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Silviculture Prescription
Beaman Pond Lot 2.0

Massachusetts Department of Conservation and Recreation
Bureau of Forestry

Mid State District
Otter River State Forest – Beaman Pond Lot
Baldwinville and Winchendon, MA

Prepared by:

Joelle Vautour – Management Forester – Mid State District
Massachusetts Department of Conservation and Recreation
355 West Boylston Street Clinton, MA 01510
joelle.vautour@mass.gov – 617-429-8683

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Approved by:

Management Forestry Program Supervisor _____ Date: 10/19/21
Thomas Brulé

SITE DATA

Cultural and Historical

The Beaman Pond Lot is part of the Otter River State Forest complex and is located partially in the northeastern corner of Baldwinville (Templeton) and in the southern portion of Winchendon. Purchased in 1915 and formally established in 1917, it is the first state forest. The Otter River State Forest complex is currently comprised of three separate, non-contiguous state forest parcels, totaling nearly 1,000 acres. In addition, DCR leases approximately 4,200 acres of land in the area, including the Lake Dennison Recreation Area from the United States Army Corps of Engineers (ACOE). The Beaman Pond lot consists of approximately 290 acres, whereas approximately 171.4 acres will be harvested in several timber sales.

Prior to 1935, Otter River State Forest was comprised of 1,992 contiguous acres and included all three state forest parcels which are currently non-contiguous (see Plan of the Otter River State Forest in Winchendon, Templeton and Royalston, 1918). In 1935, the ACOE, by a Declaration of Taking, acquired 1,163 acres of state forest land in the Millers River and Otter River watershed for flood control operations. This action isolated the three separate state forest parcels that make up the Otter River State Forest complex today (see Plan of Otter River State Forest in Winchendon, Templeton and Royalston, revised 1943 by F. Bowers). In addition to the acquisition of land, they built the Birch Hill and Tully Dams. The Birch Hill Dam, Tully Dam, and Tully Lake provide flood protection for many towns that are located on or near the Millers River, including nearby Royalston, Athol, and Orange. It also assists in the protection of communities on the Connecticut River, which the Millers River drains into. The Birch Hill area includes land owned by DCR, the Massachusetts Department of Fish and Game, and ACOE, totaling nearly 8,500 acres of protected open space.

A Civilian Conservation Corps (CCC) camp (Camp S-63 - Company 1102) was established at Otter River in 1934 as well as a state nursery. The camp was located on former state forest land now owned by ACOE near Priest Brook. CCC projects at Otter River State Forest included forestry, road construction, fire protection, and the building of recreational sites. This includes Beaman Pond and 12 of the 82 campsites at the Otter River campground. The CCC camp planted thousands of trees in the area, including on the Beaman Pond Lot which makes up a portion of this project. The Beaman Pond Lot is bounded by ACOE to the west and north and by private ownership to the east and south. It can be accessed by Route 202, Dennison Street, and Lake Dennison Recreational Area and Otter River State Forest park roads.

The 1916 report by the State Forester describes the Otter River State Forest land area (Berg, 1999),

> *"The land is for the most part flat and the soil, light, but not sandy. The areas purchased were largely cut-over lands or abandoned pastures. Except in portions near the railroad which have been burned, there is an immense amount of volunteer pine reproduction on this forest. Conditions for artificial planting are excellent."*

A 1938 aerial photograph of the Beaman Pond Lot confirms this statement made by the State Forester in 1916. The condition of the Beaman Pond lot is a function of its past use and disturbance. Historically speaking, this property has undergone significant agricultural use, forest cutting/clearing and abandonment followed by reforestation plantings. In this case red pine (*Pinus resinosa*) and eastern white pine (*Pinus strobus)* were the primary species planted along with Scots pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*). The intent was to periodically thin these plantations in order to maintain a

stand of healthy vigorous trees with the ultimate goal of harvesting for wood products. After decades of neglected forest management, many of these plantations have stagnated. The red pine has since become infested with the red pine scale insect (*Matsucoccus resinosae*) as well as the fungus diplodia tip blight (*Sphaeropsis sapinea*). White pine has been susceptible to two foliar diseases, the Canavirgella needle cast (*Canavirgella banfieldii)* and the brown spot needle blight (*Mycosphaerella dearnessii)*, both of which are fungi.

Geology and Soils

The terrain varies dramatically throughout the project area. There are two prominent hills in the northern half of the project area and the remainder lies relatively flat. Some areas are low lying and are seasonally wet. The steepest slopes are located along the hillsides in the northern portion of the project area. The slopes on these hillsides are greater than 30% in some places.

The property is underlain by an outwash plain of mostly droughty soils that varies from moderately well drained to excessively well drained. Approximately 73% of the upland soils are excessively well drained, 9% are well drained, and 10% are moderately/somewhat excessively well drained. The remainder of the soils are poorly to very poorly drained. Harvesting operations will only take place where the soils are suitable for the use of machinery. There are seven soil types that underlie the project area. The different soil types present within the project area span multiple stands. The soil descriptions and maps were derived from the NRCS Web Soil Survey (see Soils Map).

The majority of the project area is underlain by the Colton gravelly loamy sand. This soil type is divided into 3 groups based on slope (282A = 0 to 3%; 282B = 3 to 8 %; 282E 25-35%). Despite the difference in slope the soil properties are identical across the 3 groups. This is an excessively well drained, deep soil (being more than 80 inches to a restrictive feature), which has a very low available water capacity that is comprised of sandy and gravelly glaciofluvial deposits derived from granite. It encompasses nearly 73% of the total harvest area. The next most prevalent soil is the Allagash fine sandy loam (281B = 3 to 8% slopes) which encompasses approximately 8.8% of the total harvest area. This soil type is well drained with a depth that ranges from 15 to 35 inches. The Croghan loamy fine sand (284B = 3 to 8% slope) which encompasses 8.6% of the project area. This soil type is moderately well drained with a depth that is greater than 80 inches. The Adams loamy sand (280A = 0 to 3%; 280B = 3 to 8% slopes) encompasses approximately 1.8% of the project area and is a very deep and excessively well drained soil type. The Becket-Skerry association (908C = 3 to 15% slopes) encompasses approximately 0.1% of the total harvest area. Being an association, this soil is comprised of two major soil types. Both soil types are well drained and have a depth that ranges from 15 to 35 inches with a low available water capacity.

There are two soil types which are poorly to very poorly drained. The first soil is the Searsport loamy sand (28A = 0-3 % slopes), it is a very deep soil (80 inches to a restrictive layer) and is very poorly drained. Lastly, the Naumburg fine sandy loam (29B = 0 to 5% slopes) is also a very deep soil that is poorly drained soil. Together they account for approximately 7.7% of the project area.

Site Productivity

Soil productivity varies greatly throughout the harvest area but seems to favor the development of upland plant species communities which are suited for these droughty soil types (USDA-NRCS). The upland soil types, Colton gravelly loamy sand, Allagash fine sandy loam, Adams loamy sand, Croghan loamy fine sand and Becket-Skerry association support the growth of white pine in comparison to other species. The Colton gravelly loamy sand has a site index of 62 for eastern white pine, 61 for sugar maple

(*Acer saccharum)* and 52 for red pine. The Allagash fine sandy loam has a site index of 72 for eastern white pine and 71 for red pine. The poorly drained soils encourage more of a spruce/fir forest type.

Hydrology and Watershed

The Beaman Pond lot is located in the southern portion of the Millers River Watershed. This watershed encompasses nearly 310 square miles and is located in north central Massachusetts, extending slightly into southern New Hampshire. The headwaters of the Millers River are located in Ashburnham, MA and the river continues through several towns including Winchendon, Royalston, Athol, among others, and westward until it reaches the Connecticut River, which flows into Long Island Sound. The harvest area lies within one mile of two large tributaries of the Millers River. The closest is the Otter River, which lies a half mile to the west of the property boundary. The other is Priest Brook, which is approximately one mile to the northwest. The merge of these tributaries into the Millers River are within one mile of the property boundary.

