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NORTH UPTON OPEN SPACE LAND STEWARDSHIP PLAN

Prepared by:

Upton Land Stewardship Committee
(A Subcommittee of the Upton Conservation Commission)

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1. INTRODUCTION

The North Upton Open Space (NUOS) property consists of five contiguous parcels located west of North Street and north of Grafton Road that are managed as conservation areas by the Town of Upton. These parcels total 303.3 acres and include the Warren Brook Watershed Conservation Area (202.9 acres), the Howarth Glen Conservation and Recreation Areas (36.6 acres), the western parcel of the Whitney Conservation Area (34.4 acres) and two, unnamed town owned parcels that are 22 acres and 7.4 acres in size, respectively (Figure 1-1). The NUOS consists primarily of forests although a 3.3 acre field is also present within the Howarth Glen Conservation Area. Subsequent to the purchase or donation of the above properties by/to the Town of Upton, a stewardship plan that guides future management can now be developed that extends throughout the NUOS and showcases the characteristics which make this area an important open space resource to the town.

The Land Stewardship Committee (LSC) is a subcommittee of the Upton Conservation Commission. The committee was established in 2006 to manage Upton conservation land such as the NUOS as well as other town-owned land as designated by the Upton Board of Selectmen. Committee members are recommended by the Conservation Commission and appointed by the Upton Board of Selectmen. This stewardship plan is intended to guide stewardship of the NUOS property for the next ten years.

1.1 Objective of the Stewardship Plan

The objective of the land stewardship plan is to identify the NUOS resources and develop approaches that protect and/or restore these natural, pre-contact, and historic resources while providing passive recreation opportunities and promoting good forest stewardship as detailed in the Upton Forest Management Policy and Guidelines (Appendix A). Technical information was received from state and private conservation entities as well as from a consulting forester and a tribal historic officer in order to support the management plans and priorities. The plan shall also consider input from other town boards, including the Historical Commission, Recreation Commission, Board of Selectmen, as well as members of the public. It should be viewed as a living document that will require periodic updates. Implementation timeframes are estimates and will depend largely upon volunteer boards with limited financial support.

1.2 Location and General Description

The NUOS is located in northern Upton north of Grafton Road and west of North Street. The NUOS is situated adjacent to additional areas of protected open space to the west (153-acre Pell Farms Conservation Area in the Town of Grafton) and to the east (Sweetwilliam Farm Conservation Restriction, Whitney and Howarth Conservation Areas and the Upton State Forest) (see Figure 1-1). This large contiguous area of protected open space provides one of the most important natural resource and recreational areas in the Town of Upton. The entire NUOS is located within the Miscoe, Warren, Whitehall Watershed Area of Critical Environmental Concern (MWWW ACEC).

The NUOS consists of five parcels as follows:

1. Warren Brook Watershed Conservation Area: 202.9 acres (Map-Parcel 007-27)
2. Howarth Glen Conservation/Recreation Areas: 36.57 acres (Map-Parcel 005-020.65)
3. Whitney Conservation Area (West): 34.45 acres (Map-Parcel 005-004.01)
4. Unnamed Parcel A: 22.0 acres (Map-Parcel 004-012)

5. Unnamed Parcel B (also known as the Thompson Parcel): 7.44 acres (Map-Parcel 005-005)

Table 1-1 lists the properties that comprise the NUOS as well as information regarding the date and method of acquisition along with their status regarding Article 97 protection.

Table 1-1. NUOS Properties

Property	Acres	Acquisition	Article 97 Protection	Notes
Warren Brook Watershed Conservation Area	202.9	1995	Y	• Self Help Grant • Includes strip of land off George Hill Road in Grafton
Whitney Conservation Area (west parcel)	34.4	2011	Y	• Land Grant, CPA • CR held by Sudbury Valley Trustees (SVT) • Sweetwillian Farm CR held by town and SVT allows access for trail management through SWF pasture • Easement deed held by town on 153A North Street provides parking and trail access
Howarth Glen Conservation Area	27.4	2006	?	• Acquired by town from Glen Echo Open Space Subdivision • Managed by LSC per 2007 ATM vote • Parking at DPW Pump Station
Howarth Glen (Recreation Area)	9.2	2006	?	• Managed by Recreation Commission per 2007 ATM vote • Managed by LSC as directed by Town Manager in 2010 • Includes 3 acre field off North Street and the Schoolhouse 6 foundation
Unnamed Parcel A	22	2002	N	• Tax taking. • Managed by LSC per 2014 BOS vote
Thompson Parcel	7.4	1945	N	• Tax taking. • Managed by LSC per 2014 BOS vote
Oak Knoll (owner unknown)	0.1	In process	n.a	• Provides access to WBWCA from Oak Knoll • Town Tax Collector is pursuing acquisition

The NUOS is accessible primarily via a 300-foot frontage with Grafton Road in the very southwestern portion of the NUOS where a small parking area is provided. However, other access points are also available including a 50-foot wide link to the Oak Knoll Lane cul-de-sac, a fee owned strip of land and easement located adjacent to Sweetwilliam Farm that provides access from the east, and a trail on the Howarth Glen Recreation Area off North Street. Parking is available at each of these access locations. The Warren Brook Conservation Area includes a fee owned 60 foot wide strip of land and a 15 foot wide easement which provides access from George Hill Road in Grafton.

The northern portion of the NUOS is at an elevation of approximately 630 above sea level and slopes gradually to the south (elevation of 570 feet at Grafton Road) and steeply to the east where elevations of 390 to 440 feet are present along Warren Brook. Warren Brook is present within the eastern portion of the NUOS but only contains intermittent surface water flows within the reach present on the NUOS. The NUOS consists primarily of upland forest dominated by northern red oak and eastern white pine. One field, with a total acreage of about 3.3 acres is present within the southeastern portion of the NUOS. The field was last mowed in the fall of 2016 to maintain the

herbaceous vegetation and clear encroaching shrubs. Approximately 10 acres of the NUOS are wetland according to Massachusetts Department of Environmental Protection (MADEP) wetland maps. There are several potential vernal pools located within the NUOS and several intermittent streams that ultimately flow into Warren Brook.

1.3 History of the NUOS Area

The Nipmuc Indians lived in the general area of the NUOS Area at the time of English contact. The Nipmucs were fresh water fishermen and are still here today. There is a 3-acre Hassenamessit Nipmuc Indian reservation in the town of Grafton to the west of Upton. A cultural history of the general NUOS area is provided in Appendix G.

Most of the NUOS land was part of two farms - the Stow[e] family of Grafton and the Whitney family of Upton. The Warren Brook Watershed Conservation Area and one of the town-owned parcels was part of the Stow farm (sometimes spelled Stowe). The Whitney Conservation Area West was part of the Ephraim Whitney farm. The Eleanor T. Howarth Glen Conservation Area was part of another Whitney family farm. All the farms date from the mid-1700s (though the Stow land within NUOS was added to the farm in the 1800s) and were farmed by the respective families to the end of the 19th century. A brief history of the Whitney farm (later to become Sweetwilliam Farm and now Five Forks Farm) is provided in Appendix G.

The historical resources within the NUOS lands consist of the cellar hole for Upton's District No. 6 schoolhouse, retaining walls around the school house site, a nearby dry-laid stone well that may have provided water to the schoolhouse, and stonewalls. The original lease for the land for the schoolhouse site from Jacob Whitney to the "inhabitants of the north west school district" is dated 1823, though the lease refers to the land as the "same on which the old school house now stands near the said Whitney's dwelling house," so the school may predate the lease. It was a lease for eleven square rods – five and a half rods long and two rods wide (90.75 feet by 33 feet.) A picture held by the Upton Historical Society shows a brick building on the site. It was the only brick school in Upton at the time. It was approximately 20 feet by 20 feet and consisted of only one floor. There was one door at the front of the building with one window on either side of the door. There were three windows on each side of the building which was important to let in natural sunlight since there was no electricity. The schoolhouse was heated with a wood stove and there was an outhouse located to the left of the front door. District No. 6 (one of nine town school districts present in the mid-1800s) included the area north the Westborough town line, west to the Grafton town line, east to almost Ridge Road and south to Orchard Street. Some of the children that attended school here were probably from the families that lived in the area including Whitney, Forbush, Warren, King and Wood. Town records show that the school was closed from time-to-time for lack of "scholars." In those instances the students would attend the north east school formerly located near the intersection of Westborough Road and Southborough Road. The schoolhouse closed in the late 1800s and the building was sold to Harris J. Potter for $10.00 in 1900. It was later sold to David J. Moroney and his sons dismantled it and used the bricks to build a chimney at a farmhouse they build on Gore Road.

Based on a historic Harvard University map, a significant portion of the NUOS was forested in 1830 (see Figure 1-3). In addition, the scarcity of stonewalls throughout a substantial portion of the NUOS may indicate that a large portion of the NUOS has always been woodland representing primary forest. Primary forest is uncommon within Upton due to past agricultural uses which resulted in many previously forested areas being used as pasture for livestock such as sheep. There

are two areas of white pine forest (just to the west of Warren Brook and on the western edge of WBWCA) that suggest abandoned fields. The Whitney white pine forest is surrounded by stonewalls.

A personal history written by Silas E Stowe, son of Harris G Stowe, the last Stowe to operate the farm, describes how Harris used the Stowe farm forest in the early 20th century:

> *"It produced all the necessary products that a family needed to survive, plus a bonus, of a large acreage, almost 150 acres, of chestnut trees. Chestnut wood was at that time of the hardest and most beautiful woods when processed. My father had six to eight men in the woods, summer and winter, cutting wood and living in various cabins in the woods. The Boston & Albany R.R. was supplied with R.R. ties from Worcester to Framingham from Stowe Farm. A large amount of wood was also cut for firewood for the city of Worcester."*

The cabins were likely lost in a forest fire as described in this May, 1935 article from the Boston Globe. A portion of the same area described in the article suffered a forest fire in 1914.

Friday, May 3, 1935
Forest Fire Losses Set at About $20,000
Approximately 1,000 acres of 40-year Old Timber Destroyed by Flames

> *A forest fire that taxed the energy of more than 200 men for nearly two days broke out on Merriam Hill at the Grafton and Upton line last Saturday forenoon and caused damages estimated at between $15,000 and $20,000. Nearly 1400 acres of 40-year old timber and sprout land was burned over. The fire line extended about 5 ½ miles and the path of the flames reached nearly a mile in width at its broadest dimension.*
>
> *The fire was first seen about 11 0'clock Saturday morning and within an hour the fire fighting forces of Grafton, Upton, Westboro and Hopkinton, as well as a state contingent of trained firefighters under the direction of State Deputy Fire Warden John P. Crowe of Westboro, Chief William C. Blois, Fire Warden H. Daniel Fay of Upton; Deputy Chief Albert Smalley of Hopkinton and Chief Horace Warren, of Grafton.*
>
> *Fire Warden Crowe state that in his 40 years of experience in fore fire fighting Saturday's conflagration provided some thrills that were record breakers. Fanned by a 30-mile wind the flames fairly leaped through the sunbaked timber, jumping 75 to 100 feet at a time. Because of the peatlike soil it made fighting the fire extremely difficult and in one place water was pumped onto an acre of land for four hours before it was extinguished. Much of the territory that was burned over recently was acquired by the state. Other land was owned by Howard Gilmore, of Westboro; Knowlton Farms, Joseph Poirier and B.C. Wood of Upton, and Harris Stowe, of Grafton.*
>
> *Many game birds and animals were seen in a general exodus from the area, also several deer and fox were sighted. Several woodcutters' cabins were destroyed, many cords of wood and a large number of chestnut posts. Several groups of farm buildings were threatened and only through the combined efforts of the several departments at the scene was their destruction prevented.*
>
> *The Westboro department under Chief William C. Blois was among the first on the scene and were among the last to leave. State Fire Warden Crowe was loud in his praise of the*

way the local men acquitted themselves, working efficiently and tirelessly to stamp out the destructive flames.

During the night Mrs. H. Daniel Fay, wife of Fire Warden Fay, of Upton, made and carried more than 200 sandwiches to the firemen. It was open house to all at the Commonwealth Rescue League farm and Mrs. Woods served meals to more than 70 men during the day and late into the night. Walter E. Stearns, commissioner of the league carried sandwiches, coffee and home made donuts to the men who were unable to come out of the woods and also took an active part in fighting the fire.

Reaching the fireline was extremely difficult in several places and a lack of water forced the men to employ old fashioned methods such as brooms, shovels and hand extinguishers. The fire was finally extinguished late Sunday night, after a two days battle just as many of the volunteer firefighters had reached a state bordering on exhaustion.
The blackened charred timbers stand today mute symbols of the loss to nature, damage and loss to property owners that can result from the careless discarding of matches, pipe ashes or cigarettes by unthinking persons who travel over wooded areas.

The border of the two days' fire was from the Anderson farm in the Merriam district, Grafton, near the Upton town line, to the meadow land of Joseph Poirier, North street, North Upton, thence northerly to point south of Adams street in Westboro, thence back west into Grafton again.

Figure 1-4 depicts the NUOS as viewed from a 1938 aerial photograph. Significant portions of the Whitney Conservation Area appeared to have been partially cleared (logging/firewood/hurricane of 1938?) along with areas within the eastern and southern portions of the Warren Brook Watershed Conservation Area. The Howarth Glen Conservation Area also contained additional areas of early successional habitat in the form of fields.

2. ECOLOGICAL SETTING AND EXISTING FEATURES

The NUOS is located within the Northeastern Coastal Zone ecoregion and Southern New England Coastal Plains and Hills sub-ecoregion (Griffith et al., 1994). Based on this classification, the Southern New England Coastal Plains and Hills sub-ecoregion is the largest sub-ecoregion of the 13 sub-ecoregions present in Massachusetts and consists of variable topography influenced by the presence of bedrock. Based on the classification of others (Braun 1950 and Kuchler 1964) the NUOS is within the Central Hardwoods – Hemlock – White Pine forest region which has a similar distribution. The predominant vegetation within forested areas within these sub-ecoregions or forest regions is comprised of central hardwoods (e.g., oaks and hickories) along with some northern hardwoods (yellow and white birch, sugar maple, American beech) and eastern hemlock/eastern white pine as the primary conifers. Red maple is also common and may form nearly pure stands on wetter sites.

2.1 Unfragmented Landscape

Unfragmented forest blocks are large areas of woodland habitat with few roads, residential or commercial/industrial development, or other fragmenting features. Forest interior habitat is very important for species sensitive to forest fragmentation and is becoming increasingly scarce in highly populated areas such as eastern and central Massachusetts. A large unfragmented block of habitat typically has greater capacity to support forest interior species (e.g., ovenbird, scarlet tanager) as well as greater ability to sustain ecological processes that can be sensitive to effects such as noise and light pollution from roads and development, invasive species establishment and alterations to climate variables including wind and temperature.

Development that results in the fragmentation of forested habitat into small, unconnected parcels generally results in forest interior species being more susceptible to predation from predators such as raccoon, skunk and red fox as well as nest parasitism by species such as the brown-headed cowbird. These “generalist” predators adapt better than other species to a fragmented landscape. In addition, small blocks of habitat located adjacent to roadways or residential housing expose wildlife to higher rates of road mortality, increase conflicts with humans and pets and offer more opportunity for invasive plant species to spread to natural areas.

The Massachusetts Natural Heritage & Endangered Species Program (MANHESP) and The Nature Conservancy developed BioMap2 as a conservation plan to protect the biodiversity within Massachusetts (MDFW, 2012). Forest Core habitat includes the best examples of large, intact forests that are least impacted by roads and development. Generally, the minimum Forest Core habitat within eastern Massachusetts is approximately 500 acres. The NUOS consists of approximately 300 acres of forest habitat and lies within a large Forest Core of 822 acres that was identified in BioMap2 (see Figure 2-1). This Forest Core extends to the north and west from the NUOS. In addition, the NUOS is contained within a larger 2,038- acre area that comprises a Critical Natural Landscape (see Figure 2-1). This larger area of Critical Natural Landscape identified by BioMap2 represents an area that is minimally impacted by development and, if protected, will provide habitat for wide-ranging wildlife species, support intact ecological processes, maintain connectivity among habitats, and enhance ecological resilience to natural and anthropogenic disturbances. The protection and stewardship of both forested Core Habitats and Critical Natural Landscapes are needed to accomplish the biodiversity conservation goal identified in BioMap2.

