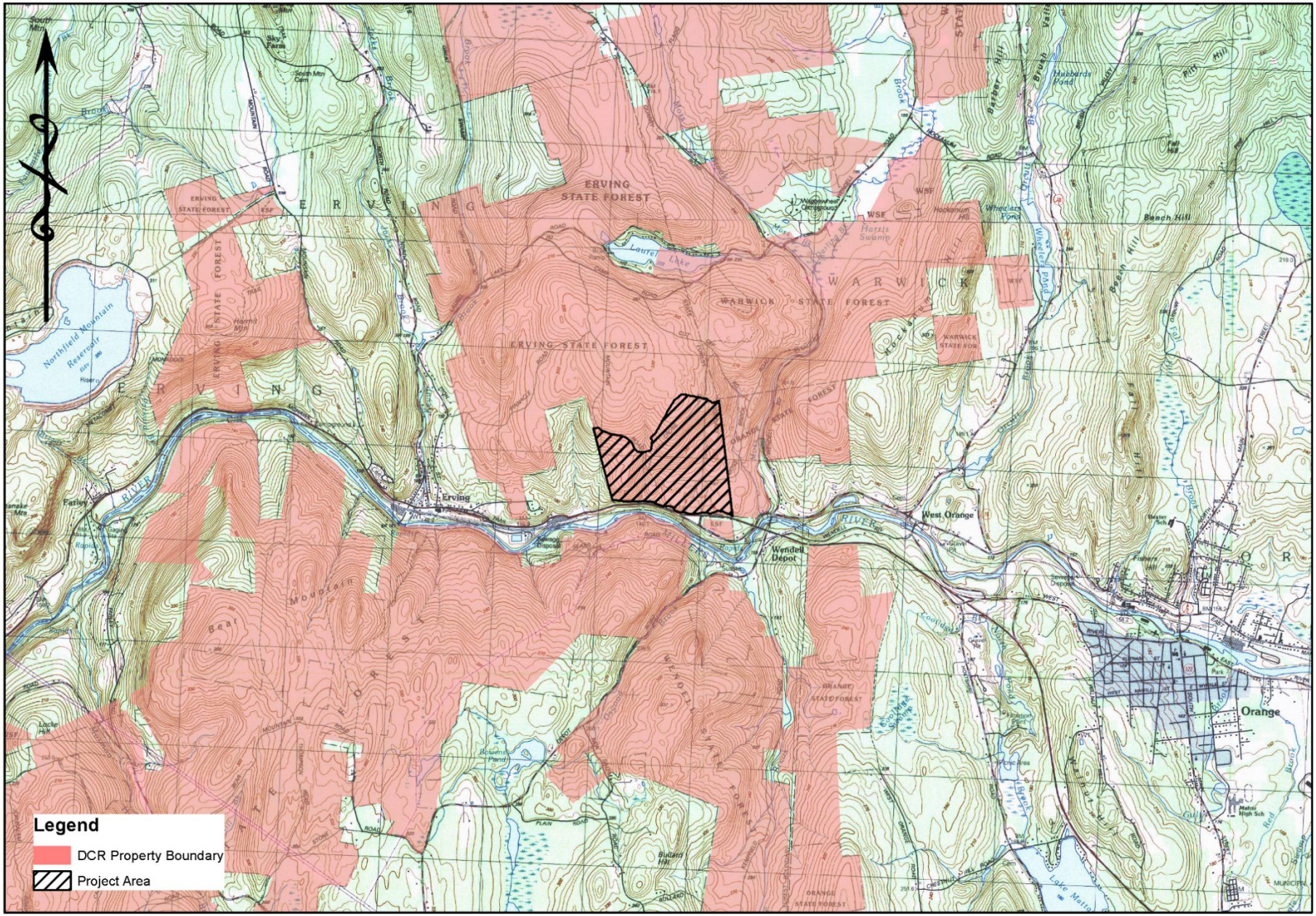
Species	% Cover
wintergreen (*Gaultheria procumbens*)	13.33
partridgeberry (*Mitchella repens*)	8.33
trailing arbutus (*Epigaea repens*)	3.33
lowbush blueberry (*Vaccinium angustifolium*)	1.33

Species	% Cover
Indian cucumber (*Medeola virginiana)*	1.33
clubmoss (*Lycopodium spp.*)	0.67
starflower (*Triantalis borealis*)	0.33