There are several mixed wooded and shrub swamps and one intermittent stream located within the project area or along its perimeter. Beaman Pond, although outside of the project area, is located centrally in the state forest and is a result of a CCC constructed dam. It is currently utilized as a designated swimming area at the Otter River campground. There are three perennial streams located adjacent to the project area. The first is Beaman Brook which enters the property from the east side of Route 202 and flows into the southern end of Beaman Pond. The second perennial stream enters the property from the south and flows north into Beaman Pond. A third perennial stream flows northwestward out of Beaman Pond into the Mud Pond wetland system located on the ACOE property. All wetland resource areas will have appropriate buffers and filters as indicated in the Massachusetts Forestry Best Management Practices Manual (BMPs). These buffers and filter strips will be delineated in the field prior to harvesting. This will aid in directional felling away from these resource areas. No equipment will operate in streams, wetlands, or wetland buffers except on pre-existing woods roads and trails or at designated crossings approved by a forest cutting plan. The intermittent stream will be temporarily crossed. There are no wetland crossings planned at this time. Extensive planning efforts will reduce site impacts and avoid stream and wetland crossings at all opportunities.

There will be no harvesting in wetlands. Appropriate measures will be taken in order to mitigate and prevent erosion (i.e., water bars, seeding, slashing of skid roads). Slash will be left on site not only to provide nutrients to the soil and for habitat purposes, but to also slow overland flow of water and to promote percolation of water into the soil.

Wildlife

A review of the Natural Heritage and Endangered Species Program (NHESP) atlas shows that there is a priority habitat mapped throughout the project area. Communication with NHESP has begun and there is one species listed for the priority area mapped. NHESP will review the project prior to any harvesting to determine if any limitations or modifications will be required.

As outlined in the DCR Management Guidelines (Commonwealth of Massachusetts, 2012), selected large trees will be reserved as wildlife trees for future snag and den trees. Snags, dead trees, and coarse woody debris will be retained for habitat as well. A minimum of two cords of coarse woody debris (256 cubic feet) will be maintained per acre. Browse for wildlife will be enhanced during the harvest and for many years after the harvest as regeneration becomes established.

Recreation

The Beaman Pond Lot is located along a portion of Route 202, Dennison Street (Baldwinville) and along "Old 202" which are actively used for recreation. All aesthetic considerations will be made to legal recreational users of the state forest. As mentioned in the DCR Management Guidelines for roads and trails, hazard trees will be harvested along the truck roads, skid trails and hiking trails (Commonwealth of Massachusetts, 2012). Harvesting operations will be limited to times when ground conditions are considered stable by the forester. Directional felling to protect residual trees, wetlands, woods roads, and trails will also be implemented.

There are many passive recreational uses of the Beaman Pond Lot and surrounding protected lands (Birch Hill Wildlife Management Area, Lake Dennison Recreational Area, Birch Hill Flood Control Area). Hiking, mountain biking, cross country skiing, snowshoeing, hunting and fishing, equestrian use, dog sledding, swimming, and legal snowmobiling are potential uses of this state forest. The Wilder-Mackenzie interpretive hiking trail is a popular trail which connects Otter River campground to Lake Dennison. Forest management will occur in the 50 foot wide corridor on the Wilder-Mackenzie interpretive hiking trail (see Project Map). Due to public safety concerns, the required management guidelines (Commonwealth of Massachusetts, 2012) in the trail's corridor have been waived. There is an extensive network of snowmobile trails that are permitted for use and maintained by the Coldbrook Snowmobile Club. These trails extend through several local towns. Some of these trails will be utilized as main truck/access roads. Active harvesting operations will be planned to minimize impacts to recreational users as much as possible. The project area will be closed to the public during active logging hours for safety purposes.

Current Vegetation

Currently this site is dominated by white pine, red pine, Scots pine, and Norway spruce plantations which were planted by the CCC. The overstory is mature and has stagnated in growth. The red pine plantation is currently infested with red pine scale and mortality is evident throughout the plantation. The white pine plantation has been infected with Canavirgella needle cast and brown spot needle blight for several years. These fungi cause lesions to form in current year needles and can cause death to the distal portion of the infected needle. This fungal infection, combined with stagnated growth and moderately to excessively drained soils, are causing mortality within the white pine plantation. The Scots pine plantation has been dying back for many years being most likely caused by growth stagnation.

The Beaman Pond Lot consists of three forest stand types, stand 1 is a red pine plantation, stand 2 is a white pine plantation, and stand 3 is a Scots pine plantation (see Project Map). The most common overstory species are red pine, white pine and Scots pine. Other associated species include Norway spruce, red maple (*Acer rubrum*), and Northern red oak (*Quercus rubra*).

From November 2017 through November 2018, the majority of stands 1-3 were harvested. The red pine plantation was treated with the shelterwood regeneration method and the white pine and Scots pine plantations were treated with the uneven aged group selection method. In addition to this management, there is a robust history of prior forest management. The red pine located on the east side of Route 202 was treated in 1989, the red pine located in the northwestern portion of the property was treated in 1993 along with a portion of stand 2, and the red pine south of the campground and on the west side of the campground road were treated in 2000 along with stand 2. These treatments were the preparatory cut of the shelterwood regeneration method aimed at harvesting portions of the overstory to create optimal conditions for the establishment of regeneration in the understory. Stand 3 was not treated prior to 2017-2018. Past management practices and natural mortality have begun the

creation of a new age class throughout the property. White pine, red oak, red maple, black cherry (*Prunus serotina)*, and Eastern hemlock (*Tsuga canadensis*) are present in the understory. The ground species are for the majority associates of upland forest communities. Winterberry (*Gaultheria procumbens),* lowbush blueberry *(Vaccinium angustifolium),* and bracken fern (*Pteridum aquilinum*), among others, are common in the ground layer throughout the project area.

STAND DATA

Stand Descriptions

Stand 1

Stand 1 is a 69.6 acre red pine plantation located in several separate locations throughout the harvest area (see Project Map). The dominant overstory species is red pine. Eastern white pine also occurs in the overstory in lesser amounts (Appendix, Table 1). This stand is roughly 85 years old. There is a small inclusion of Norway spruce in the southern portion of the plantation, totaling 1.1 acres. Growth response from forest management prior to the 2017-2018 was very minimal suggesting that the plantation had stagnated in growth beginning in the early 1990's. Growth response from the 2017-2018 harvest was negligible, as the stand is infested by the red pine scale and is dying back at this time. The overstory is very uniform and consists of co-dominant trees. The current basal area is 70.7 square feet per acre (83% red pine by species) with 80.8 trees per acre. The quadratic mean diameter is 12.7 inches (Appendix, Table 1).

There are an estimated 1,000 stems of regeneration in the understory throughout stand 1 (Appendix, Table 2). Areas that have seen repetitive past entries have the highest amount of regeneration. There are areas of dense grass growth in the understory in portions of the plantation which contain very sparse native tree or understory plant growth. It is assumed that a combination of past land use practices, particularly livestock grazing, as well as winter harvesting with cut-to-length machinery are cause for this site condition. White pine, red pine, and red maple seedlings and saplings are the most prevalent regeneration species with some patches of hemlock, black birch (*Betula lenta),* and American beech (*Fagus grandifolia)* present also (Appendix, Table 2). Ground species present in this stand are associated with upland forest ecosystems and include mostly dewberry (*Rubus spp.),* wintergreen, bracken fern, low bush blueberry, and an assorted mixture of grass species, among others. There are 5.4 snags per acre inventoried in this stand and an estimated volume of 634 ft^3 per acre of coarse woody debris. There are several forested wetlands located throughout this stand or along the perimeter.