2.2 Geology and Soils

The NUOS is primarily composed of granite, schist and gneiss bedrock types overlain with glacial till. A USGS surficial geology map indicates the entire NUOS is underlain by thin deposits of glacial till that are generally less than 10 to 15 feet (see Figure 2-2). Bedrock outcrops occur on the northeastern portion of the NUOS, especially within the Whitney Conservation Area. The Whitney property contains a large quartz outcrop. Coarse glacial deposits (sands and gravels) underlay the eastern portion of the NUOS adjacent to Warren Brook.

Bedrock outcrop in central portion of NUOS.

The northern portion of the NUOS is at an elevation of approximately 630 above sea level and slopes gradually to the south (elevation of 570 feet at Grafton Road) and steeply to the east where elevations of 390 to 440 feet are present along Warren Brook. The 22 acre parcel contains a well-defined unnamed hill which is higher than any of the named hills in Upton.

The predominant factors that determine the soil types are parent material and topography. The NUOS supports primarily soil types that were formed from glacial till parent material although glacial outwash soil types are present along Warren Brook. The soil types present within the NUOS are depicted on Figure 2-3 and identified in Table 2-1.

Table 2-1. Soil Types on the NUOS.

Soil #	Soil Name	Acres	Drainage Class	Slope	Parent Material
Wetland Soils					
3A	Scarboro and Walpole	1.8	very poorly drained	0 to 3%	glacial outwash
Upland Soils					
102C	Chatfield-Hollis-Rock outcrop	10.3	well-drained	0 to 15%	glacial till
102E	Chatfield-Hollis-Rock outcrop	23.7	well-drained	15 to 35%	glacial till
254B	Merrimac fine sandy loam	16.7	excessively drained	3 to 8%	glacial outwash
307B	Paxton fine sandy loam	54.6	well-drained	0 to 8%	glacial till
307C	Paxton fine sandy loam	37.9	well-drained	8 to 15%	glacial till
307E	Paxton fine sandy loam	16.7	well-drained	15 to 35%	glacial till
312B	Woodbridge fine sandy loam	111.7	well-drained	0 to 8%	glacial till
422B	Canton fine sandy loam	29.8	well-drained	0 to 8%	glacial till
Total		303.4			

The well-drained glacial till soils (Chatfield-Hollis-Rock outcrop complex, Paxton, Woodbridge and Canton) are found throughout most of the NUOS as these soils comprise over 90% of the soil type associations present. The Chatfield-Hollis-Rock outcrop soils contain exposed bedrock or very

shallow depths to bedrock while the Paxton, Woodbridge, and Canton soils are classified as extremely stony. Steep slopes (greater than 15%) are present on nearly 15% of the NUOS, primarily in the form of interesting ledges and cliffs along the eastern edge of a continuous north to south ridge present to the west of Warren Brook.

Although there are no prime farmland soils present within the NUOS, the Woodbridge soil type which comprises approximately 35% of the NUOS represents Prime 1 forest land (highest designation) while most of the remainder of the NUOS is designated as Prime 2 forest land. Prime forest land is categorized based on potential average timber productivity (cubic volume of timber per acre and site index based on height of trees at age 50) of eastern white pine and northern red oak.

Mapped wetland soils comprise less than 1% of the total NUOS, however, small unmapped pockets of wetland soils are also present.

2.3 Watersheds, Water Resources, and Wetlands

The entire NUOS lies within the watershed of the Blackstone River. Almost the entire NUOS is located within the drainage area associated with Warren Brook. Portions of the NUOS along the western boundary of the NUOS are located within the watershed of Miscoe Brook. Warren Brook represents a coldwater fishery that supports native brook trout and other coldwater species that require highly oxygenated surface waters to survive. The portion of Warren Brook located within the NUOS is not perennial as this upper portion of the brook typically becomes dry during the summer/early fall.

The health of larger rivers and streams such as Warren Brook is dependent on the health of smaller streams and wetlands farther up in the headwaters of a watershed. These smaller headwater streams may begin as seeps that discharge into small channels which gradually become larger further downgradient before discharging into streams. The quality and integrity of these headwater streams is critical to maintaining downstream habitats such as Warren Brook. Two of these headwater streams are present on the NUOS and are depicted on Figure 2-4.

The upper reaches of a watershed such as present on the NUOS store water (within wetlands), recharge groundwater and reduce the intensity and frequency of flooding. Small streams provide a critical link between land and water. Since these small streams form a link between upstream and downstream portions of the watershed, they carry invertebrates, leaves, and other organic materials that form the basis of the aquatic food chain. In addition, much of the cleansing action and nutrient cycling in streams occurs in saturated sediments, at the interface between stream water and the channel substrate and stream banks.

Forested wetland within NUOS.

Although most of the NUOS consists of forested uplands, several forested and scrub-shrub wetlands are present as depicted on Figure 2-4. Approximately 10 acres of the NUOS are wetland according to the MADEP wetland maps while 26 acres of the NUOS were classified as red maple swamp by a consulting forester (see Section 2.4.1). These wetlands consist primarily of wooded swamps that are dominated by red maple in the tree overstory with some yellow birch or tupelo trees occasionally present. The understory shrub vegetation varies depending on the site but typically contain highbush blueberry, sweet pepperbush and swamp azalea – some of which form dense understories. Forested wetlands generally have a diversity of herbaceous plants along with abundant fallen trees and rotting stumps. Some forested wetlands may also contain large depressions that function as vernal pools.

Vernal pools are ephemeral bodies of water than fill in either the spring or autumn from rainfall, snowmelt or rising groundwater. These pools are typically small in size ranging from less than $1/10^{th}$ acre to more than an acre although size is not always an indicator of the quality or productivity of a vernal pool. Most vernal pools are completely dry by the end of summer and consequentially cannot support fish populations. The lack of fish predators makes these pools attractive and safe for breeding amphibians such as wood frogs, spotted salamanders and spring peepers. The length of time that a vernal pool retains surface water is known as its "hydroperiod". Most species that use vernal pools for breeding require approximately four months to complete their reproductive cycle.

The vegetation surrounding the vernal pool is important for providing shading (lower temperatures and reduce evaporation) as well as nutrient input in the form of fallen leaves. In addition, fallen branches are very important as attachment sites for egg masses of amphibians such as spotted salamanders.

One documented vernal pool that has been certified by MANHESP is present a short distance (less than 300 feet) north of the NUOS while one potential vernal pool is located in the northwestern portion of the NUOS (see Figure 2-5). In addition, several other potential vernal pools are present to the southeast and west of the NUOS (generally within approximately 500 feet) while additional smaller areas of seasonally ponded areas are also present on the NUOS.

2.4 Biological Resources

The NUOS currently consists primarily of upland forest that provides habitat for wildlife that prefer mature wooded areas. A consulting forester (see Appendix B), the Massachusetts Division of Fisheries and Wildlife (see Appendix C) and Mass Audubon (see Appendix D) have all conducted a reconnaissance of the NUOS and provided descriptions of the forest and wildlife habitat currently present within the NUOS.

2.4.1 Forest Vegetation

The woodlands within the NUOS are comprised primarily of even-aged trees that are approximately 100 years old. Even-aged forests are defined as having two or less established age-classes that developed from a previous large-scale disturbance such as clearing for agriculture, fire or hurricane event. These forests are generally young (less than 100 years old). The presence of stonewalls within portions of the NUOS indicates that these areas were formerly pastureland and reverted to an even-aged forest when the pastures were abandoned. However, the scarcity of stonewalls through much of the NUOS may indicate that a large portion of the NUOS has always been woodland representing primary forest. Today, the forests present in the NUOS contain healthy, although

somewhat homogenous, maturing woodlands comprised of red oaks (northern red, black and scarlet oaks) within the uplands and red maple in the wetlands.

Forest Stands

A total of 18 forested stands (Table 2-2) have been identified within the NUOS by a consulting forester (see also Figure 2-6 and Appendix B). Portions of the forest that exhibit trees of different ages ("multi-aged forests") are primarily the result of past thinning operations. However, these areas are limited to only a small portion of the NUOS.

Table 2-2. Forest Stands at the NUOS.

Forest Stand	Size (Acres)	Description
1	12.1	Red Oaks – Even-aged
2	3.6	Mixed Oaks/Pine – Multi-aged
3	1.0	Red Maple– Multi-aged
4	3.6	Mixed Oaks/Pine – Multi-aged
5	3.3	Red Maple – Even-aged
6	3.3	Mixed Hemlock/Red Maple/Oaks – Even-aged
7	35.4	Red Oaks/Red Maple – Even-aged
8	75.9	Red Oaks/Red Maple – Even-aged
9	2.2	Mixed Oaks/Pine – Even-aged
10	6.0	Mixed Oaks/Pine – Even-aged
11	75.7	Red Oaks – Even-aged
12	1.8	Red Maple– Even-aged
13	10.2	White Pine – Even-aged
14	0.6	Red Maple– Even-aged
15	5.3	Red Maple– Even-aged
16	14.0	Red Maple– Even-aged
17	7.6	Mixed Oaks/Pine/Maple – Even-aged
18	8.5	Pine/Maple – Two-aged

The upland forests dominated by red oaks (Stands 1, 7, 8, and 11) comprise approximately 200 acres of the NUOS. The even-aged overstory trees consist primarily of northern red oak, black oak, scarlet oak, red maple, and eastern white pine. Other trees also present in these stands include white oak, shagbark and pignut hickories, ash, yellow and black birches, sugar maple, aspen, tupelo, and sassafras although these species are relatively infrequent. Understory vegetation and tree

regeneration is generally sparse to moderate within these stands. Canopy gaps, snags (standing dead trees), and coarse woody debris are generally scarce within these forested oak stands.

Typical oak forest stand within the NUOS. Note sparse understory growth typical of the NUOS.

Upland forests comprised primarily of a mixture of red oaks and eastern white pine (Stands 2, 4, 9, 10, and 17) total 23 acres. Red maple and/or white oak are also important components of the tree overstory for one or more of these stands. Stands 2 and 4 (total 7 acres) consist of a multi-aged tree overstory with moderate to full regeneration although with a moderate shrubby undergrowth. Stands 9 and 10 total 8 acres and represent an even-aged mixed oak-pine forest type. Regeneration of trees is moderate to heavy within these stands although the shrub undergrowth is sparse. The predominant shrub understory vegetation is comprised of witch-hazel, lowbush blueberry, and black huckleberry. Stand 17 is developing into a multi-aged forest due to fairly recent thinning that occurred approximately 20 years ago.

Forest Stand 13 consisting of eastern white pine.

Stands 13 and 18 are upland woodlands that consist primarily of eastern white pine in the tree overstory although red maple is also an important component. These stands total nearly 19 acres. Stand 13 is even-aged forest containing elements of a multi-aged overstory while Stand 18 consists of two predominant age classes due to a previous cutting operation approximately 20 years ago. Understory vegetation is generally sparse within these stands due to the dense canopy closure that is present.

The forested wetlands (Stands 3, 5, 12, 14, 15, and 16) are generally small but total approximately 25 acres in total. These even-aged stands are dominated by red maple in the tree overstory with minor contributions from yellow birch, tupelo, eastern white pine, ash, hickory and oaks. The overall form of the overstory trees ranges from poor to good while regeneration/shrub understory is variable within these stands. Some portions of these wetland woodlands contain a dense understory comprised of highbush blueberry and sweet pepperbush while other areas contain a relatively sparse understory.

The last forest stand (Stand 6) is only 3.3 acres in size but contains characteristics of both uplands and wetlands. The overstory consists of red maple, eastern white pine, oaks and one of only two noted occurrences of eastern hemlocks present within the NUOS (other being in northeastern portion of NUOS between forest stands 11 and 13).

Legacy Trees

A legacy tree is a mature overstory tree that is larger and older than most trees within the local landscape. These trees may provide large hollows or cavities that can be used as nest or den sites for larger birds and mammals.

Legacy trees often have large branches that provide horizontal and vertical structure within the canopy as well as dead branches that can provide foraging habitat. These large trees may provide habitat for uncommon insects, lichens and other biota. After a legacy tree dies, it provides habitat as a large snag and subsequently as a downed log on the forest floor for many years.

The NUOS contains quite a few large legacy trees as depicted on Figure 2-7. These legacy trees include eastern white pine, northern red oak, white oak, shagbark hickory, and yellow birch. Most of the identified legacy trees are associated with forested wetlands or riparian areas of streams that are present on the NUOS. Additional legacy trees are likely also present within the NUOS.

Carbon Storage

Forests sequester significant amounts of carbon by removing carbon dioxide from the atmosphere In the U.S., forests make up 90% of the U.S. carbon sink and sequester approximately 10% of U.S. carbon dioxide emissions (USDA, 2017). There are four places where carbon can be stored: 1) aboveground in plants – particularly trees; 2) long-lived products such as wood furniture; 3) soil including roots, leaf litter, and soil organisms; and 4) inorganic carbon in soil/rock. The oak-hickory forested uplands present within much of the NUOS are very good at storing carbon due to their high carbon to cubic foot of wood ratio. A recent published study from Harvest Forest found that over a 40 year period, a central Massachusetts woodland with forests similar to NUOS sequestered 3.5 metric tons of biomass per hectare per year (Eisen and Plotkin, 2015). A detailed discussion of carbon storage within the NUOS is provided in Appendix B.

2.4.2 Wildlife Habitat Characteristics

In order to survive and reproduce, wildlife habitat needs to provide food, water, cover and space. Each species of wildlife has unique habitat requirements so the presence of a given species in an area depends on the availability of the habitat characteristics that the give species relies on. Wildlife food sources includes plants and their nectar, fruits, seeds, and nuts, insects and other invertebrates, and

vertebrate animals such as small mammals or amphibians. Almost all wildlife require water daily with aquatic or semi-aquatic species clearly more dependent on it than upland species. Cover provides protection from predators and weather as well as sites for nesting, resting, travel and other activities. The juxtaposition of food, water, and cover in a given area determines the wildlife community that may occur within that area.

An area with many different kinds of food/cover/water typically supports a greater diversity of wildlife. This reflects habitat structure and the presence or absence of these features on the NUOS are discussed below.

Horizontal Vegetation Diversity

This feature relates to the horizontal arrangement of different plant communities (type as well as age) present in a given area. An area that contains aquatic habitats and non-forest habitats such as fields are more diverse than an area that is just forested. For example, a 100-acre oak mature oak forest has less horizontal vegetation diversity than if that 100-acre area forest contained a mixture of scrub-shrub wetlands and mixed hardwood-softwood forested areas. Similarly, a 100-acre forest that has a mixture of tree ages that includes herbaceous vegetation openings, early-successional areas that are beginning to revert to forest, and large, old trees is more diverse than a forest with trees approximately all the same size and age.

The NUOS property primarily includes maturing hardwood (i.e., oak) forest with some small areas of maturing mixed oak-pine forest, pine forest and red maple swamp also present. In addition, an existing field is also present in the southeastern corner of the NUOS. Most of the forested habitats consist of even-aged trees that are approximately 100 years old. Habitat management can change and enhance horizontal vegetation diversity through providing varying ages, sizes and composition of the forest habitats. Natural disturbances such as beaver activity and use of fire by Native Americans formerly provided much of the horizontal vegetation diversity historically.

Vertical Vegetation Diversity

Vertical diversity refers to the extent of layering within a forest which includes the presence of ground cover (e.g., ferns, herbaceous plants and low-growing shrubs), mid- and tall shrubs, and various heights of trees beneath the forest canopy. High stem and foliage densities of woody shrubs and trees in the understory provide nest sites, foraging substrates and protective cover for a wide variety of forest birds. The greater the variety of vertical layers, the greater diversity of habitats provided and the greater diversity of wildlife. Forests with little ground cover and vertical vegetation diversity in the understory have fewer wildlife species. Most of the NUOS forest and particularly the oak hardwood forested stands presently have a poorly developed understory.

Food Resources

The availability of different foods is a key habitat component for wildlife and often varies seasonally. Breeding birds generally require abundant insects to feed their nestlings during the spring and early summer. However, later in the summer and fall the fledglings switch to berries and seeds that are often present in different habitats. White-tailed deer rely on herbaceous vegetation during the growing season and woody vegetation during the winter when snow restricts the availability of herbaceous plants. Small mammals such as mice and voles also may shift their diet in response to availability of plants. Predators such as raptors (hawks and owls) depend on sufficient small mammal populations throughout the year while larger mammals such as coyote, red and gray

foxes, and fishers prey on small mammals but may also eat fruits when available. Seeds are favorites for many small mammals as well as a variety of birds.