1 inch = 4,000 feet

LOCUS MAP
ERVING STATE FOREST

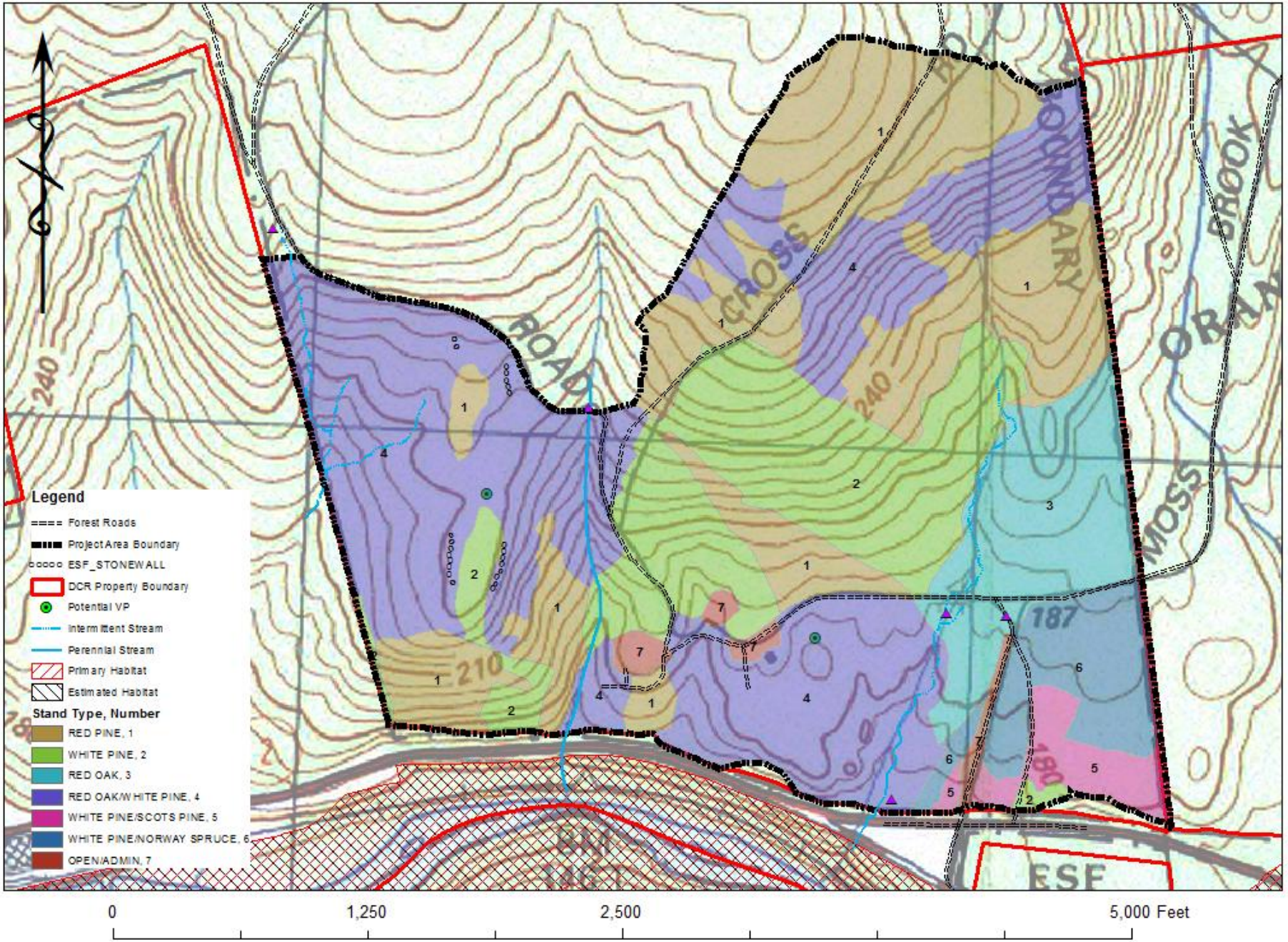
10/19/2015



1 inch = 600 feet

FOREST STAND MAP
ERVING STATE FOREST

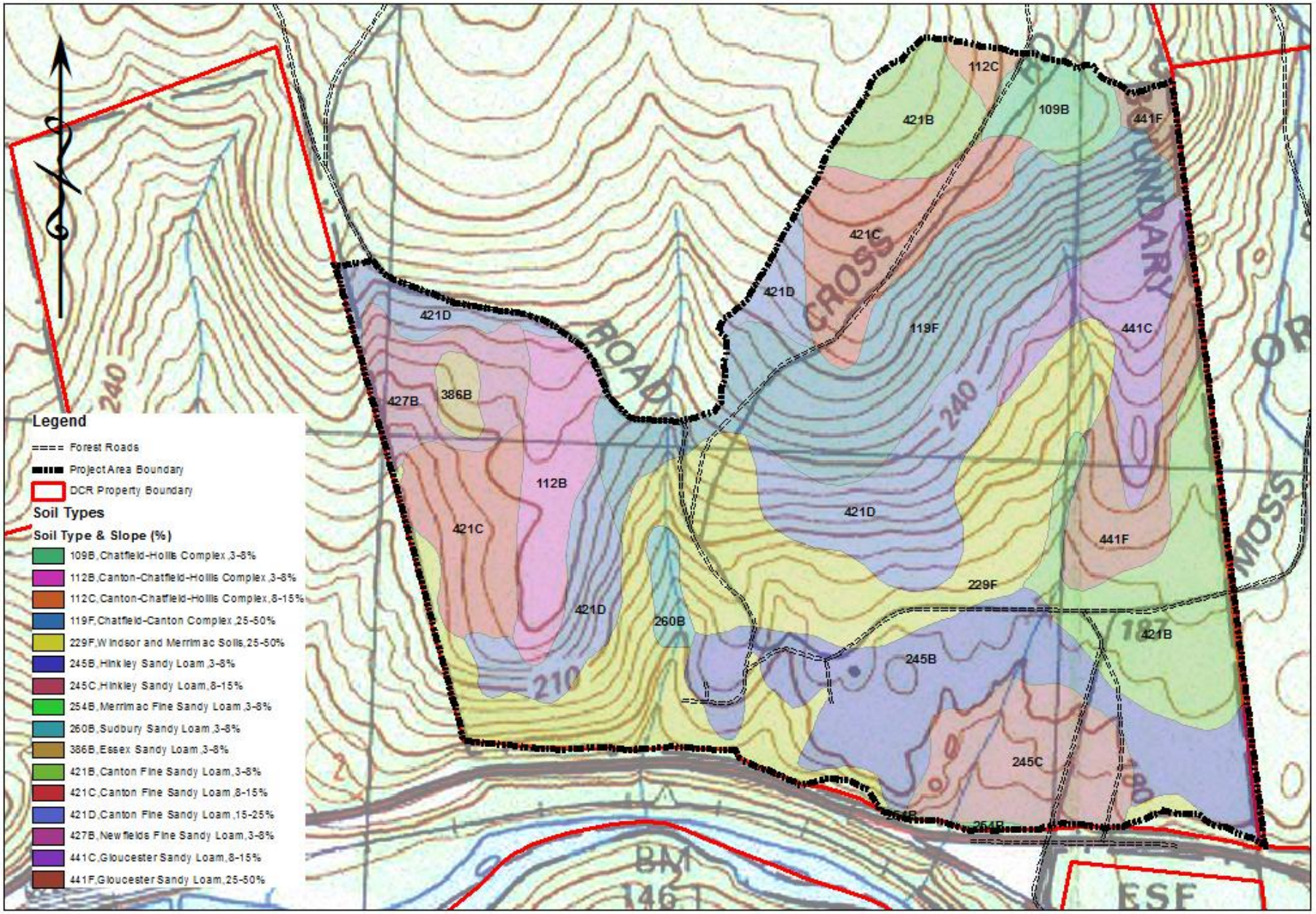
10/19/2015



1 inch = 600 feet

SOIL MAP
ERVING STATE FOREST

10/19/2015



Legend

==== Forest Roads

Project Area Boundary

DCR Property Boundary