Stand 2

Stand 2 is a 86.4 acre white pine plantation that is located in four separate locations throughout the harvest area (see Project Map). The dominant overstory species is white pine. Hemlock, Norway spruce, and red oak also occur in the overstory in lesser amounts (Appendix, Table 3). This stand is roughly 85 years old. The basal area is 83.3 square feet per acre with 143.1 stems per acre. The median stand diameter is 13.1 inches and the estimated relative density is 35% (Appendix, Table 3). Throughout most of the stand, the live crown ratio on standing trees is extremely low. The stocking level in this stand is spatially variable, from under to overstocked. In 2017-2018, within 32 group openings applied, 22.2 acres of the stand were regenerated, or 25.69% of the overall stand area.

Regeneration is dense in areas that were treated previously. There are an estimated 3,923.1 stems per acre in the understory (Appendix, Table 4). Red maple, northern red oak, and white pine seedlings and saplings make up the majority of the regeneration in these areas. In areas that were not thinned, natural

mortality and thin overstory crowns have released enough sunlight to the forest floor to allow pockets of regeneration to become established. Ground species present in this stand are associated with upland forest ecosystems and include mostly bracken fern, low bush blueberry, an assorted mixture of grass species, and dewberry.

Due to high levels of mortality, there are many dead standing trees and scattered large volumes of coarse woody debris. There are an estimated 30.4 snags per acre in this stand, all of which are white pine. Each snag measured was less than 12 inches dbh (Appendix, Table 6). There is an estimated 550.8 ft^3 per acre of coarse woody debris. There are several forested wetlands and one intermittent stream located in this stand. There will be no harvesting in wetlands.

Stand 3

Stand 3 is a 15.4 acre Scots pine plantation that is located along the northwestern side of the project area. Prior to the 2017-2018 harvest, this stand was untreated since planting. The dominant overstory species is Scots pine, with some inclusions of white pine (Appendix, Table 7). This stand is roughly 85 years old. The basal area of this stand is 33.3 square feet per acre with 24.7 stems per acre. The quadratic mean diameter is 17.0 inches with a relative density of 34% (Appendix, Table 7).

Throughout most of the stand, the live crown ratio on standing trees is extremely low. The lack of thinning through the years has resulted in a high level of competition and crowding, leaving the overstory trees with thin crowns and stagnated growth. Mortality can be seen throughout the stand due to these close growing conditions and high level of competition. The stocking level in this stand is spatially variable, from under to overstocked. In 2017-2018, within 10 group openings, 6 acres of the stand was regenerated, or 38.96% of the stand area.

There are an estimated 3,000 stems per acre of regeneration in the understory, most of which is under 4.5 feet in height (Appendix, Table 8). The majority of the regeneration at this time is red pine and red maple seedlings and saplings, with white pine, northern red oak and paper birch (*Betula papyrifera)* also present. Ground species present in this stand are associated with upland forest ecosystems and include mostly dewberry, bunchberry (*Cornus canadensis),* and an assorted mixture of grass species (Appendix, Table 9). There is an estimated volume of 1,724.2 ft^3 per acre of coarse woody debris in the stand.

EVALUATION OF DATA AND PROJECTED RESULTS

As outlined in the Forest Futures Visioning Process and associated DCR Management Guidelines, published in March 2012, the Beaman Pond Lot has a Parkland designation. This property is located in an area with high recreational value including an established campground, day use picnic areas, hiking trails, and waterfront swimming opportunities. While commercial production of wood for wood products is not an intended goal for Parkland designated properties, silvicultural treatments are permitted for the following purposes (Commonwealth of Massachusetts, 2012):

1.) Vegetation management necessary to protect public health and safety, public interests, public assets and/or restore or maintain recreation sites following significant natural disturbances or destructive insects or disease.

2.) Removal of plantations to restore more natural and diverse vegetative communities – if public health and safety are at risk, or

to restore ecologically significant communities such as pitch pine barrens.

The project at the Beaman Pond Lot is being proposed at this time because:

1.) The plantations are rapidly declining in health and vigor and offer little vegetative diversity.
2.) Public safety and assets are being jeopardized by the current forest condition.

Project Objectives

There are several overall objectives of this project:

1.) Demonstrate harvesting techniques in an even aged red pine plantation that build on past management and natural disturbances to facilitate regeneration and conversion to native species.
2.) Demonstrate harvesting techniques to prepare even-aged plantations of white pine and Scots pine for the regeneration of a mixture of native tree species.
3.) Mitigate public safety risk by implementing silvicultural treatments that work to proactively harvest trees which are rapidly failing in condition.
4.) Increase the vegetative diversity and structural complexity within the project area to include an assortment of native plant species including native shrubs and herbaceous plants.
5.) Demonstrate harvesting techniques and best management practices (BMPs) that protect forest productivity, soil, and water resources.
6.) Educate the public on forest management practices by creating interpretive messaging along the Wilder-Mackenzie interpretive hiking trail and in other locations as appropriate.

Silvicultural Prescription and Desired Results

Stand 1

Stand 1 will undergo a partial overstory removal throughout the plantation. This treatment is the final harvest of the even aged shelterwood regeneration system. The shelterwood regeneration system applies a series of harvests to an area intended to be regenerated which alters the amount of light available to the understory over time to create the optimal growing conditions to regenerate the site with desirable species. The purpose of this treatment is to harvest the majority of the overstory to allow an increase in resource availability to the advanced regeneration that grew as a result of previous shelterwood cuttings. In areas containing sparse amounts of advanced regeneration, the soil will be scarified down to bare mineral soil which will better enable white pine and other native seedlings to become established. Scarification will occur in areas with dense grass and bracken fern cover. In addition to being past grazing lands, much of those areas were harvested with a cut to length logging system in the winter months when soil scarification couldn't easily be accomplished. Advanced regeneration will be protected where present. The future desired condition is a young, rapidly growing forest that is dominated by drought tolerant species which are well suited to the site. Much of this area has previously undergone the first two stages of the shelterwood regeneration system, the preparatory (1980's & 1990's) and regeneration harvests (2000 & 2017-2018). In many cases, the entire overstory is removed as a part of the final overstory removal. At this time, we intend to partially remove the overstory, purposefully retaining portions of the overstory for wildlife habitat purposes. Per the DCR Management Guidelines (Commonwealth of Massachusetts, 2012), 1-3 live, large diameter (>18" dbh) trees per acre and 4 live, 12" to 18" dbh trees per acre will be retained for future snag and den trees for wildlife. Native tree species that meet these requirements will be preferred, while red pine will be the least preferred.

Stand 2 and Stand 3

Stands 2 and 3 will be treated with the group selection method. For this treatment, approximately one third to one half the acreage of each stand will be regenerated with openings up to 1 acre in size. The main objective is to regenerate a portion of stands 2 and 3 (1/4 to 1/2 of each stand) in this entry, followed similarly by 1-2 future entries which will regenerate the remaining acreage of stands 2 and 3 to achieve 3 or more age classes. Group selection is being applied to these stands for two main reasons. The first is that the overstory tree quality is so poor that it is anticipated that it would not respond well enough as to be expected if the shelterwood regeneration method was used instead. Lastly, it is anticipated that by using an uneven aged regeneration system, species diversity can be enhanced from what is currently occupying the site. In this entry, new group openings will be placed in areas between the group openings that were harvested in 2017-2018. In addition, portions of the mature overstory will be reserved in each stand in this entry and in future entries.

By applying group selection, the forester will be able to implement group openings that are variable in size and which will aim to regenerate a broad mixture of species that prefer varying levels of light to grow. The size of the group opening to be cut is generally determined by the species desired to regenerate the site (Lamson & Leak, 2000). For example, small openings (1/10 acre and less) and light thinnings favor shade tolerant tree species such as sugar maple and hemlock. Larger openings and heavier thinnings favor shade intolerant species such as cherry (*Prunus spp.)*, poplar (*Populus spp.),* and birch (*Betula spp.)* tree species. Opening sizes between 1/4 to 2/3 acre will regenerate a mixture of shade tolerant, shade intolerant, and partially shade tolerant species (oak, white pine, red maple) (Lamson & Leak, 2000). Therefore, applying group selection openings of varying sizes will create more of an opportunity to achieve a greater level of species diversity in each stand.