Fruits, nuts and seeds from woody plants that provide food for wildlife is often collectively referred to as "mast". Hard mast includes nuts and seeds such as acorns, beechnuts, and hickory nuts that are typically high in energy content and available into the winter. Soft mast includes fruits/berries such as from cherries, tupelo, sassafras, dogwoods, blueberries, grapes and the fleshy fruits of other woody plants. Soft mast is generally high in carbohydrates but is only available for a short time during the year. However, when available, soft mast may provide a source of moisture for wildlife during drought years and provide an important energy source for birds that are migrating or preparing to migrate.

A diversity of both hard and soft mast producing trees, shrubs and vines is important to wildlife by providing different foods at different seasons of the year. Some species of plants such as oaks vary widely on the amount of acorns they produce each year dependent on the species and weather conditions. Red oaks take two years to produce acorns while white oaks may produce acorns each year. White oak acorns have less tannin and are generally preferred by wildlife over red oak acorns but, due to their unreliability in acorns every year, a mixture of red and white oak trees is preferred to maximize wildlife benefits.

The NUOS has an abundance of red oaks (includes northern red, black and scarlet oaks) but few other hard mast species such as white oaks and hickories. Soft mast is provided to a limited degree by shrubs such as highbush blueberry in wetlands as well as by the uncommon sassafras within the forested uplands. Overall, the NUOS currently produce little soft mast for wildlife while hard mast is limited primarily to red oak acorns. However, the NUOS does have quite a few eastern white pines which provide a source of seeds for birds as well as mammals.

Cavity/Den Trees

Many species of birds and mammals depend on tree cavities for nesting, roosting or denning while other species such as the brown creeper and northern long-eared bat utilize loose bark that is typically associated with standing dead trees. These cavity-dependent species require a range of tree size classes present within dead or partially dead standing trees (snags) while live trees with cavities are also used as den sites. Some species such as woodpeckers and black-capped chickadees excavate their own cavity from snags while others use existing holes (often excavated by woodpeckers in previous years).

Although the NUOS contains snags scattered throughout the forested stands, their availability is rather limited, particularly the larger size snags 12 inches in diameter that are required by larger wildlife species.

Coarse Woody Debris

Dead and down woody material including logs, large branches, stumps, fallen trees and upturned roots is important for providing wildlife habitat as well as other functions including nutrient cycling and nursery sites for vegetation. The decaying woody debris provides habitat for many insects and other invertebrates which are in turn eaten by wildlife such as shrews and a variety of birds including woodpeckers. The debris also provides cover for salamanders as well as small mammals including mice, chipmunks, and voles which then attract predators such as weasels, fishers and snakes.

In general, the larger the woody debris, the more beneficial it is for wildlife as it can provide den sites as well as escape areas. Coarse woody debris is generally scarce within the NUOS, particularly within the forested upland stands. As the forests continue to mature, mortality of the larger trees will likely increase resulting in more snags and eventually an increase in coarse woody debris.

Inclusions

Small patches or even individual trees that are different from the surrounding landscape habitat are valuable for increasing the biodiversity of an area. These inclusions provide habitat for wildlife in the form of cover or an additional food source that may be important seasonally. For example, the small stand of eastern hemlock present within forest Stand 6 can provide better shelter that may not be readily available in the surrounding habitat for various wildlife such as songbirds during winter storm events. Similarly, a small patch of white oak trees within a forest dominated by red oaks would provide an important food source in the form of acorns for wildlife such as white-tailed deer, wild turkey, gray squirrel as well as many small mammals. These inclusions need to be recognized during land management planning and accounted for in the implementation of management activities.

2.4.3 Wildlife – Habitat Associations

The types and sizes of plant communities and other habitat characteristics described above determine the wildlife that may be present within an area. The NUOS currently provides several different habitats that can support a variety of plant species and wildlife. These habitats and the wildlife inhabiting these different communities are described below.

Open Field Habitat

The existing 3.3-acre field present within the southeastern corner of the NUOS presently provides the only non-forested habitat within the NUOS. Wildlife that are likely to use this habitat include a variety of butterflies and other pollinating insects including bees. A large population of Baltimore checkerspot butterflies were noted in this field in the summer of 2016.

Several species of small mammals such as meadow voles and meadow jumping mice would inhabit the field. Birds that forage on the ground within grasslands (e.g. northern flicker, mourning dove, sparrows, wild turkey) would also be expected to use this field as would small mammal predators such as the red-tailed hawk. Other wildlife including the state-listed eastern box turtle may also use this field habitat.

The open field habitat is not of sufficient size to provide suitable habitat for grassland birds such as bobolinks or eastern meadowlarks. However, mammals such as white-tailed deer and eastern cottontails may forage within this field as would predators such as red fox and coyote. Several species of bats may also feed on insects that fly over the field during the night. The field was recently mowed in the fall of 2016.

Early Successional Forest/Scrub-Shrub Habitat

Currently, the NUOS does not contain any significant areas of early successional forest or scrub-shrub habitat. Areas that are regenerating into forest after disturbance are very important for many species of wildlife, particularly avian species which are undergoing population declines in Massachusetts such as brown thrashers, eastern towhees, ruffed grouse, American woodcock as well as a variety of warblers and sparrows. Brown thrasher and eastern towhee populations have declined over 90% in Massachusetts since 1966 while other species including the golden-winged warbler and yellow-breasted chat no longer occur within the state. The declines in these early successional habitat specialists is largely a result of the significantly decreasing amount of habitat available. In addition to these early successional specialist species, some birds that breed within mature forested habitats also depend on the presence of early successional areas during the critical post-fledging period. Early successional habitats provide greater fruit and insect resources as well as better protection from predators and may be just as important for population viability as nesting habitat.

Finally, the creation and maintenance of early successional habitats also benefit insects such as butterflies and bees.

Red Maple Swamp Habitat

Forested wetlands such as the small stands present within the NUOS provide good horizontal diversity with the surrounding oak/pine woodland. These wetlands also provide seasonal sources of water to wildlife and may provide important invertebrate and/or amphibian breeding areas. Plant species adapted for wetland habitats are present within these forested stands which increase the vegetation biodiversity of the NUOS which in turn increases wildlife biodiversity. Several of the forested wetlands contain good vertical diversity in the form of dense shrub understories that provide both nesting sites and food (e.g., blueberries) for different birds such as the veery that may not utilize the upland forests for nesting.

Even-Aged Oak/Pine Forest

The upland forests that are dominated by even-aged red oaks and eastern white pine provide the majority of the available habitat present within the NUOS and represents a relatively homogenous woodland with little horizontal diversity (other than with the small areas of red maple swamp discussed above). The forested areas surrounding vernal pools that are used as amphibian breeding areas provide important non-breeding habitat for these species by providing food and cover throughout most of the year. Vertical diversity within the even-age oak/pine forest stands is also limited due to the closed canopy provided by the overstory trees which preclude the development of different levels of vegetation which would support additional avian species. Although some snags and coarse woody debris is present, these features are generally sparse throughout these forest stands. The presence of the large red oak species (northern red, scarlet and black) provide abundant hard mast that can be used by wildlife during years of high acorn production. Large white oaks that may produce the more palatable acorns to wildlife are rare as are trees and shrubs that produce soft mast in the form of berries. Understory herbaceous vegetation is also very sparse within these woodlands.

Multi-Aged Forest

Forests that consist of multiple age-classes of trees contain high vertical diversity as high stem and foliage densities are present in the understory and mid-story along with large canopy trees. Small gaps in the canopy also provide for an herbaceous understory. The increase in the understory and mid-story layers of vegetation provide additional nesting, foraging areas and protective cover for species that are in addition to those inhabiting the upper canopy layer. Therefore, these forests are very productive wildlife habitats. Although no multi-age forests are currently present within the NUOS, several forest stands are beginning to develop into a multi-aged forest from previous thinning operations.

2.4.4 Endangered, Threatened and Species of Concern

The southeastern portion of the NUOS is mapped as rare wildlife habitat by the MANHESP (Figure 2-8). A state listed threatened species (marbled salamander) was previously documented to occur in the vicinity of the NUOS and the estimated habitat for this salamander extends onto the southeastern portion of the NUOS which includes the open field and adjacent woodlands. The marbled salamander requires vernal pools that contain surface water from fall through early summer for

breeding areas and woodland habitat that provides cover where it forages on various invertebrates during the remainder of the year.

Several other wildlife species, although not currently state-listed as endangered, threatened or special concern are considered “species of greatest conservation concern” by Massachusetts Division of Fisheries and Wildlife and are likely to inhabit or could inhabit the NUOS with the implementation of various management activities. Appendix C presents more information on these species and the habitats that they are dependent upon for their continued survival. Two species formerly listed as special concern (spotted turtle and four-toed salamander) have also been noted within the NUOS as has the eastern box turtle (currently listed as a special concern species).

The Foresters for the Birds program was developed by Mass Audubon, the Massachusetts Department of Conservation and Recreation, and the Mass Woodlands Institute and focuses conservation efforts on 40 forest birds which are a priority in the state and are named Responsibility Species. Fourteen of the Responsibility Species are birds that are primarily found within young early successional forests while 20 species are present in mature deciduous woodlands or mature mixed woods (contain both deciduous and conifer trees). The remaining species are primarily found in wetland or boreal forest areas. Appendix D contains more information on this program.

2.4.5 Invasive Species

Plant species that are not native to an area may become abundant due to high productivity, aggressive root systems, ability to thrive from disturbance, habitat generalist role and the absence of limiting factors such as invertebrate species that feed on them which provides a check on their growth and reproduction. These species are invasive in that they become abundant at the expense of native vegetation which generally provides food for many more native species than do the invasive plants. Invasive species within the NUOS are uncommon. However, several invasive plants including multiflora rose, Asiatic bittersweet, glossy buckthorn, honeysuckle, garlic mustard and Japanese barberry are present in the vicinity of the adjacent woodlands surrounding the open field and within the riparian area associated with Warren Brook. These areas are located in proximity to disturbed open areas or near more recent agricultural areas where invasive plants generally first gain a foothold and become established. However, the forested portions of the NUOS are exceptional in that very few invasive plants are currently present.

2.5 Historic and Cultural Resources

The NUOS contains numerous stonewalls throughout portions of the property that reflect past agricultural use as pastures. In addition, a historic stone foundation is present within the southeastern portion of the NUOS adjacent to North Street.

The Wampanoag Tribal Historical Preservation Officer (THPO) has noted many stone features including ceremonial landscapes that include various stone groupings, stone rows, and effigies. These features are historically and culturally important and need to be given full consideration in any future management activities.

2.6 Trails and Recreational Use

Access to the NUOS for recreation users is currently good. The NUOS is accessible primarily via a 300-foot border with Grafton Road in the southwestern portion of the NUOS where a small parking area for five or six vehicles is provided. Other access points are also available including a 50-foot wide link to the Oak Knoll Lane cul-de-sac (parking also available) as well as a right-of-way located adjacent to Sweetwilliam Farm that provides access from the east (parking available).

A fairly well-developed trail system is present through the NUOS as depicted on Figure 2-9 and considerable infrastructure in the form of boardwalks, signage, etc. are present (Table 2-). The trails provide opportunities for hikers to do a large loop through most of the NUOS while additional open space areas to the east and west allow longer hikes from trails originating at the Upton State Forest entrance off Southboro Road all the way through conservation land or easements including the NUOS to the entrance to Pell Farms Conservation Area on George Hill Road in Grafton.

The NUOS is used by hikers, hunters, horseback riders, and cross-country skiers. Trail maps are currently available to the public on the Town of Upton website at: http://www.uptonma.gov/land-stewardship-committee/pages/upton-conservation-land-and-trail-maps. Camping is not allowed, except by special permission from the Conservation Commission.

Table 2-3: NUOS Existing Infrastructure.

Property	Type	Year	Description	Notes
Warren Brook Watershed Conservation Area				
	Parking Area	ca. 1995	4 cars	Plowed by DPW
	Sign	ca. 1995	Wooden, carved	Parking area; posts are rotting and will need to be replaced.
	Boardwalk	2010	5 feet x 60 feet	Eagle Scout (Anthony Ward); CPA funded
	Plank Boardwalk	ca. 2007	12 feet long	Wetland crossing; undersized; poor condition
	Plank Boardwalk	ca. 2007	8 feet long	Stream crossing
	Kiosk	2017		Grafton Road Parking Area, Eagle Scout Luca Nicholson)
	Small kiosk	2017		Oak Knoll, Eagle Scout (Doug Cook)
Whitney Conservation Area (west parcel)				
	Culvert		12” x 18” stone	unnamed tributary; cart path crossing
	Culvert		16” corrugated	Warren Brook; cart path crossing; poor condition
	Gate		Aluminum gate	Interior gate on trail; no longer needed
	Sign	2011	Printed on RTG	Required LANDS Grant signage
	Sign	2016	Wooden, carved	Parking area
	Parking Area	2013	6 cars	Constructed on Parking Easement at 153A North Street; funded by grants and private donations
	Pasture Fence	2012	ca. 1100 ft.	Funded by grants and private donations
	Boardwalk	2012	5 feet x 24 feet	Stream crossing; Eagle Scout (Christian Dumas)
	Boardwalk	2013	5 feet x 16 feet	LSC and Americorps
	Plank Boardwalk	2015	45 feet long	Boy Scout Service Project (Lucas Nicholson); funded by private donation
Howarth Glen Conservation Area				
	Boardwalk	2010	5 feet x 100 feet	Warren Brook crossing; Eagle Scouts (Jefferson Gruber and Patrick Nigro)
Howarth Glen Recreation Area				
	Parking Area	ca. 2007	Several cars	Pump Station; plowed by DPW
	Boardwalk	2013	24” x 16 feet long	Stream crossing; LSC
	Kiosk	2017		North Street Parking Area, Eagle Scout (Lucas Nicholson)
Parcel 4-12				
	Boardwalk	2014	18” x 12 feet long	Stream crossing; LSC

3. STEWARDSHIP GOALS

The NUOS represents a wonderful community resource that offers many benefits and values including wildlife habitat, scenic beauty, hiking trails and other outdoor recreation opportunities, wood products, water supply protection and historical/cultural artifacts. People value the NUOS for a variety of reasons. Therefore, the stewardships goals must balance traditional and future use of the NUOS. Based on review of existing information and site conditions the Land Stewardship Committee identified a number of goals and opportunities. These are described in the following sections along with recommendations in Section 4.

3.1 Stewardship Goals for the NUOS

- Maintain biological diversity and integrity of wetlands and water resources and their ecological processes;
- Enhance biological diversity within the NUOS by creating early successional and multi-aged forest habitats;
- Protect and enhance forest diversity including late-successional forest characteristics that provide carbon storage and promote forest resiliency to invasive plants, insects, diseases and climate change;

Incorporate sustainable forestry to provide a source of wood products in balance with other stewardship goals;

- Provide public access for low-impact outdoor recreation and natural resource education;
- Preserve cultural pre-contact resources and historic resources; and,
- Retain scenic quality.

3.2 Vision for the NUOS

The overall vision for the NUOS is:

- A resilient forest that contains a diversity of stand ages including early successional habitat and multi-age habitat characteristic of late-successional forests;
- A range of sizes and types of downed woody debris, snag trees, cavity trees, and very large/ old trees (legacy trees) are present throughout all portions of the NUOS forest;
- Supports a full array of habitats with their associated plants and animals including any rare species and species/communities of state or regional concern;
- Conserves and protects wetlands, water resources and riparian habitats;
- Contains high quality forest resources including carbon storage achieved through long-term stewardship;
- Lacks invasive plant and animal species;
- Offers outdoor recreational activities that enable public enjoyment and education of the NUOS values and benefits while protecting the forest resources; and,
- Provides a cultural pre-contact history of past uses of the NUOS.

4. STEWARDSHIP RECOMMENDATIONS

The stewardship of a community resource such as the NUOS is a long-term commitment by various community members working together. The creation of this Land Stewardship Plan provides a foundation for moving forward on enhancing and maintaining this wonderful open space. The Land Stewardship Plan is a living document that should be reviewed and updated as part of the long-term stewardship of the NUOS.

Stewardship recommendations for the NUOS are provided below. These recommendations were developed based on each of the stewardship goals and considering existing site conditions, site capabilities, specific stewardship issues and feasibility and opportunity to achieve the desired outcome. Inputs from natural resource professionals were strongly considered in the development of these recommendations. The stewardship recommendations are organized by stewardship goal, although some issues and goals are interrelated and some apply to many of the goals. For example, the implementation of specific forestry operations is guided by the desire to protect wetlands, water resources, and cultural resources and therefore addresses sustainable forestry, wetlands protection and cultural protection goals.

4.1 Overall Stewardship Recommendations

The following stewardship recommendations apply to the entire NUOS and not to one particular stewardship goal.