Soil Types

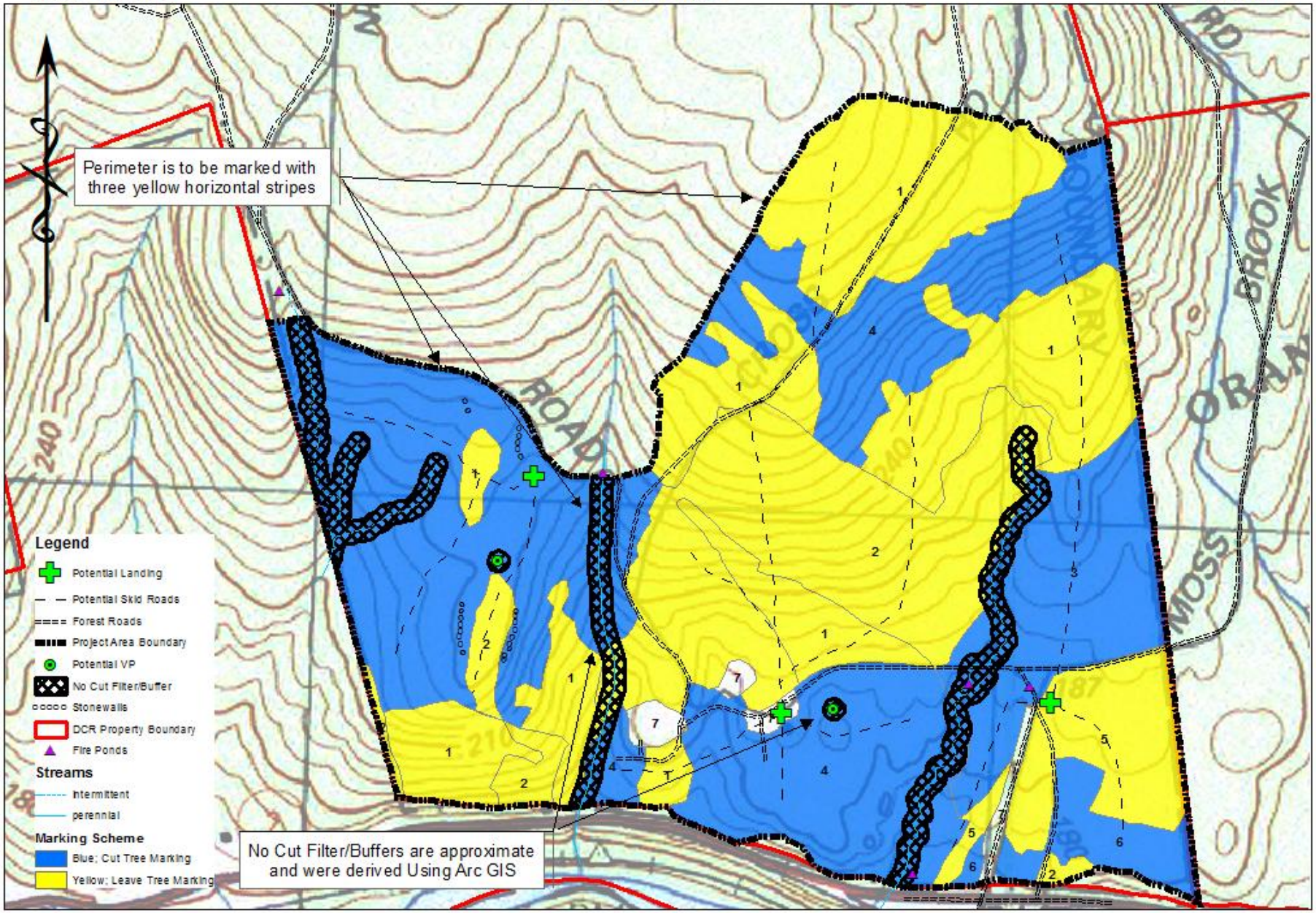
Soil Type & Slope (%)

- 109B, Chatfield-Hollis Complex, 3-8%
- 112B, Canton-Chatfield-Hollis Complex, 3-8%
- 112C, Canton-Chatfield-Hollis Complex, 8-15%
- 119F, Chatfield-Canton Complex, 25-50%
- 229F, Windsor and Merrimac Soils, 25-50%
- 245B, Hinkley Sandy Loam, 3-8%
- 245C, Hinkley Sandy Loam, 8-15%
- 254B, Merrimac Fine Sandy Loam, 3-8%
- 260B, Sudbury Sandy Loam, 3-8%
- 386B, Essex Sandy Loam, 3-8%
- 421B, Canton Fine Sandy Loam, 3-8%
- 421C, Canton Fine Sandy Loam, 8-15%
- 421D, Canton Fine Sandy Loam, 15-25%
- 427B, Newfields Fine Sandy Loam, 3-8%
- 441C, Gloucester Sandy Loam, 8-15%
- 441F, Gloucester Sandy Loam, 25-50%