Group selection mimics small scale natural disturbances that occur more frequently in natural forest stands than large scale disturbances such as the Great Hurricane of 1938. Laying the groups out in the field will focus on access and slope as well as potential impacts to water resources, aesthetic buffers, and recreational impacts, among others. As mentioned above, group openings will be implemented in areas that benefit advanced regeneration or expand on previous natural disturbances or past management practices.

Per the DCR Management Guidelines (Commonwealth of Massachusetts, 2012), 1-3 live, large diameter (>18” dbh) trees per acre and 4 live, 12” to 18” dbh trees per acre will be retained for future snag and den trees for wildlife.

Logging System Requirements

This harvest will be completed using a fully mechanized logging system. Stand 1 will be limited to the use of a cut to length logging system. This type of harvesting equipment allows for a level of efficiency that is especially well suited for operating in plantations. A cut to length system will allow for increased levels of slash and woody material to be left on site, effectively replenishing nutrients to the forest soil, providing cover and habitat for wildlife, and mitigating erosion by slowing the overland flow of water. Use of a skidder will be permitted to assist in soil scarification.

The minimum goal for downed woody debris to be left on site is 256 ft^3 per acre as directed by current DCR Management Guidelines (Commonwealth of Massachusetts, 2012), which will be easily achieved by using the above described system. Currently, stands 1-3 surpass the minimal threshold for coarse woody debris retention.

Stands 2 and 3 contain large volumes of low quality pulpwood and a low volume of merchantable sawtimber. While it would be most efficient to sell the entire timber sale area as one unit to a single contractor, stand 1 is declining so rapidly that the intent is to prepare stand 1 for harvest and separate a future harvest for stands 2 and 3 at a later date. Stands 2 and 3 will also be harvested using a fully mechanized logging system. At this time, it cannot be determined whether a cut to length or whole tree logging system will be sought. Ultimately, this will be dependent on the current markets for low quality wood products at the time of bidding and the exact volume of low quality wood that is required to be cut.

Access to the lot for removal of wood products is available from Route 202, Dennison Street (Templeton), and park roads at Otter River State Forest and Lake Dennison Recreational Area.

Marking Guidelines
General

1.) Unless pre-existing, skid roads will be flagged and painted with red paint.
2.) Marked areas will protect pockets of advanced regeneration where appropriate.
3.) Trees targeted for removal will be poor in health and vigor, have obvious defects such as crook, sweep, excessive limbiness, decay, epicormic branching and multiple leaders or are suppressed and/or dying.
4.) Retention trees should exhibit excellent form and vigor and will be retained regardless of species and size class to encourage species diversity.

Stand 1

1.) Yellow leave tree marking paint from 2017-2018 is sparsely visible within the plantation. Therefore, a leave tree marking system using blue paint will be implemented. All residual trees will be marked with a blue horizontal stripe at breast height around the bole of the tree with a butt spray mark. Trees having a single horizontal blue line marked at breast height are to remain uncut. Red pine trees located within the harvest perimeter and that remain unpainted are designated for removal.
2.) The perimeter of the harvest area in stand 1 will be marked on trees with three horizontal lines and will be harvested.
3.) 1-3 live, large diameter (>18” dbh) trees per acre and 4 live, 12” to 18” dbh trees per acre will be retained for future snag and den trees for wildlife.
4.) Retention trees should be native species where present, followed by the healthiest, best formed, most wind firm red pine present.

Stand 2 & 3

1.) Group selection, with group openings varying in size up to 1 acre, will be implemented. Group opening shape will be irregular and will benefit the establishment of advanced regeneration. The perimeter of the openings will be marked using a visible paint color on trees with two horizontal lines and will be numbered sporadically along the perimeter. A cut tree marking system will be used within the group openings with a color of the foresters choosing.

EXPECTED RESULTS

Stand 1

This harvest will create a very drastic change to the aesthetics of the area. There will be very few overstory trees in the forest and the advanced regeneration will be flooded with sunlight. At this point, the regeneration will be competing for sunlight, nutrients, water, and growing space. Trees will be rapidly allocating their resources for increased height growth while slowly beginning to grow larger in diameter. White pine is likely to outcompete most other native species on this site, particularly native hardwoods. Some areas that are void of white pine regeneration will grow a mixture of hardwoods and hemlock if present. The residual overstory trees are unlikely to benefit from the increased growing space and it is assumed any red pine overstory trees will be dead by the end of the 2022 growing season. Future entries may focus on improving the growing stock present into the future and could include pruning of white pine and pre-commercial or commercial thinnings. However, this will be several decades into the future. Monitoring of regeneration growth and the presence of invasive species will be necessary to ensure that the management goals are being achieved.

Stand 2 & Stand 3

After the harvest, there will be many new group openings scattered throughout stands 2 and 3 in areas adjacent to the groups established in 2017-2018. They will begin to regenerate a mixture of native tree and shrub species depending on group opening size and aspect relative to increased light exposure. Smaller group openings will provide the light requirements for the growth of more shade tolerant species such as hemlock and sugar maple. Larger openings, closer to one acre in size will favor the growth of shade intolerant species such as cherry, poplar and birch. Medium sized group openings will provide the light requirements for a mixture of shade intolerant, shade tolerant, and partially shade tolerant species (white pine, oak, red maple). Advanced regeneration will have been either fully released if within an opening, or partially released on the perimeter of openings with increased diffuse light. In areas with little to no advanced regeneration, the openings will provide increased sunlight for species to become established.

This treatment will seek to regenerate another ¼ to ½ of the acreage of stands 2 and 3. It is anticipated that another treatment would be scheduled in 15-20 years. The goal will be to finish regenerating stands 2 and 3 by using group selection. This treatment would mimic the treatment planned at this time in with another set of group openings being harvested in stands 2 and 3. The group openings in 15-20 years will work to expand upon the group openings previously cut. By this time, the previous group openings should have adequate established advanced regeneration. Saplings and poletimber will likely make up the majority of the advanced regeneration present in the openings. Species diversity and vertical complexity will have been enhanced from the original, pre-harvest condition of stands 2 and 3. Similarly, in 15-20 years, group openings will be irregular and will vary in size to enhance species diversity.

APPENDIX

CURRENT CONDITIONS

Table 1. Stand 1 - Red Pine Overstory Data Tables - (Stems ≥ 5" dbh)

Species	Sawlog BF/ac	Sawlog BF standard error (% of mean)	Pulp cords/ac	Pulp cords/acre standard error (% of mean)	Total BF (stand)	Sawtimber mean height (16ft logs)	Total cords (stand)	Topwood cords (stand)
Norway spruce (*Picea abies*)	34	112%	0.1	141%	2,639	2	9.5	1.1
Red pine (*Pinus resinosa)*	6,181	8%	0.9	100%	485,418	2.7	73.7	87.5
Eastern white pine (*Pinus strobus)*	228	34%	2.8	32%	17,924	1.3	221.9	17.5
Eastern hemlock (*Tsuga canadensis*)	-	0%	2.0	51%	-	2.2	160.9	0.0
Red maple (*Acer rubrum)*	9	122%	0.1	122%	741	0.5	9.3	1.4
Black birch *(Betula lenta)*	5	141%	0.1	141%	371	0.5	4.6	0.7
American beech (*Fagus grandifolia)*	-	0%	0.0	0%	-	0.5	0.0	0.0
Black cherry (*Prunus serotina)*	19	117%	0.2	117%	1,483	0.5	18.5	2.9
Northern red oak (*Quercus rubra)*	5	141%	0.1	141%	371	0.5	4.6	0.7
ALL	6,480	11%	6.4	19%	508,947	2.2	503.1	111.9