4.1.1 Boundary Maintenance

Clearly marked boundaries are an important component for the stewardship of the NUOS. A survey was completed on the Whitney Conservation Area recently while the Howarth Glen Conservation Area has also had a survey conducted within the recent past. The boundaries of the NUOS should be marked (e.g., blazed and painted) so it can be readily identified while walking on the town-owned open space properties. This is important when implementing timber harvesting, laying out trails or other land management activities to ensure that they are carried out entirely within the boundaries of the NUOS. In addition, the identification of the boundaries is important in the event that encroachments into the NUOS occur in the future.

Stewardship Recommendations:

- Mark boundaries of NUOS where necessary. Consult with abutters prior to blazing or marking the boundary. Some abutters may have already marked or posted their boundaries; these property boundaries do not need to be redone.
- Follow standard procedures for painting and blazing the boundaries. Refer to Woodlot Boundary Line Marking available at: https://extension.unh.edu/resources/resource/244/Woodlot_Boundary_Line_Marking.
- Alternatively, aluminum markers can be used to identify the NUOS properties. Either volunteers can perform this task or someone such as a land surveyor can be hired. Blazes may need to be re-done every 10 to 15 years.

4.1.2 Reporting/Coordination with Town Officials and Community Outreach

Most activities described in the stewardship plan will be accomplished without further coordination with the Board of Selectmen, Conservation Commission, or community meetings. Major infrastructure or proposed land management actions will be coordinated in advance with the Board of Selectmen, Conservation Commission, and the public. These actions include construction or enlargement of parking areas and timber harvests. A summary of all activities conducted at the NUOS will be prepared each year by the LSC for inclusion in the annual Upton Town Report.

In addition to boundary marking, there are other compelling reasons to cooperate with property owners that abut the NUOS. Due to their close proximity, neighbors may spend more time on the NUOS and may be willing to volunteer time to provide maintenance such as trail clearing. Several of the stewardship goals include implementing sustainable forestry and creating early successional and multi-aged forests. Cooperating with neighbors may provide an opportunity to work with mutual forestry harvesting operations as well as potentially provide additional access to portions of the NUOS that currently have limited access due to distances from roads. The NUOS is part of a larger unfragmented landscape (Forest Core) that extends to the north and west. This large forest block provides a larger functional wildlife habitat for woodland species. Working with interested neighbors to help ensure this unfragmented forest remains will maintain the values and ecological integrity of the NUOS.

Stewardship Recommendations:

- Conduct community outreach to town boards and residents regarding proposed management activities associated with the NUOS.
- Meet with neighbors to the NUOS to discuss boundary marking, land conservation, volunteer opportunities (e.g., land stewards) and mutual forestry operations that may benefit the Town and neighbors.
- Work with interested landowners to conserve additional land abutting the NUOS and land that maintains connectivity with other conservation areas.

4.1.3 Maintain Records/Documents for NUOS

The town is expected to manage the property for open space in perpetuity. The composition of the Land Stewardship Committee will change over time. It will be essential to keep good records to document how the project was managed to guide future management decisions and to help people in the future understand and appreciate the management history of the NUOS.

Stewardship Recommendations:

- Keep good operational records to document property management, use and resources. The record should describe management activities, document public use, and contain results of historic and biological inventories and studies. These records should be accessible to the public by maintaining a subdirectory on the town website.

4.1.4 Invasive Species Control

Invasive species within the NUOS are currently uncommon. However, several invasive plants including multiflora rose, Asiatic bittersweet, winged euonymus, glossy buckthorn, honeysuckle and

Japanese barberry are present in the vicinity of the adjacent woodlands surrounding the open field and within the riparian area associated with Warren Brook. Invasive plants are a major threat to the integrity of natural communities. The invasive plant species may eventually spread throughout the designated forest core provided by the NUOS unless they are controlled.

Stewardship Recommendations:

- As part of routine monitoring of trails or management activities, look for invasive species as early detection is the key to preventing severe infestations. Small, newly established populations are easier to control.
- Conduct an annual monitoring of invasive plants along the Warren Brook riparian corridor and within the woodlands adjacent to the open field. Remove invasive plants by either pulling the entire plant including roots or cutting the stem(s) and applying an appropriate herbicide to the cut stem only.
- Prior to conducting any forest management activities and following any forest cutting activities, conduct surveys for invasive species to ensure these plants do not get a foothold into the NUOS within these areas.

4.2 Stewardship Goal – Maintain and Protect Wetlands/Water Resources

4.2.1 Identify and Protect Vernal Pools

Several wetlands located on the NUOS or in very close proximity have been identified as potential vernal pools that contain seasonal standing bodies of water that provide very important breeding habitat for invertebrates and amphibians. These potential vernal pools have not been surveyed for representative indicator species that would confirm their use as breeding areas. Trail layout and forestry operations near vernal pools need to be conducted in a manner that preserves the important habitat features associated with these pools. Most amphibians that breed in vernal pools spend the vast majority of the year in cool, moist terrestrial habitat surrounding the pool. Terrestrial areas with a moist forest floor with deep leaf litter, coarse woody debris and canopy shade are important for these species and need to be considered in management activities.

Stewardship Recommendations:

- Conduct a spring survey of all potential vernal pools to determine whether vernal pool indicator species (e.g., fairy shrimp, wood frog, and mole salamanders) or other amphibians use these areas as breeding areas. Document those seasonal water bodies that qualify as vernal pools and submit supporting information to the MANHESP for vernal pool certification. Determine the circumference of documented vernal pools using Global Positioning System (GPS) technology.
- Management activities in the vicinity of documented vernal pools need to follow recommendations that maintain the integrity of the vernal pool and surrounding habitat (see Appendix A; Calhoun and deMaynadier, 2004; MDFW, 2007). These guidelines include avoiding any disturbance of the vernal pool depression or within 100 feet of the vernal pool, maintaining at least 75% canopy closure within 100 feet of vernal pools, and maintain at least 75% canopy closure within 70% of the area located within 100 to 600 feet of the vernal pool.

4.2.2 Protect Warren Brook and Headwater Streams

The headwaters of Warren Brook including several tributary streams are partially located within the NUOS. Maintaining high water quality within these streams will benefit downstream reaches of Warren Brook which provide habitat for coldwater fisheries.

Stewardship Recommendations:

- Maintain an undisturbed 25-foot riparian zone adjacent to Warren Brook and the intermittent tributary streams present within the NUOS.
- Maintain at least 50% of existing tree basal area within 100 feet of streams and 50 feet of wetlands. Steeper slopes greater than 10% should incorporate wider management zones as provided in Catanzaro et al., 2013.

4.3 Stewardship Goal – Protect and Enhance Biological Diversity

4.3.1 Create and Enhance Early Successional Habitat

Early successional habitats including grasslands, shrublands and young forests are declining in the northeast as a result of forest maturation, decreased tolerance of natural disturbance such as beavers and fire, and loss of habitat to development. Mass Audubon (see Appendix D) recommends that 10% of a forest consist of early successional young forest. Currently, the NUOS contains approximately 1% early successional habitat (open field present in Howarth Conservation Area and portions of wetlands dominated by shrubs). The near absence of early successional habitat at the NUOS currently limits the potential biological diversity that may occur at the NUOS. Therefore, creating and enhancing early successional habitat is desired within the NUOS in order to increase biodiversity.

Stewardship Recommendations:

- Enhance the early successional habitat provided by the open field for birds and mammals by conducting mowing every three to four years rather than every one to two years. Increasing the mowing interval would permit some shrubs to become established that provide food, nesting areas and cover for butterflies, bees and additional wildlife species that do not currently inhabit the field. Raising the height of the mowing to eight to ten inches would also be expected to leave good residual cover at year's end for caterpillars and other wildlife that depend on the cover of herbaceous plants for overwintering. Consideration of maintaining some shrub cover within the field by rotating the mowing frequency within different portions of the field could also be given.
- Create a “soft edge” along portions of the open field by removing some of the overstory trees within the adjacent forest. Cutting (or girdling) poorly formed trees within 25 feet of the open field would increase sunlight and allow shrubs/saplings to increase and provide suitable habitat for birds such as blue-winged and chestnut warblers as well as for American woodcocks. Girdling trees would provide an additional benefit in the form of snags for cavity nesting species. Prior to creating the openings, invasive plants should first be eliminated from the field edges and adjacent woodland.
- Create one or two large five acre early successional habitats within the NUOS by conducting a forestry cutting operation (see Figure 4-1). Ideally, this area should not be near wetlands or vernal pools, and be situated within a location containing a level to slight slope (Forest

Stands 1, 7 or 8). The goal would be to create a large block of early successional habitat, however, standing dead trees and some overstory trees (particularly any legacy trees or more uncommon species) or patches of trees should remain provided that the overstory cover is not greater than 30% or 10 trees/acre.

- The created early successional habitat by conducting a forestry cutting will generally only benefit early succession-dependent wildlife for a period of 15 to 20 years. In order to maintain the five-acre area in an early successional stage, approximately 25% of the area should be maintained by conducting follow-up cuttings of regenerating trees greater than 3 to 4 inches in diameter every five years. This maintenance work may be conducted by volunteers or via habitat management grants that may be available through various government agencies.

4.3.2 Create Multi-Aged Forest Habitat

Multi-aged forests contain a high degree of vertical diversity which represent very productive wildlife habitats. Small gaps in the canopy provide for an herbaceous understory while the increase in the understory and mid-story layers of vegetation provide additional nesting, foraging areas and protective cover for wildlife in addition to those inhabiting the upper canopy layer. These small gaps in the canopy mimic natural disturbances and provide small areas of successional habitat that are typically used by a different subset of early successional species than described above. A multi-aged forest would also increase forest resiliency to various stressors such as invasive insects and diseases as well as climate change (Catanzaro et al., 2016). This forest type will be the management goal throughout most of the NUOS where sustainable forestry management is proposed and corresponds to Woodland as defined by the Upton Forest Management Policy and Guidelines (see Appendix A).

Stewardship Recommendations:

- Conduct forest cuttings within accessible forest stands as recommended by the forest stewardship plan (Appendix B) to include single-tree and small group harvesting within Stands 1, 2, 7, 16 and 17 as well as portions of Stands 8 and 11 which represent Woodland (see Figure 4-1). Initial trees to be cut will be an improvement thinning to remove the poorly formed and dying trees to provide growing space for healthiest individuals and promote regeneration of new age-classes.
- Hire a forester to oversee the identification of individual trees to be removed within each of the forested stands and assist with the selection and subsequent supervision of the logging company retained to conduct the forest thinning. Discuss stewardship goals with the forester regarding maintaining forest diversity prior to the selection of the trees for removal. The contracts with logging companies should include a performance bond to ensure work is done according to the contract.
- Girdle trees of lowest merchantable quality to achieve goal of at least 6 snags > 6 inches dbh/acre with at least 1 snag > 15 inches dbh/acre.
- Protect legacy trees and snags during any timber harvesting activities.

4.3.3 Conduct Biodiversity Inventories

The property has not been thoroughly inventoried for various taxonomic groups and rare/unusual species and there is no quantitative data available concerning use of property by breeding bird and

butterfly populations. Such data is needed to monitor population trends and access the impacts of management practices on these species.

Stewardship Recommendations:

- Conduct surveys of the property for plants, lepidopterans (butterflies and moths), dragonflies, and vertebrate wildlife species. The focus should be on rare and state-listed species. Some of this work may be done by town volunteers while other surveys may be best done by professional biologists. A search of the Howarth Glen Conservation Area for marbled salamander should be a priority. The Stewardship Committee should keep a log book to record incidental reports of unusual species observed on or near the property.
- Develop a standardized plan for surveying property for breeding birds and butterflies. The survey methods should conform to existing professional practices and be repeatable to allow assessment of short-term changes from management activities as well as long-term trends. Monitoring breeding bird and butterflies populations the year before and several years after specific management activities are conducted is recommended.

4.3.4 Permanently Protect NUOS Properties.

- Work with the Open Space Committee to acquire permanent protection for unprotected NUOS properties.

4.4 Stewardship Goal – Enhance Forest Diversity and Old-Growth Features

4.4.1 Protect and Enhance Diversity

Currently, the upland forests within the NUOS consist of a fairly homogenous woodland comprised of even-aged red oaks and eastern white pine. Other tree species are also present in the overstory although these species are uncommon. American chestnut was formerly an important member associated with the oak – pine forest before it was essentially eliminated by the chestnut blight. Many sprouts of chestnuts are still present within the NUOS and reach several inches in diameter before they are killed by the blight and re-sprout once again. The near dominance of the NUOS forest by oak trees results in the forest being very susceptible to insects and/or pathogens such as the winter moth and gypsy moth infestations. The caterpillars of these species resulted in widespread defoliation of trees within the NUOS in 2016. A forest containing a greater diversity of overstory species would likely be more resilient to periodic outbreaks of pests that may occur in the future. In addition, forests within the NUOS as well as throughout southern New England are likely to be affected by changing climate during the 21st century as some tree species would benefit from a warming environment while others will decline (see Appendix F). Therefore, a goal of increasing diversity within the tree overstory is desirable. Finally, large individual trees or groups of trees (patch reserve) that can be considered legacy trees should be preserved.

Stewardship Recommendations:

- Conduct an inventory of large trees that could qualify as legacy trees within the entire NUOS that expands upon the current known legacy trees. The species, diameter at breast height (dbh) and relative health of each individual tree should be recorded along with determining its location via GPS. Preference is given for species typically long lived (i.e., 200 to 300

years) such as northern red oak, eastern white pine, sugar maple, American beech and eastern hemlock, mast producing species and trees with existing dens or signs of wildlife use.

- Uncommon overstory trees including yellow birch, sugar maple, hickories, white oak and sassafras should be retained during forest thinning to increase the diversity of the overstory trees. In addition, softwood (i.e., conifer) inclusions of eastern hemlock and eastern white pine should be retained within hardwood (i.e., deciduous) stands.
- Planting of blight-resistant American chestnuts seedlings should be undertaken in forest openings created by individual or group selection tree harvesting. This species was once an important component of the NUOS forest and should be restored. Initially, these seedlings will need to be protected from deer browsing until they reach a safe height from continued browsing.
- Monitor existing stands of eastern hemlock annually for wooly adelgids (non-native insects that adversely affect hemlocks and typically resulting in tree mortality). If identified, corrective measures should be considered in order to maintain this important component of the forest.
- Investigate ways to protect a few select white ash "legacy trees", possibly using systemic insecticides.

4.4.2 Enhance Old-Growth Forest Features

Old-growth or late-successional forests often contain a well-developed structure, including large trees, multiple-aged trees, and abundant snags/downed wood. This forest community has been greatly reduced throughout the northeast and does not currently exist within the NUOS. Planned forest management provides the opportunity to accelerate the development of old-growth structure (bigger trees, snags, various canopy gaps, diversity of tree sizes, downed logs) through carefully planned treatments (D'Amato and Catanzaro, undated). The planned creation of multi-aged forests is expected to gradually mimic old-growth characteristics. The primary difference between the multi-aged forest and old-growth forests on the NUOS is that tree removal (i.e., harvesting) will not occur within the proposed old-growth stands. Currently, access to the northeastern portion of the NUOS (Stands 10, 12 and 13 through 15 as well as portions of Stands 8 and 11) are limited by the presence of steep slopes or wetlands. These stands will be classified as Forest Reserves (see definition in Appendix A) and managed as late-successional habitat although instead of tree removal via a forestry cutting as proposed for the multi-aged forests, individual trees or small groups of trees will be either girdled or cut and left in place to provide snags and/or coarse woody debris.

Stewardship Recommendations:

- Conduct tree girdling to include primarily single-tree selection within Stands 10, 12, and 13 through 15 as well as portions of Stands 8 and 11 (see Figure 4-1). Initial trees to be girdled include poorly formed and dying trees to provide growing space for healthiest individuals, create snags and coarse woody debris, and promote regeneration of new age-classes.

4.5 Stewardship Goal – Promote Carbon Storage

The proposed forestry management will result in a shift from an even-aged forest to a multi-aged forest while other portions of the NUOS will be managed as old-growth forest. Old-growth forests may provide more carbon sequestration than actively managed forests with coarse woody debris providing significant carbon storage. The stewardship goals indicated above (Section 4.4.2) that

enhance old-growth forest features will also benefit carbon storage. In addition, areas managed as Woodland will leave as many treetops and limbs as possible to contribute to carbon sequestration

4.6 Stewardship Goal – Promote Sustainable Forestry

The proposed forestry management within the Woodland area (see Figure 4-1) will result in a gradual shift from an even-aged forest to a multi-aged forest. The forest thinning/cutting will be conducted to promote a sustainable forestry that can provide forest products and contribute to the local economy. In addition, the income derived from the cordwood and sawtimber harvested from the NUOS could provide funds to actively manage the NUOS as well as other town-owned properties. Thus, the NUOS could "pay its own way" over the course of its management and town funds obtained from general taxes could be spent on other necessary obligations.