1 inch = 600 feet

MARKING SCHEME/LAYOUT MAP
ERVING STATE FOREST

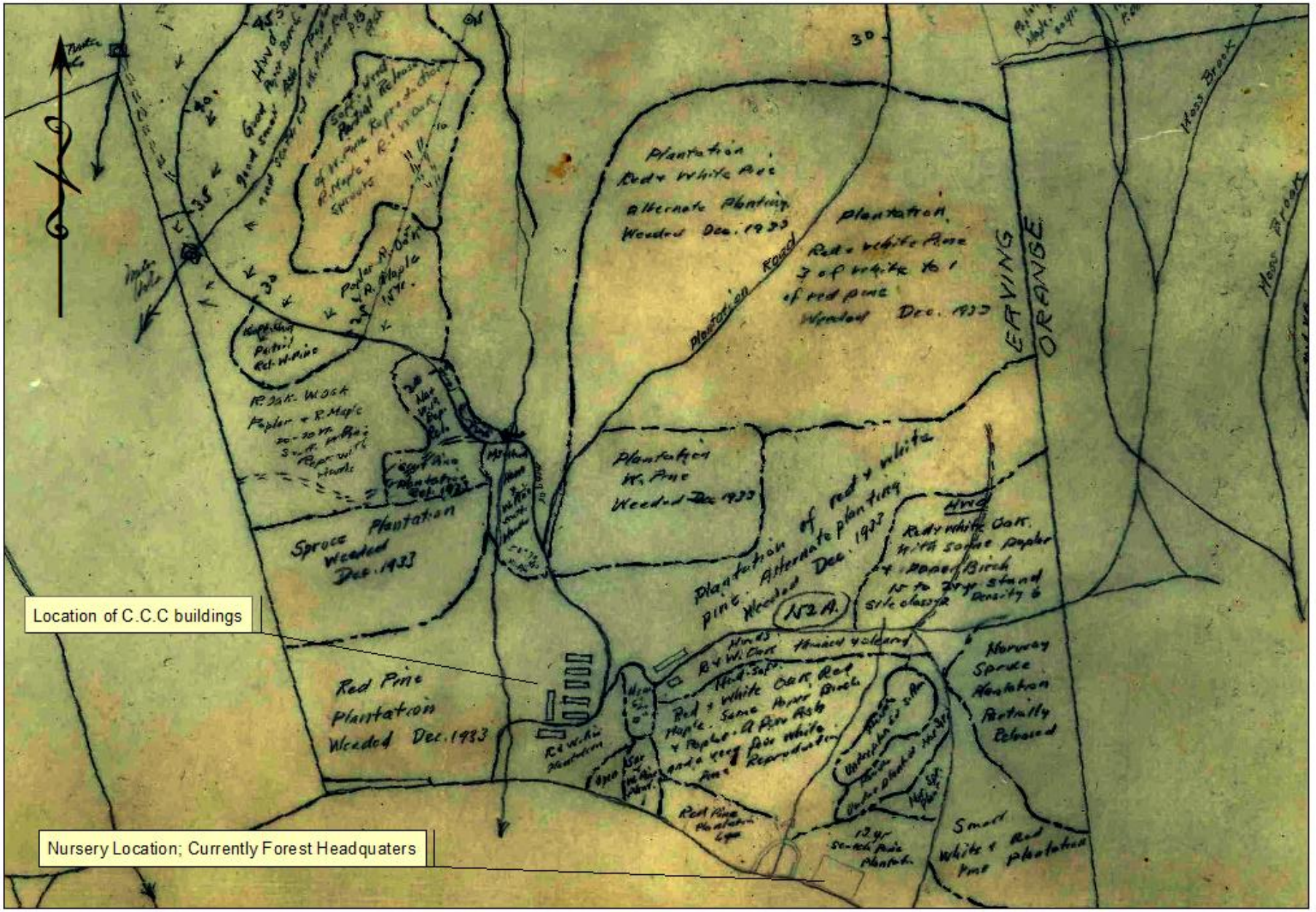
10/19/2015



1 inch = 600 feet

HISTORICAL MAP
ERVING STATE FOREST

10/19/2015



0 1,250 2,500 5,000 Feet

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