Species	Total trees/ac	Total trees/ac standard error (% of mean)	Total basal area (ft^2/ac)	Total basal area standard error (% of mean)	% basal area by species	QMD	% AGS
Norway spruce (*Picea abies*)	0.6	0%	0.5	100%	1%	12.8	0%
Red pine (*Pinus resinosa*)	62.1	8%	58.4	7%	83%	13.1	98%
Eastern white pine (*Pinus strobus*)	15.3	31%	7.7	28%	11%	9.6	75%
Eastern hemlock (*Tsuga canadensis*)	0.6	0%	1.9	51%	3%	25.1	0%
Red maple (*Acer rubrum*)	0.6	0%	0.5	70%	1%	12.8	0%
Black birch (*Betula lenta*)	0.3	0%	0.3	100%	0%	12.8	0%
American beech (*Fagus grandifolia)*	0.0	0%	0.0	0%	0%	0.0	0%
Black cherry (*Prunus serotina*)	1.2	0%	1.1	61%	2%	12.8	0%
Northern red oak (*Quercus rubra*)	0.1	0%	0.3	100%	0%	21.9	0%
ALL	80.8	9%	70.7	7%		12.7	92%

Table 2. Stand 1 – Red Pine Understory Data Table

Species	3.0 IN. ≤ HT < 1.0 FT.	1.0 FT. < HT < 4.5 FT.	4.5 FT. HT - < 1.0 IN. DBH	1.0 IN. ≤ DBH < 5.0 IN.	TOTAL
Norway spruce (*Picea abies*)	0.0	0.0	0.0	0.0	0.0
Red pine (*Pinus resinosa*)	375.0	0.0	0.0	0.0	375.0
Eastern white pine (*Pinus strobus*)	125.0	156.3	31.3	31.3	343.8
Eastern hemlock (*Tsuga canadensis*)	0.0	0.0	0.0	0.0	0.0
Red maple (*Acer rubrum*)	31.3	125.0	0.0	0.0	156.3
Black birch (*Betula lenta*)	0.0	62.5	0.0	0.0	62.5
American beech (*Fagus grandifolia)*	0.0	31.3	0.0	0.0	31.3
Black cherry (*Prunus serotina*)	0.0	0.0	0.0	0.0	0.0
Northern red oak (*Quercus rubra*)	31.3	0.0	0.0	0.0	31.3
ALL	562.5	375.0	31.3	31.3	1000.0

Table 3. Stand 2 - White Pine Overstory Data Table - (Stems ≥ 5" dbh)

Volume

Spp	Spp Code	Sawlog Bf/Acre	Sawlog Bf/Acre Conf.	Pulp Cords/Acre	Pulp Cords/Acre Conf.	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (Stand)
EWP	1	5,317	61.6	7.88	37.54	1.5	459,351	680.4	350
HEM	3	177					15,312		
NRO	16	0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
Total		5,494	58.7	7.88	69.6		474,663	680.4	350

Fox DS Cruiser Release 2013

A PRODUCT OF THE
FOX RESEARCH FOREST
Hillsborough, NH
Developed by K. Desmarais & M. Robblee

	0
Stand	WP
Acres	86.4
# of BA Pts.=	12
23-Sep-21	

Last Modified	July 6, 2009
Type	White Pine
Size Class	Saw/Pulp
Cruise Date	9/21/2021
Deg. Of Conf.	95 %
Student's "t"	2.201

Stocking Diagnostics

Spp	Spp Code	Total Trees/Acre	Total Trees/Acre Conf.	Total BA/Acre	Total BA/Acre Conf.	% BA/ac by Spp	QMD	Rel Density	% AGS
EWP	1	137.4	48.5	80.0	33.5	96%	10.3	33.2	69%
HEM	3	2.9		1.7	130.0	2%	10.3	0.0	100%
NRO	16	2.9		1.7	130.0	2%	10.3	0.0	100%
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
Total		143.1	63.3	83.3	52.8	100%	10.3	33	70%
					Median Stand Diameter ->>		13.1	35	*<<- Estimated Relative Density*

Table 4. Stand 2 – White Pine Understory Data Table – Stems/Acre

SPECIES	3.0 IN. ≤ HT < 1.0 FT.	1.0 FT. < HT < 4.5 FT.	4.5 FT. HT - < 1.0 IN. DBH	1.0 IN. ≤ DBH < 5.0 IN.	TOTAL
Red maple (Acer rubrum)	1315.4	300.0	92.3	23.1	1730.8
Northern red oak (Quercus rubra)	530.8	300.0	92.3	69.2	992.3
Eastern white pine (Pinus strobus)	230.8	300.0	115.4	184.6	830.8
Red pine (Pinus resinosa)	46.2	0.0	0.0	0.0	46.2
Black birch (Betula lenta)	0.0	23.1	0.0	0.0	23.1
Paper birch (Betula papyrifera)	0.0	23.1	0.0	0.0	23.1
American beech (Fagus grandifolia)	0.0	69.2	0.0	0.0	69.2
Poplar (Populus spp.)	23.1	0.0	0.0	0.0	23.1
White oak (Quercus alba)	69.2	69.2	0.0	0.0	138.5
Black cherry (Prunus serotina)	46.2	0.0	0.0	0.0	46.2
TOTAL	2261.5	1084.6	300.0	276.9	3923.1

Table 5. Stand 2 – White Pine Understory and Ground Species Data Table

SPECIES	Average Percent Cover	# Plots Observed	% Plots Observed
Dewberry (*Rubus spp* .)	4.8	4.0	30.8
Sheep laurel (*Kalmia angustifolia*)	4.6	2.0	15.4
Low bush blueberry (*Vaccinium angustifolium*)	18.8	8.0	61.5
Canada mayflower (*Mianthemum canadense*)	1.8	5.0	38.5
Starflower (*Triantalis borealis*)	0.4	2.0	15.4
Wintergreen (*Gualtheria procumbens*)	15.2	8.0	61.5
Pink lady slipper (*Cypripedium acaule*)	0.1	1.0	7.7
Blackberry (*Rubus allegheniensis*)	1.2	2.0	15.4
Brackenfern (*Pteridium aquilinum*)	19.5	9.0	69.2
assorted grass spp.	23.1	8.0	61.5
Hay-scented fern (*Denstaedtia punctilobula*)	13.8	4.0	30.8
Tree clubmoss (*Lycopodium obscurum*)	0.4	1.0	7.7
Northern wild raisin (*Viburnum cassanoides*)	0.2	1.0	7.7
American hazelnut (*Corylus americana*)	1.4	2.0	15.4
Black huckleberry (*Gaylussacia baccata*)	4.6	1.0	7.7
Blackberry (*Rubus allegheniensis*)	0.8	1.0	7.7
High bush berry (*Vaccinium corymbosum*)	0.2	1.0	7.7

Table 6. Stand 2 – White Pine Snag Data Table

Species	<12" dbh	12.1" to 15"	≥ 15.1" dbh	Total
Softwood	30.4			30.4
Hardwood				-
Total	30.4	-	-	30.4

Table 7. Stand 3 - Scots Pine Overstory Data Table - (Stems ≥ 5" dbh)

Volume

Spp	Spp Code	Sawlog Bf/Acre	Sawlog Bf/Acre Conf.	Pulp Cords/Acre	Pulp Cords/Acre Conf.	Sawtimber Mean Ht (logs)	Total Bf (Stand)	Total Cords (Stand)	Topwood Cords (Stand)
EWP	1	411					6,330		
SCOTCHP	30	1,233	215.7			1.0	18,991		27
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
		0					0		
Total		1,644	15.0	#VALUE!	#VALUE!		25,322	0.0	27

Fox DS Cruiser Release 2013

A PRODUCT OF THE
FOX RESEARCH FOREST
Hillsborough, NH
Developed by K. Desmarais & M. Robblee

	0
Stand	SP
Acres	15.4
# of BA Pts.=	3
24-Sep-21	

Last Modified	July 6, 2009

Type	Scots Pine
Size Class	Saw/Pulp
Cruise Date	9/21/2021
Deg. Of Conf.	95 %
Student's "t"	4.303