Stewardship Recommendations:

- Implement the forest management objectives and prescriptions detailed in the Forest Stewardship Plan (Appendix B) that would promote sustainable forestry and allow periodic sustainable harvesting of forest products from portions of the NUOS.
- Plan skid roads in advance to minimize their number and impact. Use existing roads to the extent practicable.
- Limit or prohibit timber harvesting during the spring when conditions are especially susceptible to damage or during the early summer when wildlife nesting/raising of young is most active. Conduct harvesting operations only on frozen ground or during dry conditions (i.e., late summer through winter).
- Delay timber harvesting during severe outbreaks of forest pests (i.e., gypsy moths) when woodlands are under significant stress.
- Leave as many treetops and limbs as possible to contribute to soil fertility and carbon sequestration.
- Avoid skidding on recreational trails and minimize impacts to trails by removing treetops/limbs from maintained trails.

4.7 Stewardship Goal – Recreational and Educational Opportunities

The NUOS contains both former woods roads as well as narrow trails that are well-suited for hiking, cross-country skiing, horseback riding, snowshoeing, and/or nature observation. It is also an ideal area for use by school and scouting groups for natural resource education including forestry and wildlife habitat management objectives and results.

4.7.1 Promote Recreational Activities

The NUOS has a fairly long history of public use which has been enhanced by the Sweetwilliam Farm Conservation Easement that now provides a continuous interconnected trail system from the Upton State Forest west to the Pell Farms Conservation Area in Grafton. This trail network provides some of the most interesting hiking opportunities present within the region. Access to the NUOS is good as three locations currently provide parking spaces for vehicles. Hunting is permitted within the NUOS subject to state regulations. Camping is only permitted by special permission from the Conservation Commission.

Stewardship Recommendations:

- Currently, the access location on Grafton Road provides a small parking area with a wide trail leading into the NUOS. The installation of a locked gate at this location would prevent vehicles from accessing the NUOS at this location but still allow emergency vehicles access (see Figure 4-2).
- Install or improve boardwalks, signage and kiosks (see Figure 4-2).
- Relocate trails to avoid several wet areas (one of which is in Grafton).
- Inspect all of the existing trails a minimum of twice per year – ideally in the early spring and fall. Trail maintenance in the form of fallen tree removal and boardwalk/bridge inspections and maintenance (including clearing of leaves) should be conducted as necessary. Temporary trail closures may be necessary if muddy conditions are pronounced during a particular year.
- Maintain trail blazing.
- Create a new loop trail at the Warren Brook Watershed Conservation Area (see Figure 4-2). Before constructing any new recreational trails assess the conditions of existing trails and determine what types of uses should be permitted on each trail. Steep and narrow trails may be unsuitable for horses due to the potential for erosion and nearby wetlands or other resource areas.
- Continue to allow hunting as hunters can help maintain deer populations at levels that minimize over-browsing of vegetation which would negate the proposed creation of forest regeneration within the NUOS.
- Evaluate the effects of allowed camping on the natural resources of the NUOS to determine if additional guidelines or rules are required to prevent resource alteration.
- Continue working with local scouting groups for community service projects that would benefit the NUOS including trail maintenance/enhancement.
- Update trail maps and create trail brochures for selected hikes.
- Name unnamed NUOS properties.

4.7.2 Educational Opportunities

The property has an array of natural features. Because of the wide range of features there is a great teaching opportunity here for students, scouting groups and the general public.

Stewardship Recommendations:

- Create an interpretive trail with information about plants, animals, forest succession, habitats, landscape and history. Place signs and kiosks throughout the property that identify significant features and/or install numbered markers on the trail that correspond to information on a flyer. Create and distribute handouts with maps and information about features.

4.8 Stewardship Goal – Protect Historical/Cultural/Pre-Contact Resources

Although some significant historic features such as stonewalls have been mapped on portions of the NUOS, the entire property has not been thoroughly inventoried. In addition, a large portion of the NUOS has been identified as containing a Native American ceremonial stone landscape although the precise locations of these features have not been mapped. The majority of this landscape area is associated with steep slopes or within the eastern portion of the NUOS where limited forestry activities are proposed.

Stewardship Recommendations:

- Survey the NUOS and GPS the locations of stone walls, foundations, stone piles, and other historic and pre-contact resources that are readily visible.
- Consult with Wampanoag Tribal Historic Preservation Officer (THPO) to ensure that historic pre-contact features are identified and certify the ceremonial stone landscape. Schedule day(s) when THPO can tour the NUOS and research the landscape using astronomical alignments and cultural information. Mapped features to be confidential and not on public record but stored in confidential file in Upton Historical Commission as prescribed in MA chapter 40-8D.
- Protect stonewalls during forest management, trail building, or other management activities. Do not remove or damage stonewalls.
- Remove trees growing within or adjacent to the Schoolhouse 6 foundation and stone retaining wall in order to protect this important historical resource.
- Restore stone walls damaged by natural tree-falls on a case by case basis and all walls damaged by forest management.
- Avoid conducting any large-scale forestry operations within the general vicinity of the ceremonial landscape identified by the Wampanoag THPO and other Tribes. Single-tree and small group selection harvesting activities can be compatible with preservation of historical/cultural resources provided that these resources are identified and located so that protective measures can be implemented during timber harvests.
- Photodocument for historical purposes large white ash trees at risk of being lost due to the Emerald Ash Borer or other insects/diseases.

4.9 Stewardship Goal – Protect Scenic Quality

Forests are one of the most important scenic resources and the NUOS forests provide an important backdrop to the wonderful view provided at Sweetwilliam Farm (now Five Forks Farm) on North Street. Within the NUOS itself, visitors enjoy other scenic features including views of wetlands, streams, rocky outcrops and wildlife as well as enjoying quiet spaces. A diversity of habitats such as early successional habitats also adds to the scenic quality of an area. This Land Stewardship Plan outlines ways to protect scenic values along with completing other stewardship goals. Some components of forest management may appear unattractive to some members of the public for a period of time due to changes in the viewshed or not understanding the purpose behind a particular management action. The management goals and rationale included in the Land Stewardship Plan provide an awareness of the purpose behind each management action as well as ways to protect other resources including scenic quality.

Stewardship Recommendations:

- Prior to conducting forest or habitat management, erect signs at kiosks or along trails (at potential viewsheds) that explain the purpose and goal behind the management action.
- Minimize impacts of forest management activities within 50 feet of existing trails to the extent possible by removing treetops/limbs in order to maintain aesthetic experience for trail users.
- Work with the owner of Sweetwilliam Farm (now Five Forks Farm) to manage vegetation to maintain the view from North Street.

5. IMPLEMENTATION

5.1 Implementation Plan

The Land Stewardship Committee is proposing a three-phase implementation plan. Key features of each phase are listed below. See Table 5-1 for a more detailed time-line and Figure 4-2 for the infrastructure plan.

Phase I

Short-term plan - Spring/Summer 2018 and 2019

- Conduct Outreach Program for NUOS neighbors and town residents
- Identify and mark boundaries of NUOS where necessary
- Control invasive plants along Warren Brook and adjacent to open field
- Identify and certify vernal pools present on the NUOS
- Identify, describe and locate legacy trees
- Identify and locate stonewalls and other historic features
- Identify, locate and assist in certifying the ceremonial stone landscape
- Remove trees within or adjacent to Schoolhouse 6 foundation
- Conduct breeding bird inventories of existing/proposed early successional habitats
- Hire consulting forester to prepare forest cutting plan(s)

Phase II

Intermediate plan – 2019 to 2020

- Conduct thinning within woodlands adjacent to open field
- Put up signage and information kiosk at Grafton Road
- Implement avoidance measures to protect historic and pre-contact resources prior to forest management activities
- Conduct forest management within Forest Stands 16 and 17 (single-tree and group selection)
- Conduct forest management within Forest Stand 1 (early successional habitat) and Forest Stands 1 and 8 (single-tree and group selection)
- Conduct forest management within Forest Stand 7 (early successional habitat) and Forest Stands 7 and 11 (single-tree and group selection)
- Monitor response of regeneration and breeding birds in forest management areas
- Install gate at Grafton Road access location

Phase III

Long term plan - 2021 +

- Open field maintenance
- Early successional habitat maintenance (25% every 5 years)
- Create old growth characteristics in designated forest stands
- Plant American chestnuts in created forest openings
- Assist with efforts to propose NUOS certified stone landscape for the National Register of Historical Properties

5.2 Routine Maintenance

The following routine maintenance activities will be conducted on an ongoing basis:

- Maintain parking areas (including snow removal)
- Maintain trails (remove tree falls, branches, inspect boardwalks/bridges)
- Re-mark trails
- Restock trail maps
- Invasive species control
- Tree removal at schoolhouse foundation
- Maintain records of inventories and management activities
- Conduct site visits with Tribes (every three years) to ensure cultural landscape is maintained
- Education and outreach programs (including pre-contact features with Tribal guidance)

5.3 Plan Updates

This plan would be reviewed and updated periodically, with the next scheduled formal update scheduled for 2028.

Table 5-1: Implementation Plan

			Phase I	Phase II		Phase III
Category	**Item**	Ref #				
Overall Stewardship Goal	Boundary ID and Marking	4.1.1	X			
	Public Outreach	4.1.2	X			
	Invasive Species Control	4.1.4	X	X	X	X
Wetlands & Water Resources	Identify Vernal Pools - Certification	4.2.1	X			
	Vernal Pool Certification	4.2.1		X		
Biological Diversity	Maintain Open Field Habitat	4.3.1			X	X
	Create Soft Edge Adjacent to Open Field	4.3.1		X	X	
	Create 5-acre Early Successional Habitat	4.3.1		X		
	Maintain 5-acre Early Successional Habitat	4.3.1				X
	Conduct Forest Management to Create Multi-Aged Forest Habitat	4.3.2		X	X	X
	Hire Consulting Forester to Oversee Forest Management Cuttings	4.3.2	X	X	X	
	Conduct Before/After Bird Surveys in Forest Management Areas	4.3.3	X	X	X	X
	Conduct Surveys of Biological Resources	4.3.3	X	X	X	X
Forest Diversity and Old-Growth Features	Inventory Legacy Trees	4.4.1	X			
	Plant Disease Resistant American Chestnut Trees	4.4.1			X	X
	Monitor Eastern Hemlock Stands	4.4.1	X	X	X	X
	Enhance Old-Growth Features by Selective Tree Girdling	4.4.2				X
Sustainable Forestry	Implement the Forest Management Activities	4.6.1		X	X	
Recreation & Educational	Install Gate at Grafton Road	4.7.1			X	
	Inspect and Maintain Trails and Trail Markers	4.7.1	X	X	X	X
	Evaluate, Install, and Maintain Slip Protection on Boardwalks	4.7.1	X	X	X	X
	Install, Inspect and Maintain Boardwalks/Bridges	4.7.1	X	X	X	X
	Remove unneeded Whitney Conservation Area gate.	4.7.1	X			
	Relocate Trails in Wet Areas.	4.7.1	X			
	Create new Warren Brook Watershed Conservation Area loop trail.	4.7.1		X		
	Erect Kiosks	4.7.1	X			
	Update Trail Maps and Kiosk Information	4.7.1	X	X	X	X
	Prepare Interpretive Trail	4.7.2				X
Historical & Cultural Resources	Conduct Inventory and Locate Stonewalls, Stone Piles, etc.	4.8	X			
	Conduct Inventory and Locate Native American Landscape Features	4.8	X			
	Remove trees within or adjacent to Schoolhouse Foundation	4.8	X			X
	Ensure Protection of Historic/Cultural Features	4.8	X	X	X	X

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Book 43869, Page 130. Pell Farm deed.
Book 43869, Page 139. Pell Farm deed.
Book 47516, Page 127. SWF Conservation Restriction.
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Book 47516, Page 177. Grant of Easement.
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Plan Book 459, Plan 23. Strip of land from WBWCA to George Hill Road.
Plan Book 602, Page 95. Ole Silver Maple.
Plan Book 603, Plan 5. Grafton Road abutting future WBWCA.
Plan Book 663, Page 11. Chase property.
Plan Book 690, Page 38. Chase property.
Plan Book 843, Plan 83. Glen Echo Estates Open Space Definitive Subdivision Topographic Plan (includes wetland delineation).
Plan Book 873, Plan 92. Pell Farm south of Grafton Road.
Plan Book 889, Plan 44. Sweetwilliam Farm and Whitney Conservation Area.
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FIGURES