Stocking Diagnostics

Spp	Spp Code	Total Trees/Acre	Total Trees/Acre Conf.	Total BA/Acre	Total BA/Acre Conf.	% BA/ac by Spp	QMD	Rel Density	% AGS
EWP	1	4.9		6.7	130.0	20%	15.7	0.0	100%
SCOTCHP	30	19.8	175.8	26.7	86.0	80%	15.7	26.8	50%
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
		0.0							
Total		24.7	230.5	33.3	172.1	100%	15.7	27	60%
					Median Stand Diameter ->>		17.0	34	*<<- Estimated Relative Density*

Table 8. Stand 3 – Scots Pine Understory Data Table – Stems/Acre

SPECIES	3.0 IN. ≤ HT < 1.0 FT.	1.0 FT. < HT < 4.5 FT.	4.5 FT. HT - < 1.0 IN. DBH	1.0 IN. ≤ DBH < 5.0 IN.	TOTAL
Red pine (*Pinus resinosa*)	400	1,100	-	-	1,500
Paper birch (*Betula papyrifera*)	-	200	-	-	200
Red maple (*Acer rubrum*)	900	100	-	-	1,000
Eastern white pine (*Pinus strobus*)	-	200	-	-	200
Northern red oak (*Quercus rubra*)	-	100	-	-	100
TOTAL	1,300	1,700	-	-	3,000

Table 9. Stand 3 – Scots Pine Understory and Ground Species Data Table

SPECIES	Average Percent Cover	# Plots Observed	% Plots Observed
Dewberry (*Rubus spp* .)	30.0	1	33.3
Blackberry (*Rubus allegheniensis*)	3.3	1	33.3
assorted grass spp.	23.3	3	100.0
Sweet Fern (*Comptonia peregrina*)	3.3	1	33.3
Low bush blueberry (*Vaccinium angustifolium*)	8.3	2	66.7
Wintergreen (*Gaultheria procumbens*)	6.7	1	33.3
Northern wild raisin (*Viburnum cassinoides*)	1.0	1	33.3
Bunchberry (*Cornus canadensis*)	10.0	1	33.3
Bracken fern (*Pteridium aquilinum*)	1.7	1	33.3
Partridgeberry (*Mitchella repens*)	1.7	1	33.3