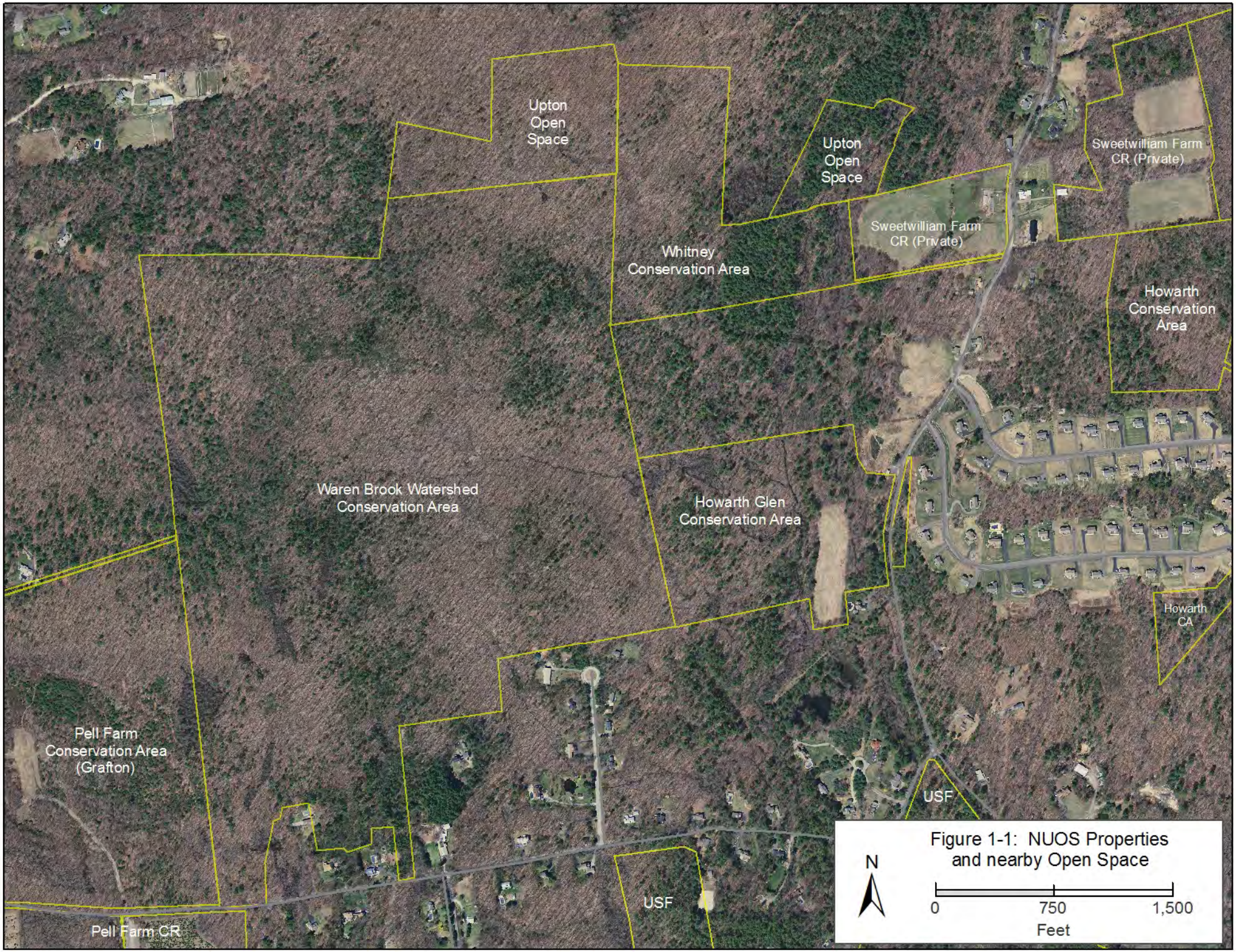


Figure 1-1: NUOS Properties and nearby Open Space

Upton Land Stewardship Committee, May 2017

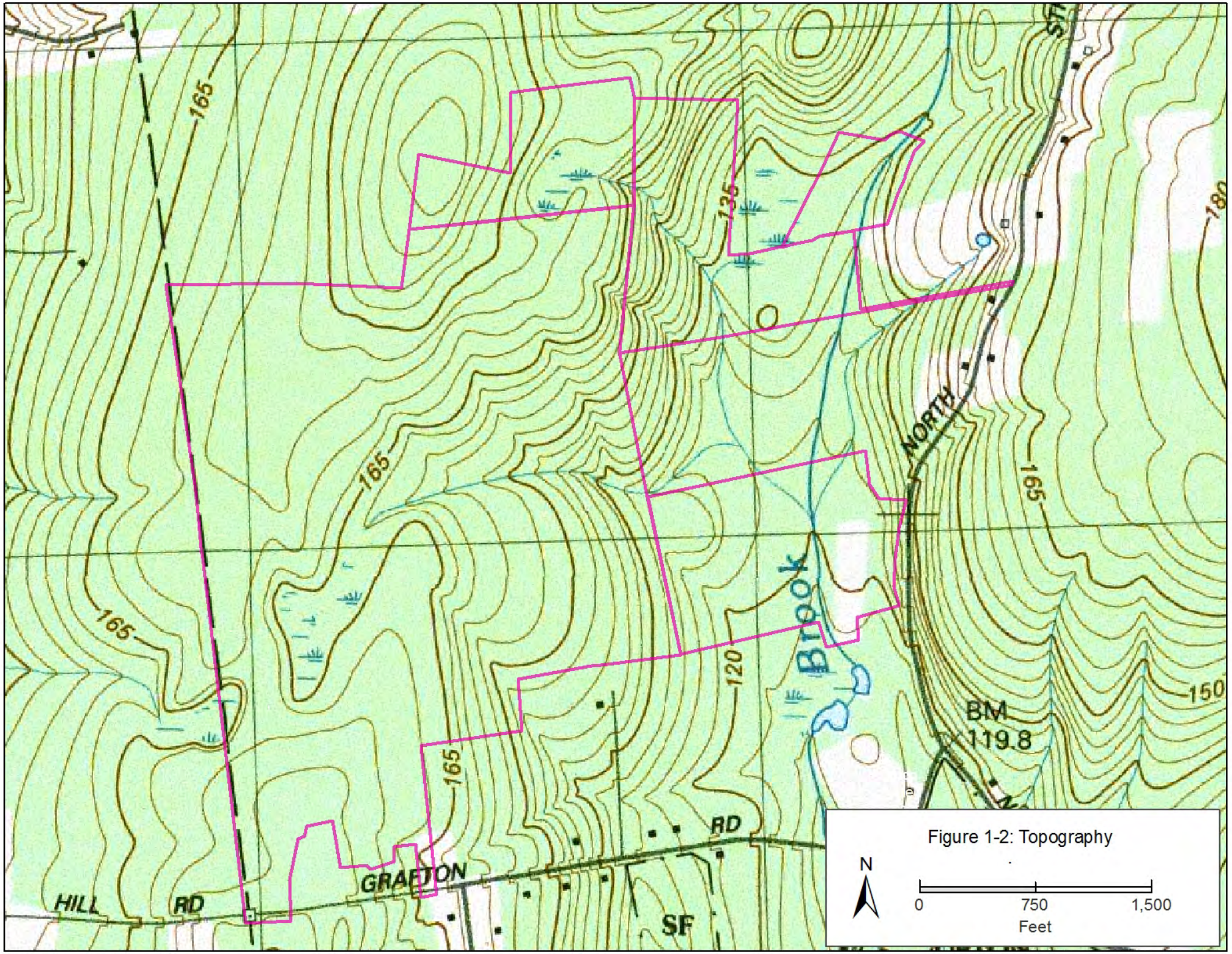
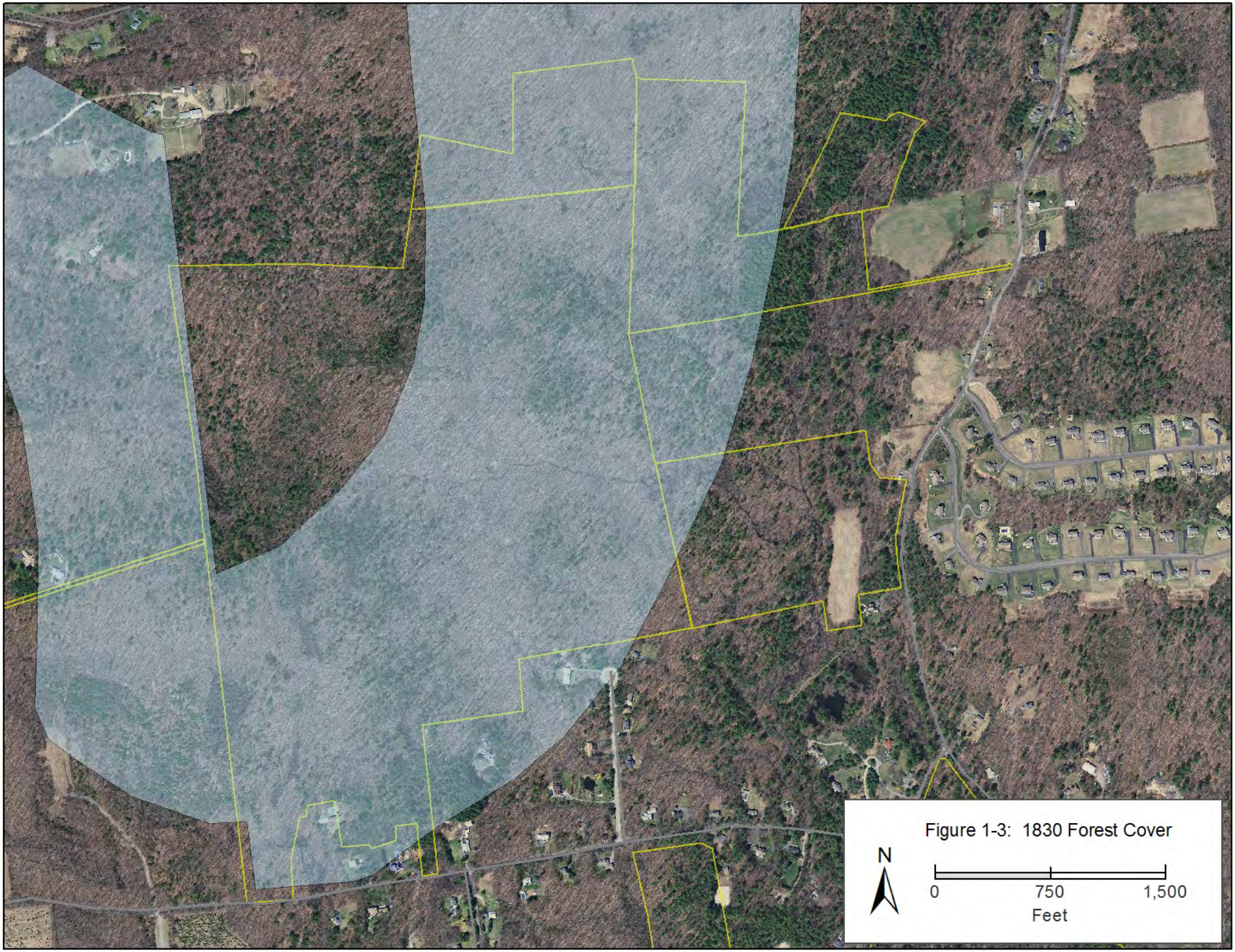
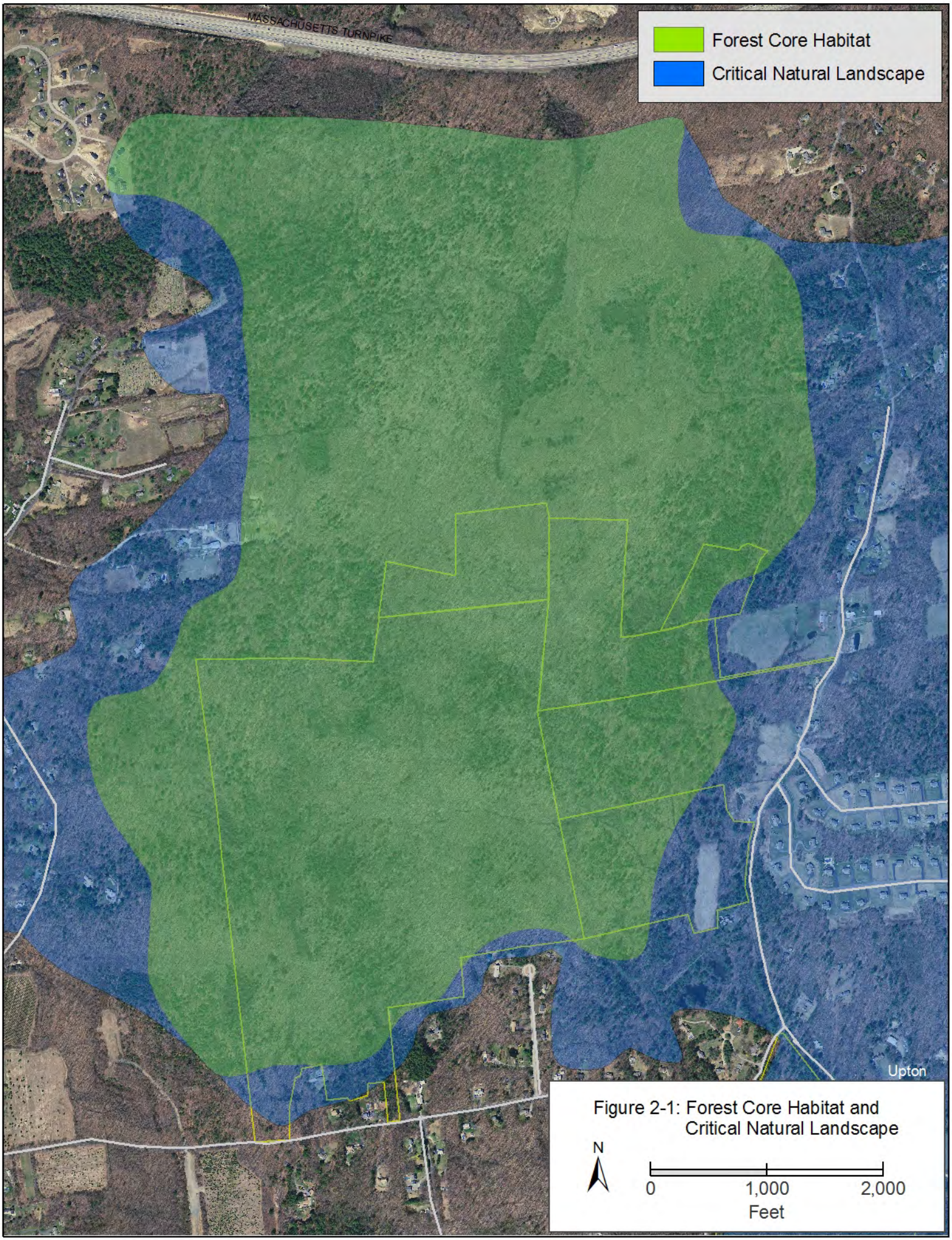


Figure 1-2: Topography

Upton Land Stewardship Committee, April 2017



Upton Land Stewardship Committee, May 2017



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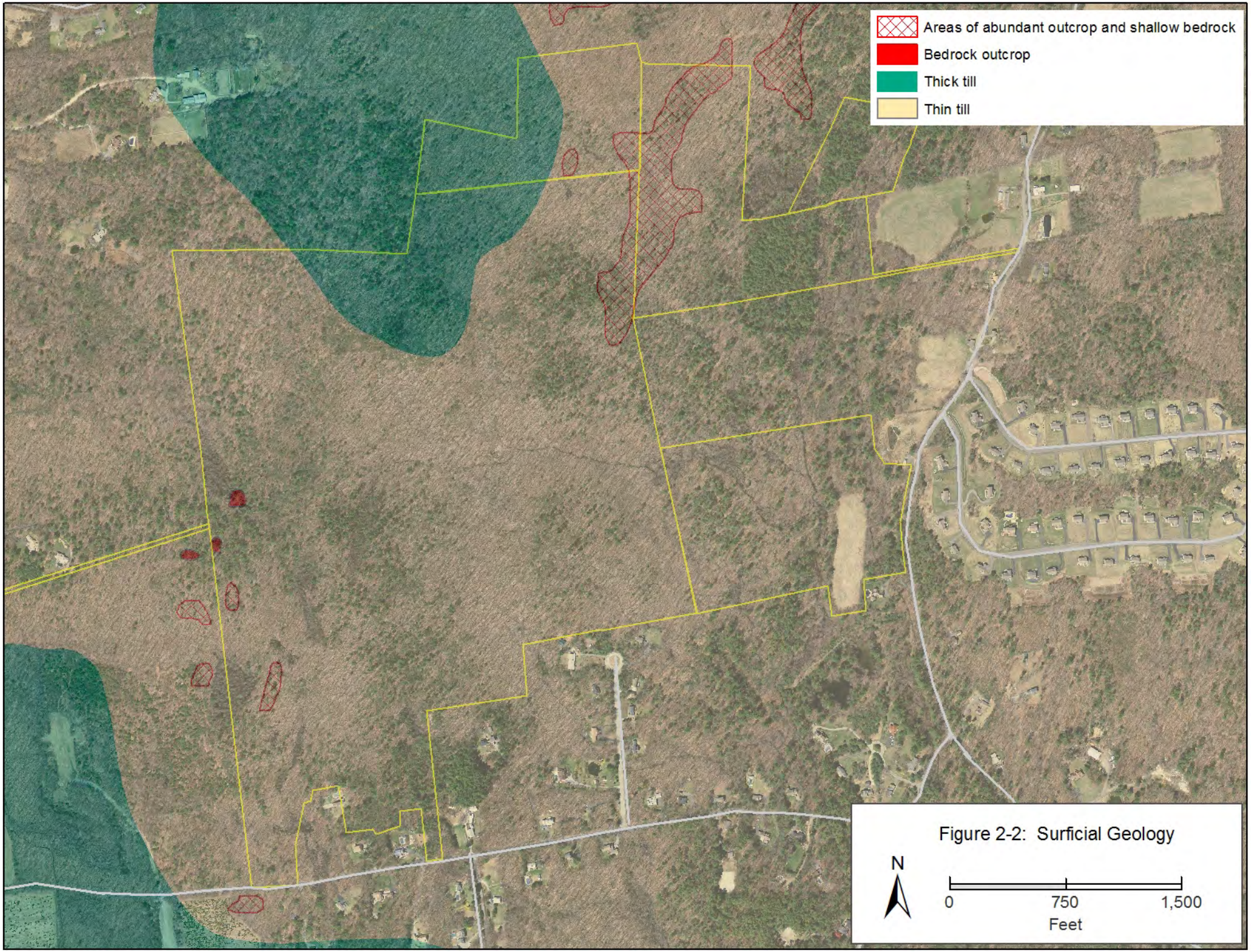
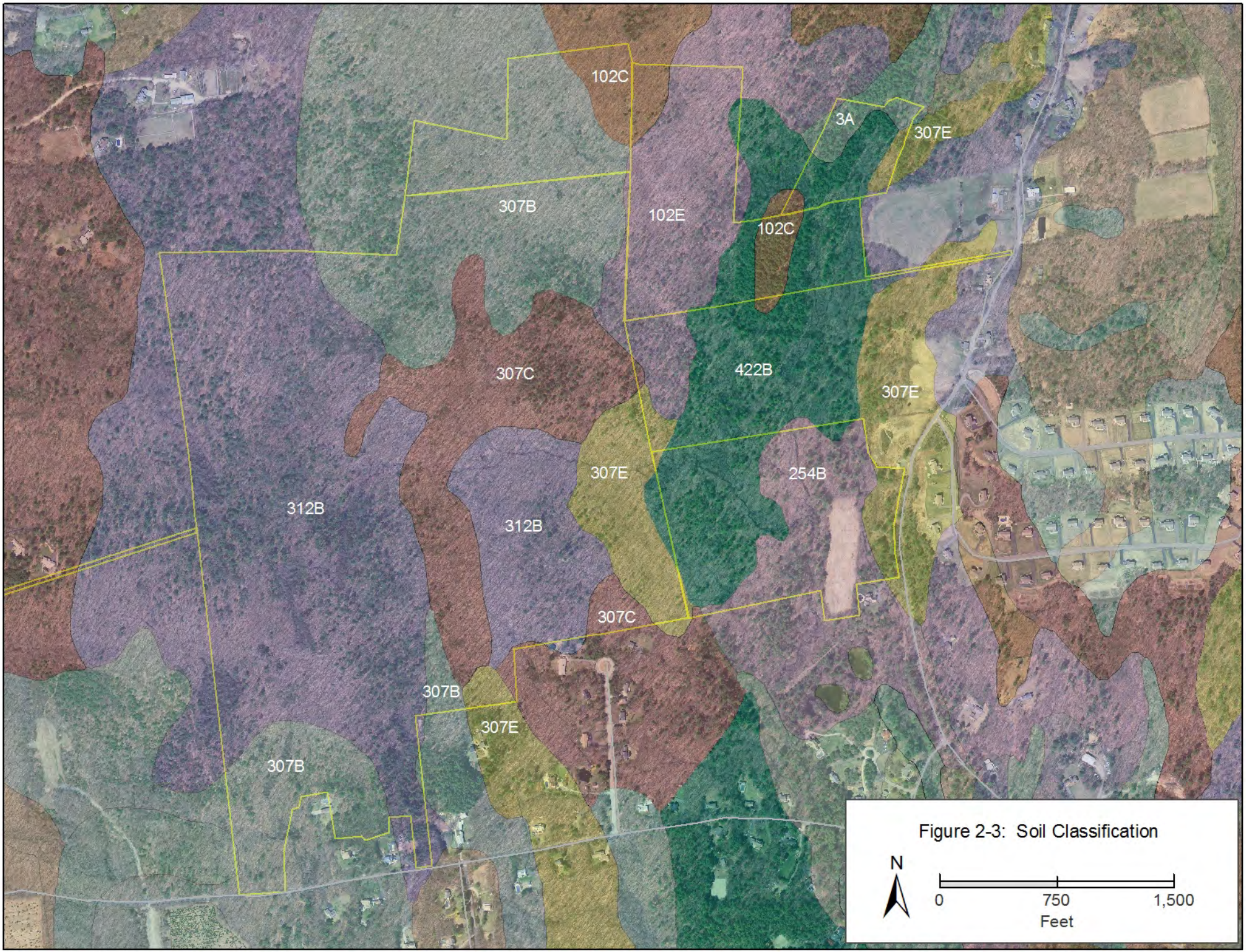


Upton Land Stewardship Committee, April 2017



Upton Land Stewardship Committee, April 2017

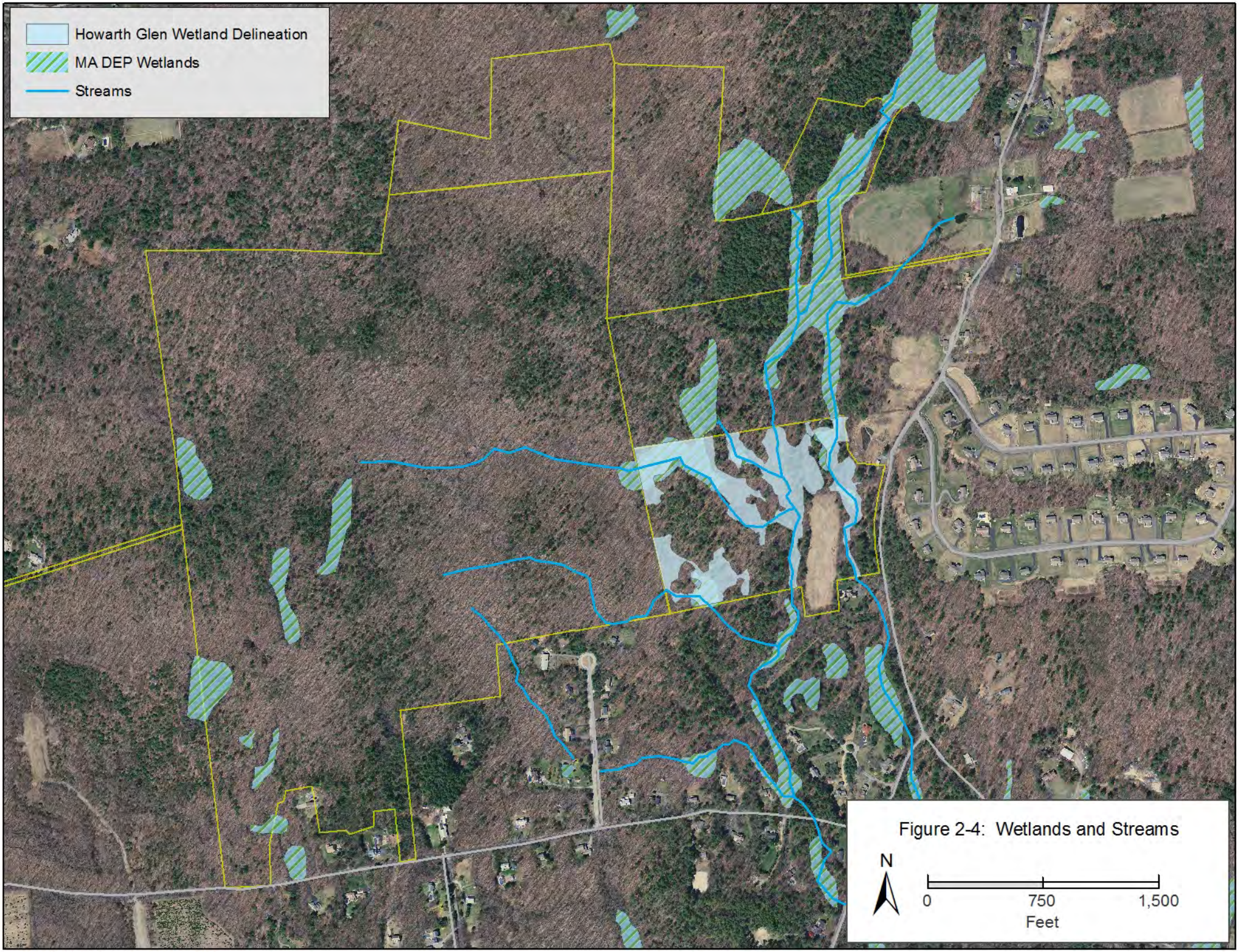
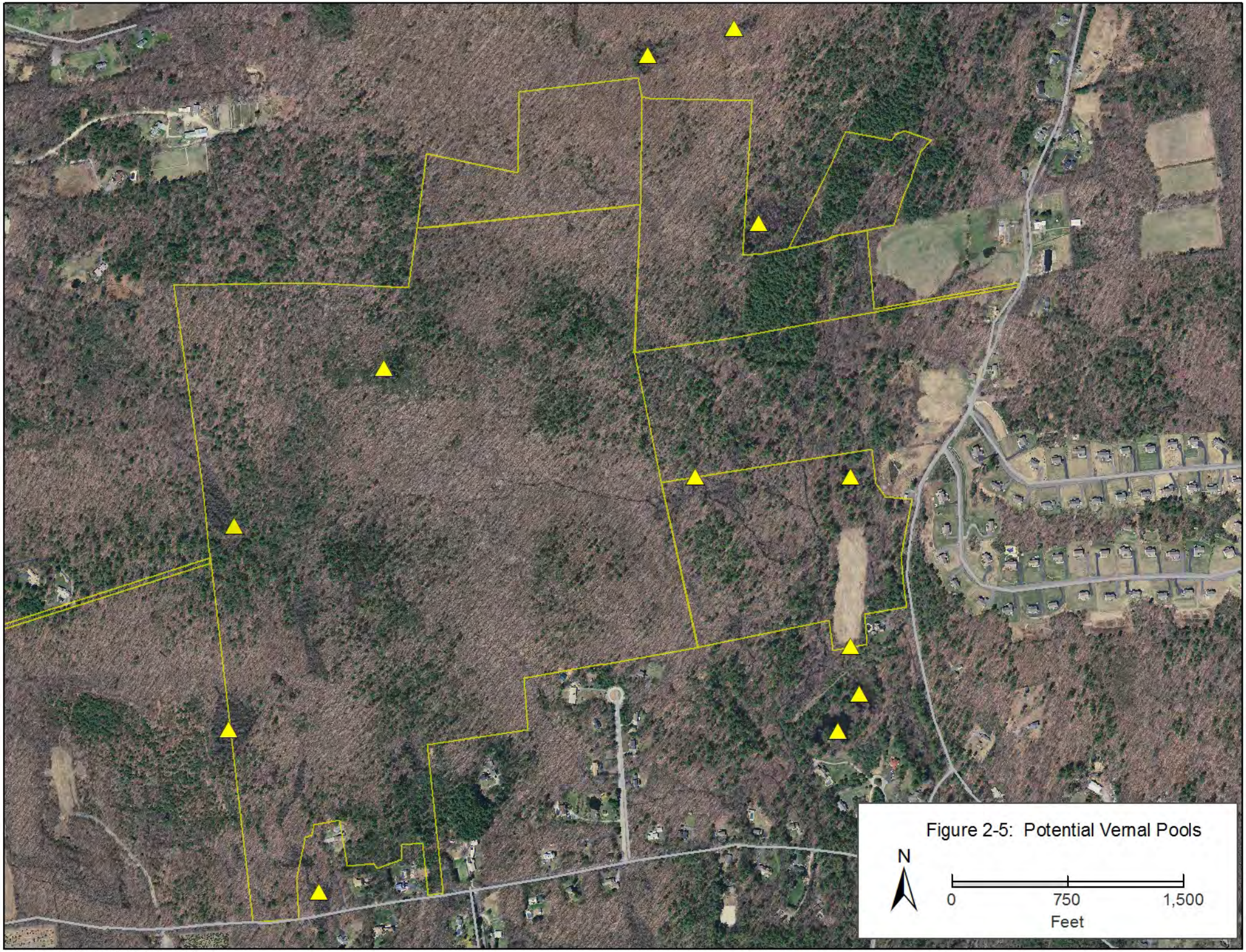
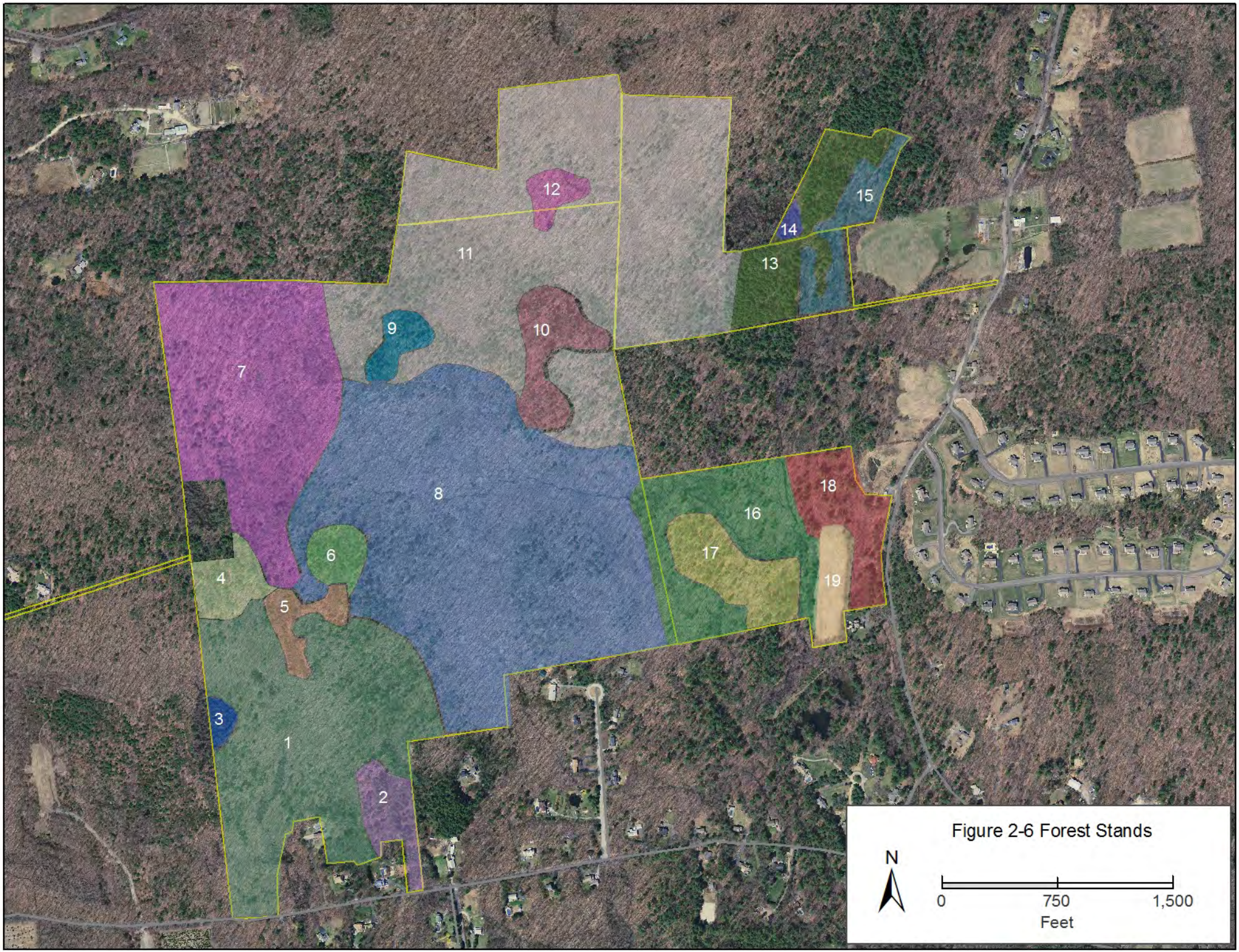


Figure 2-4: Wetlands and Streams

Upton Land Stewardship Committee, April 2017.



Upton Land Stewardship Committee, April 2017.
Source: MA DEP and Upton Conservation Commission