F-14

PLAN OF THE

OTTER RIVER STATE FOREST

IN

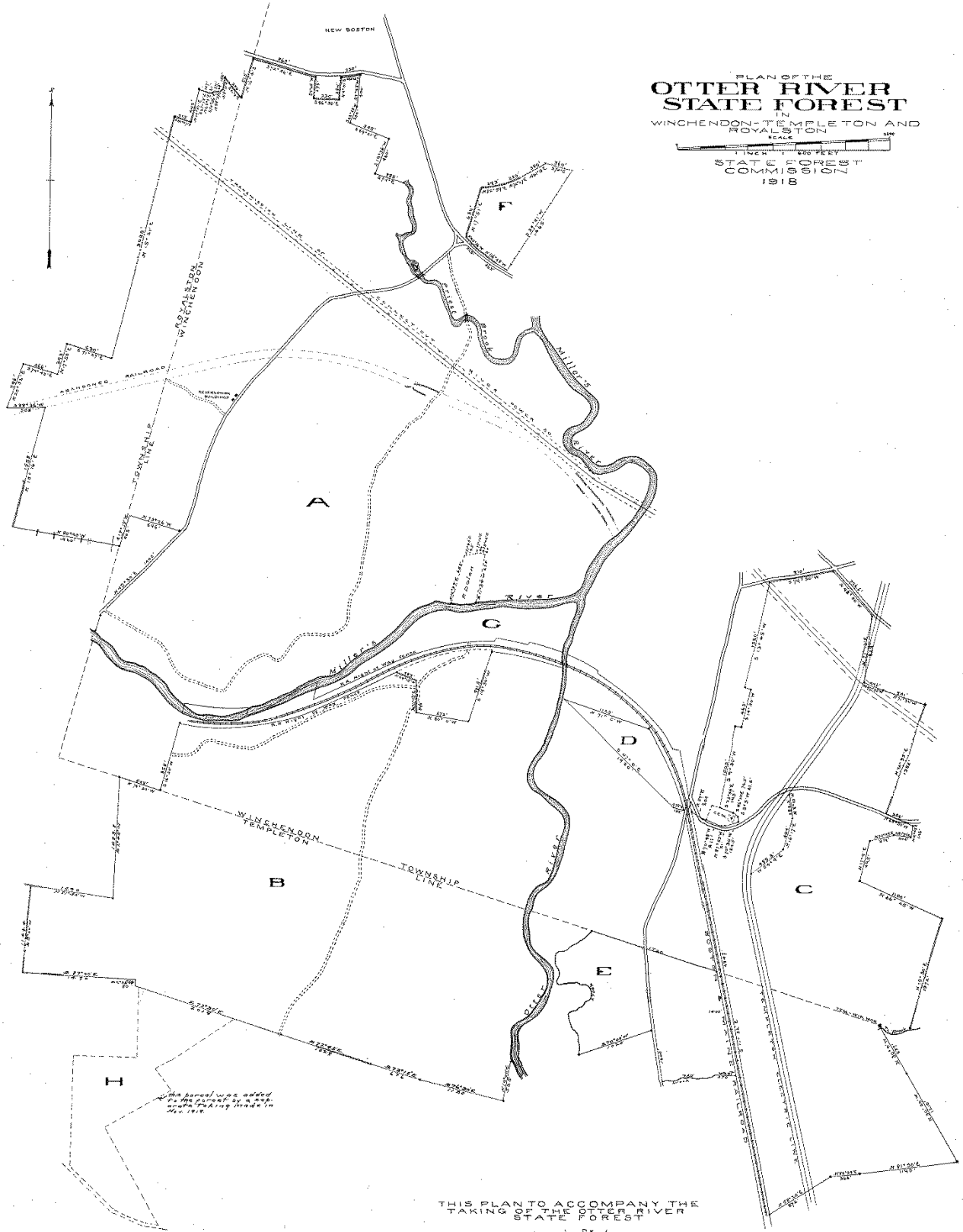
WINCHENDON - TEMPLETON AND ROYALSTON

SCALE

1 INCH = 800 FEET

STATE FOREST COMMISSION

1918

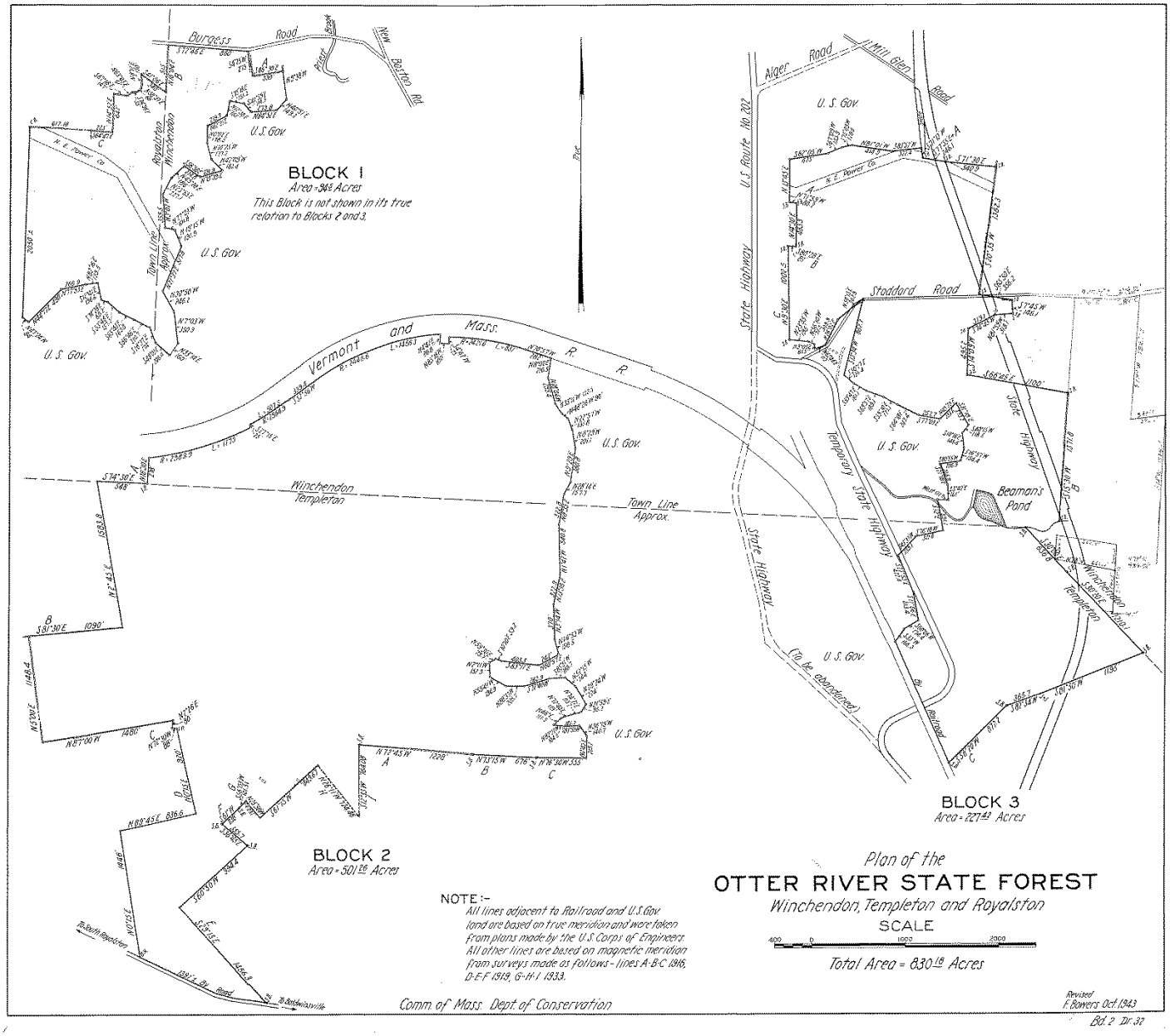


THIS PLAN TO ACCOMPANY THE TAKING OF THE OTTER RIVER STATE FOREST

Approved by { Henry N. Shepard, F. W. Cross, E. M. Wood } Board of State Forest Commission.

The above map is in perspective, inasmuch as this is a tracing of a reduced photograph, ¼ to 1.

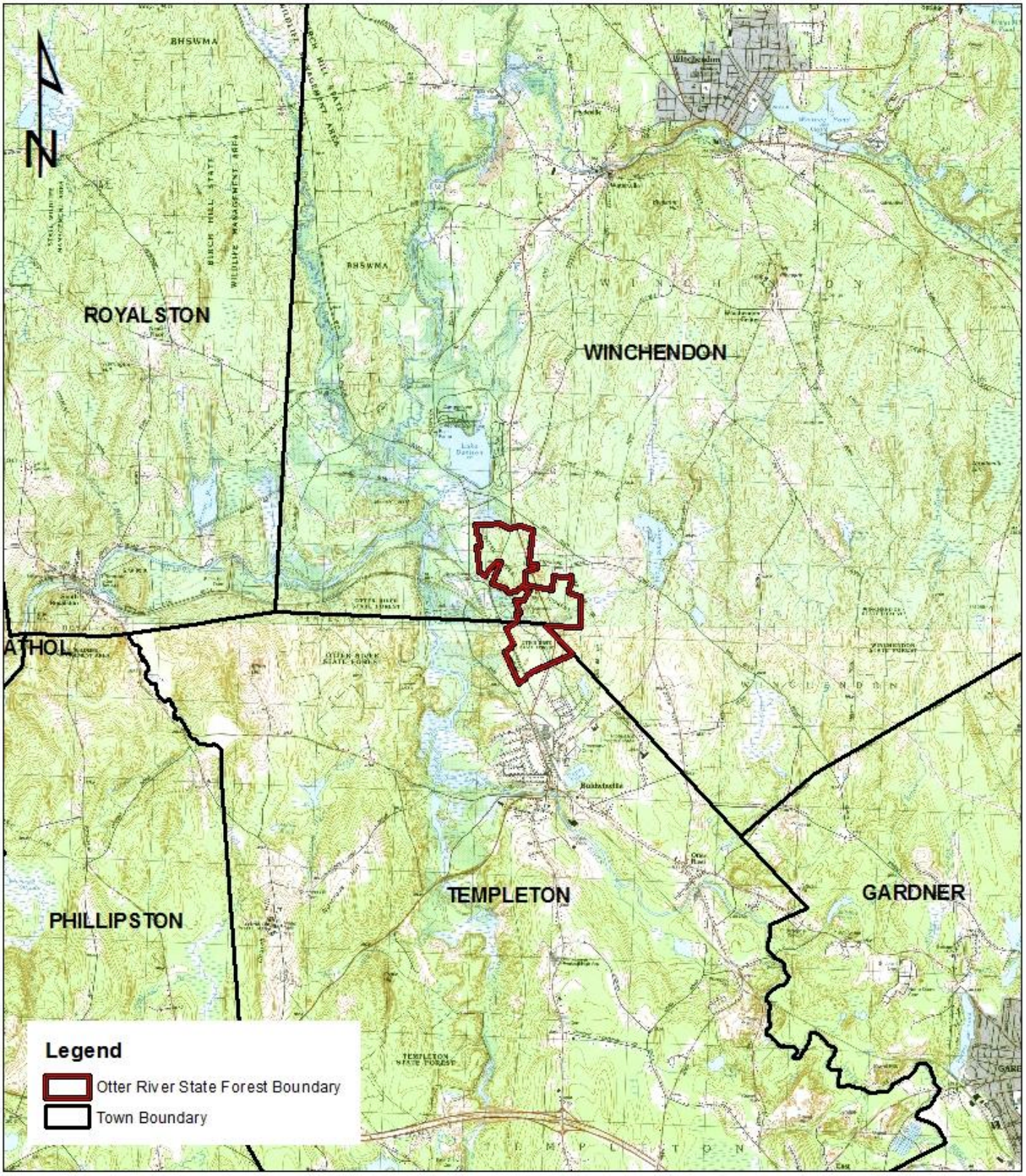
WA22 14


BLOCK 1
Area = 549 Acres
This Block is not shown in its true relation to Blocks 2 and 3.
BLOCK 2
Area = 501.26 Acres
BLOCK 3
Area = 227.42 Acres
Vermont and Mass. R. R.
Winchendon
Templeton
Town Line Approx.
U. S. Gov.
Burgess Road
Royalston
Winchendon
Alger Road
Mill Glen Road
U.S. Route No. 202
State Highway
Stoddard Road
Beaman's Pond
Temporary State Highway
(To be abandoned)
N. E. Power Co.
To North Royalston
To Baldwinville
Plan of the
OTTER RIVER STATE FOREST
Winchendon, Templeton and Royalston
SCALE
400 0 1000 2000
Total Area = 830.18 Acres
NOTE:-
All lines adjacent to Railroad and U.S. Gov. land are based on true meridian and were taken from plans made by the U.S. Corps of Engineers. All other lines are based on magnetic meridian from surveys made as follows - lines A-B-C 1916, D-E-F 1919, G-H-I 1933.
Comm of Mass. Dept of Conservation
Revised
F. Bowers Oct. 1943
Bd. 2 Dr. 32

Locus Map
Beaman Pond Lot
Otter River State Forest

1 inch = 5,000 feet

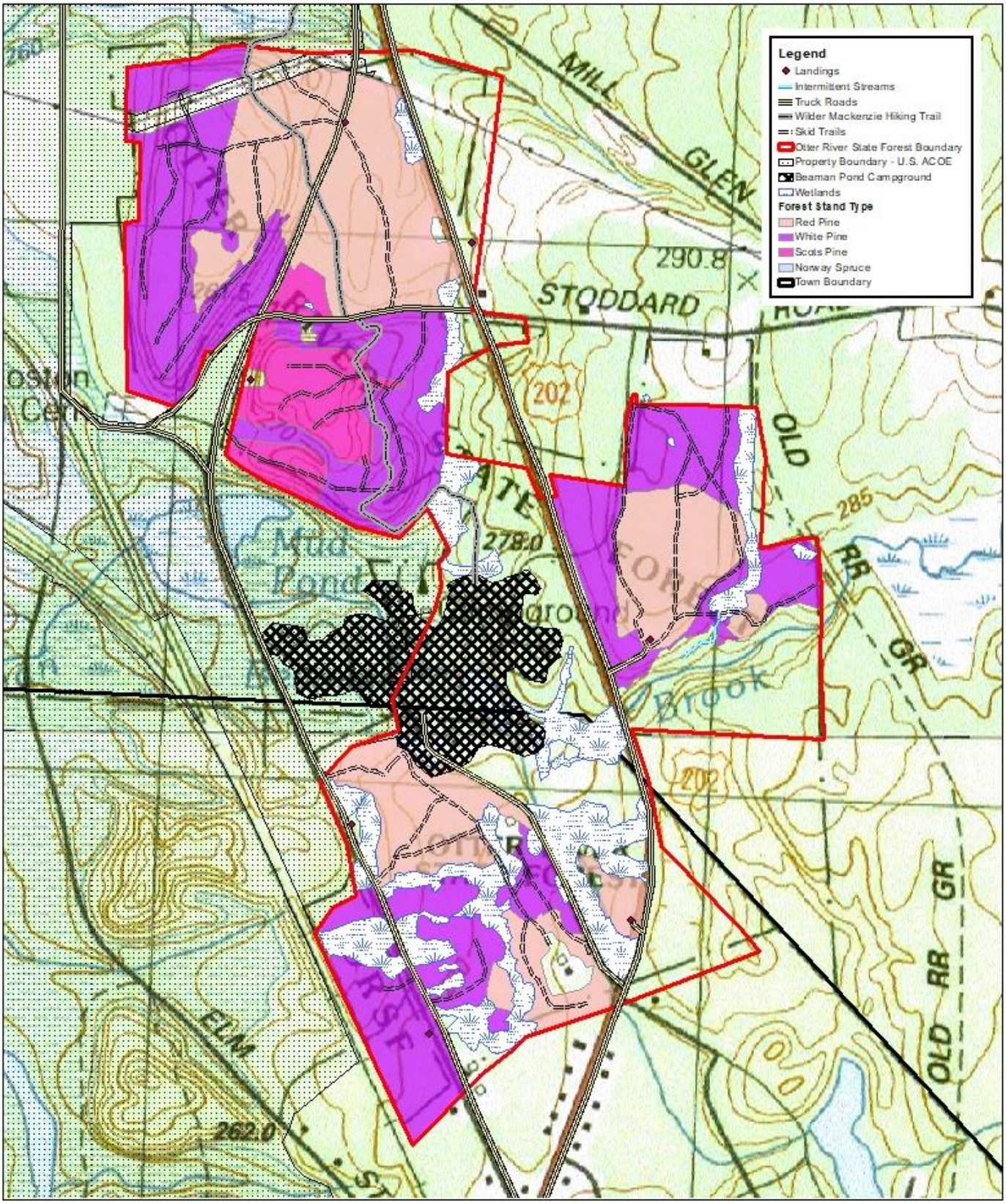
0 2,600 5,200 10,400 Feet



Map Prepared By: Joelle Vautour, DCR Management Forester - April 27, 2016

Project Map - Beaman Pond Lot 2.0
Otter River State Forest
Baldwinville, Royalston & Winchendon, MA

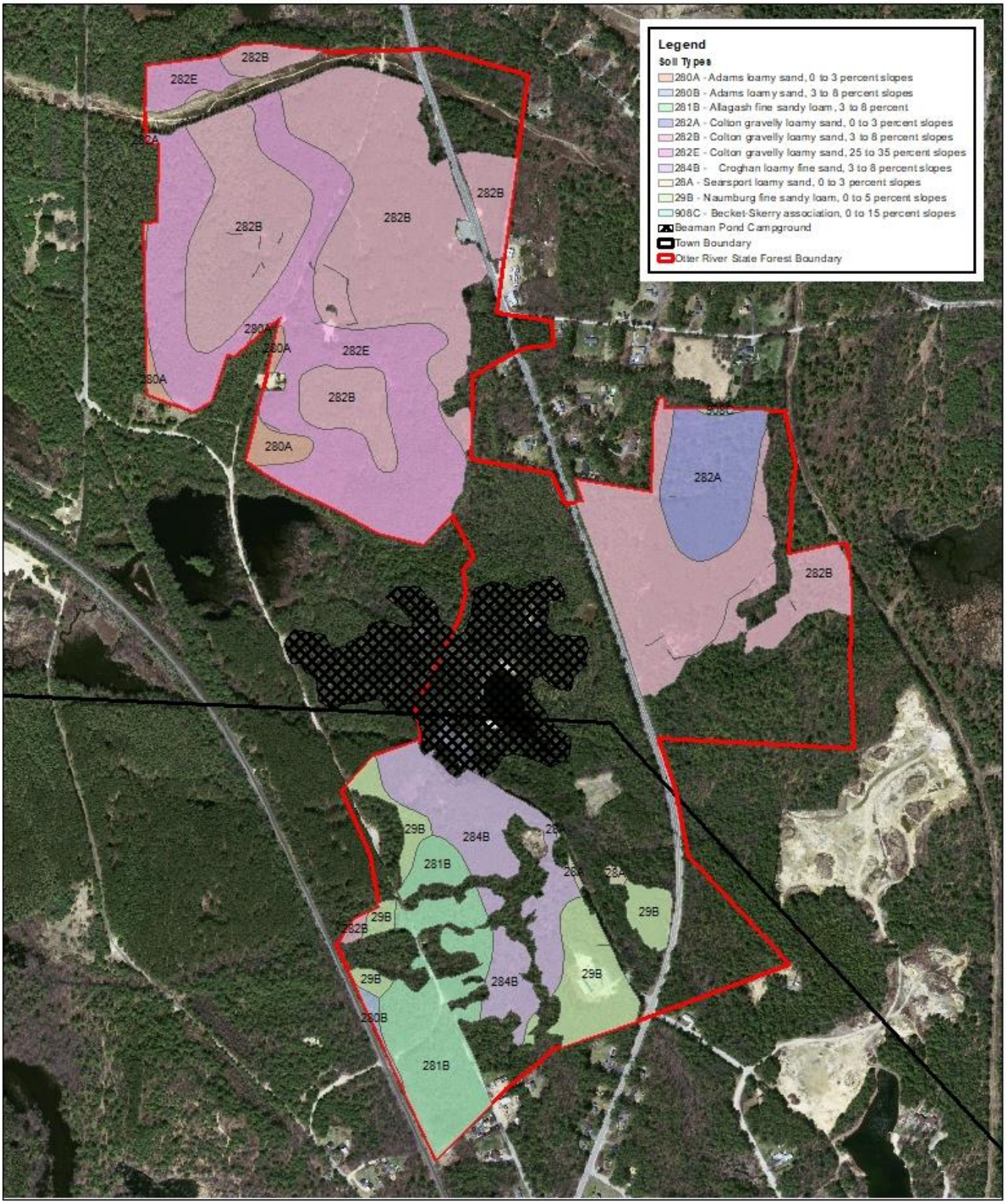
0 370 740 1,480 Feet



Map Prepared By: Joelle Vautour, DCR Management Forester - October 4, 2021

Soils Map
Otter River State Forest - Beaman Pond Lot 2.0
Route 202 - Baldwinville and Winchendon, MA

0 285 570 1,140 Feet



Map Prepared By: Joelle Vautour, DCR Management Forester - September 23, 2021

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