Upton Land Stewardship Committee, April 2017

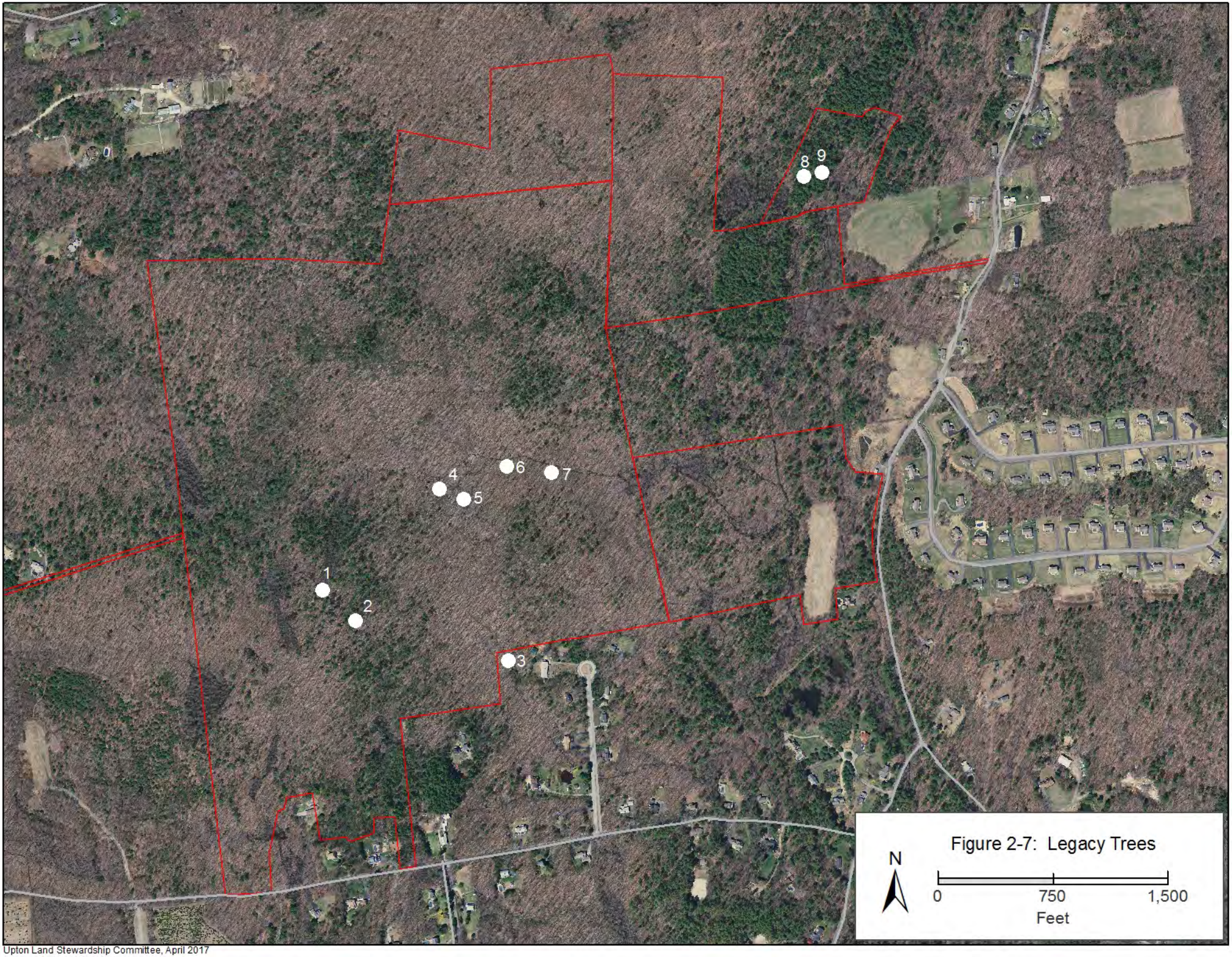
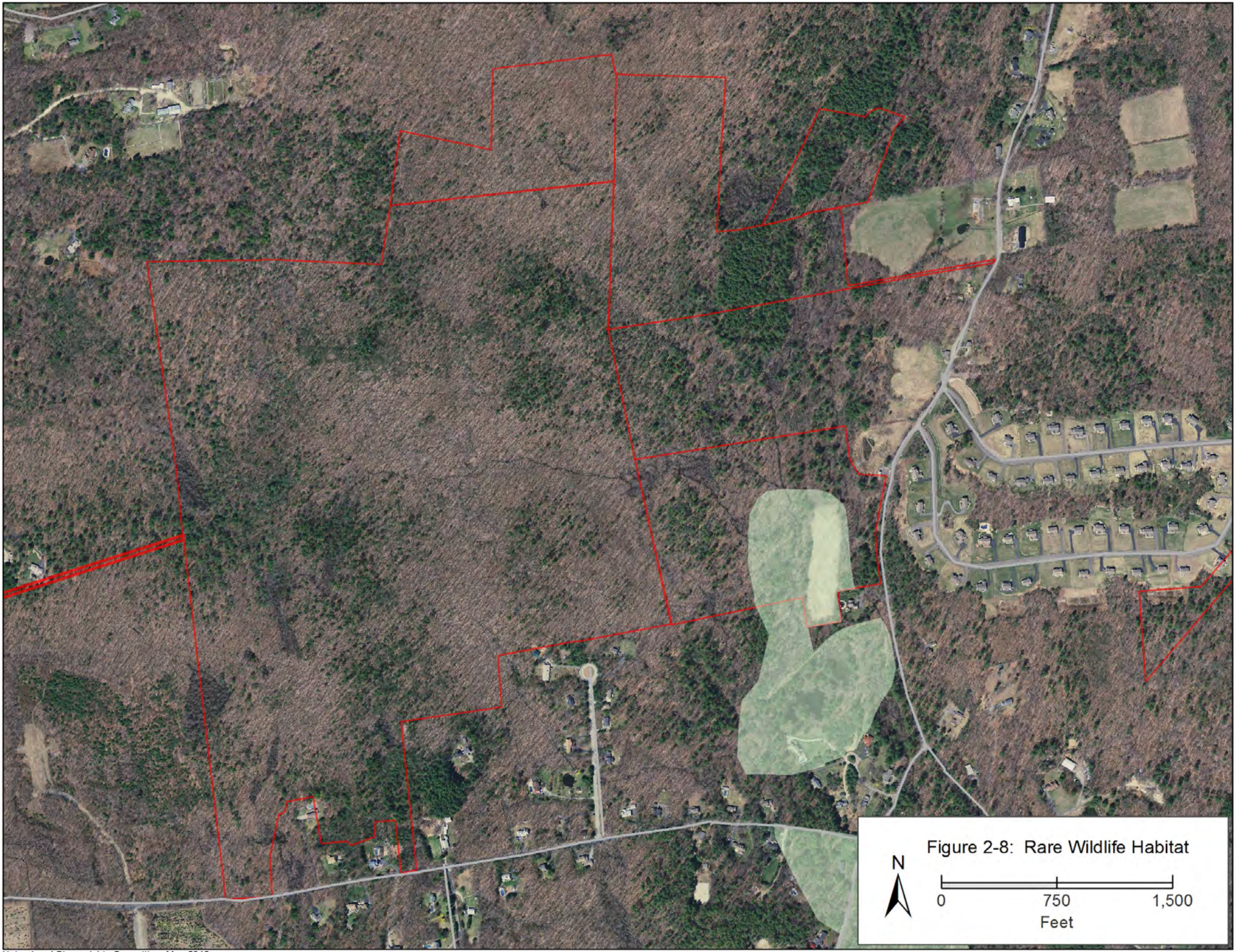
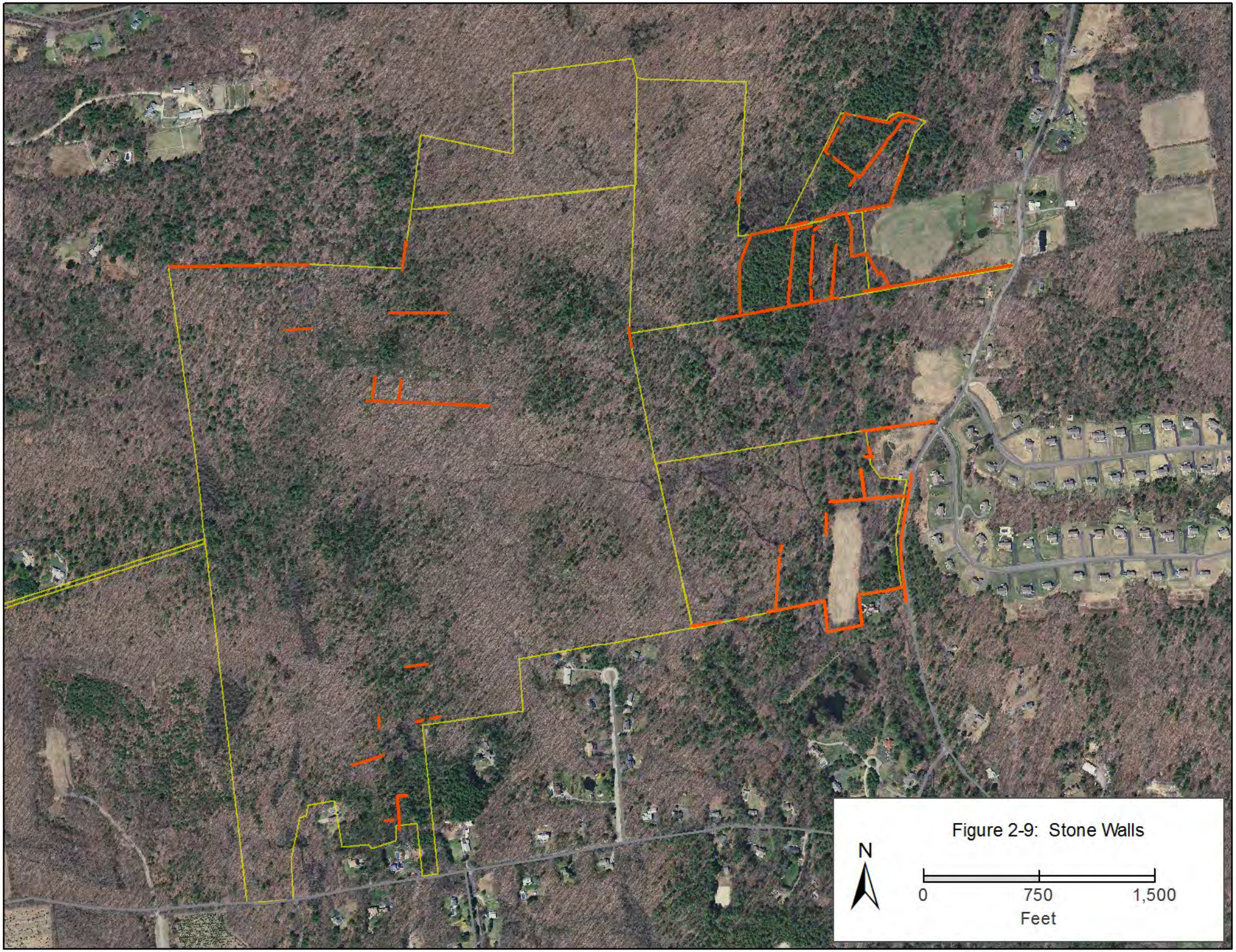


Figure 2-7: Legacy Trees

Upton Land Stewardship Committee, April 2017
Source: Walden Forest Conservation



Upton Land Stewardship Committee, May 2018
Source: MA NHESP



Upton Land Stewardship Committee, May 2017

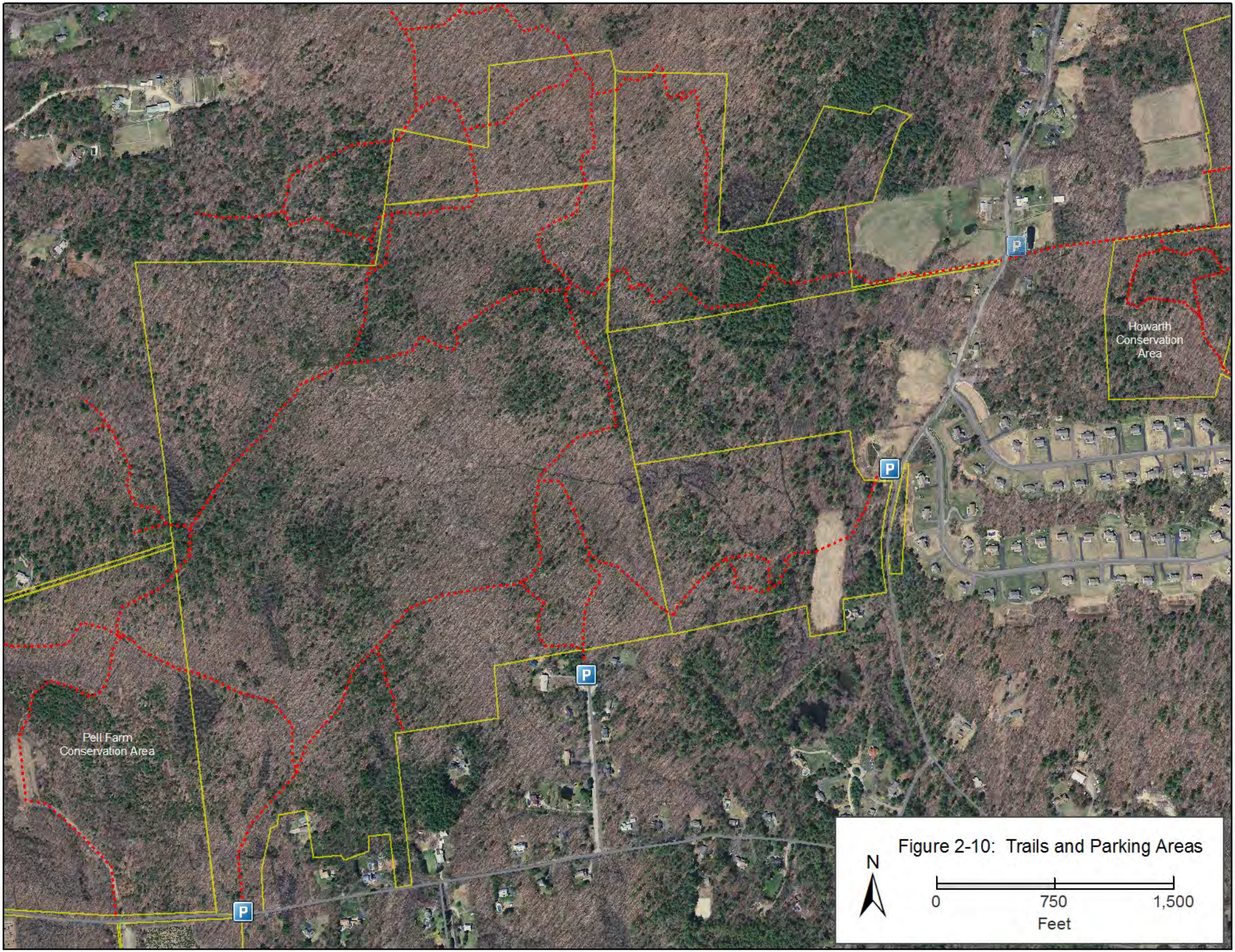


Figure 2-10: Trails and Parking Areas

Upton Land Stewardship Committee, May 2017

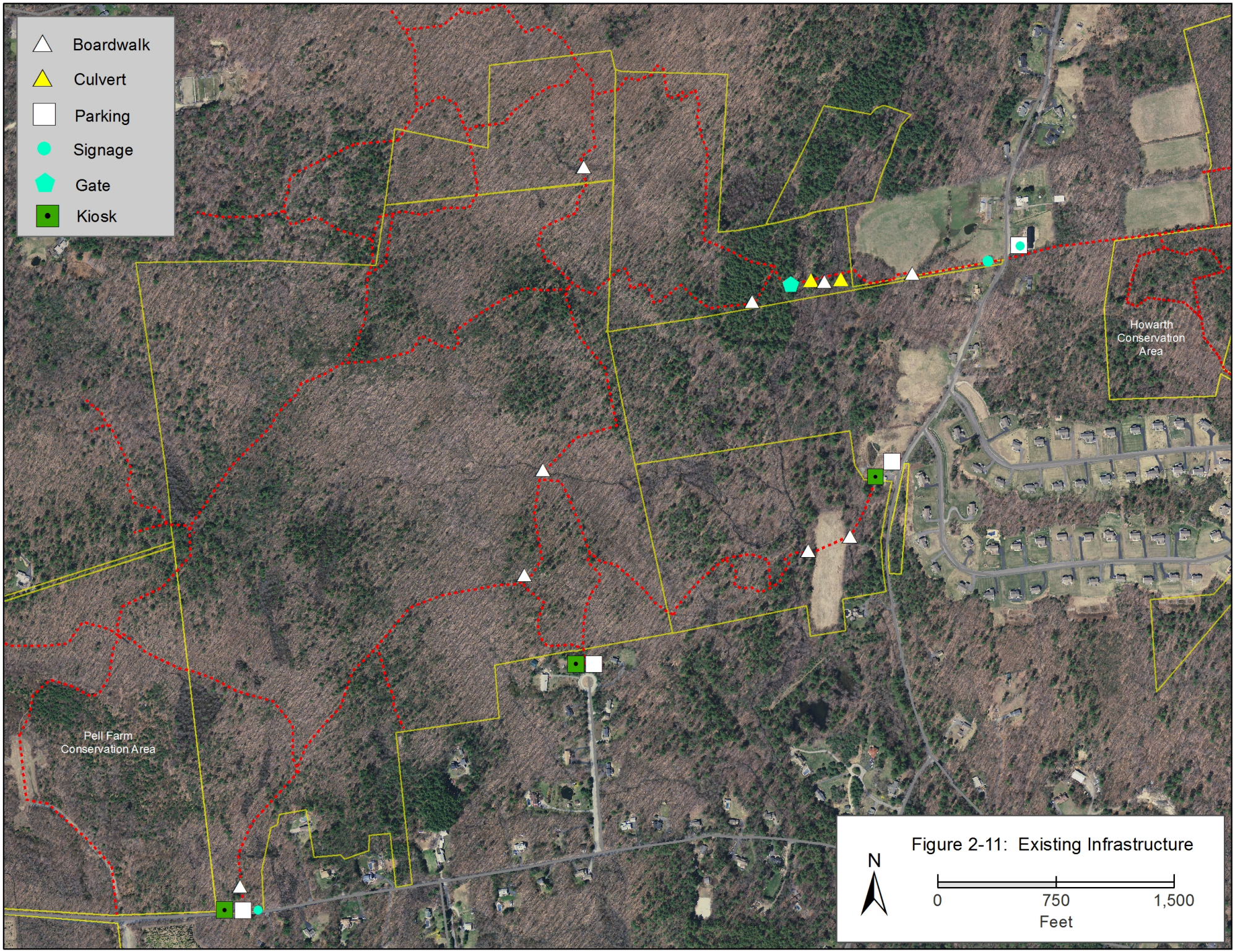
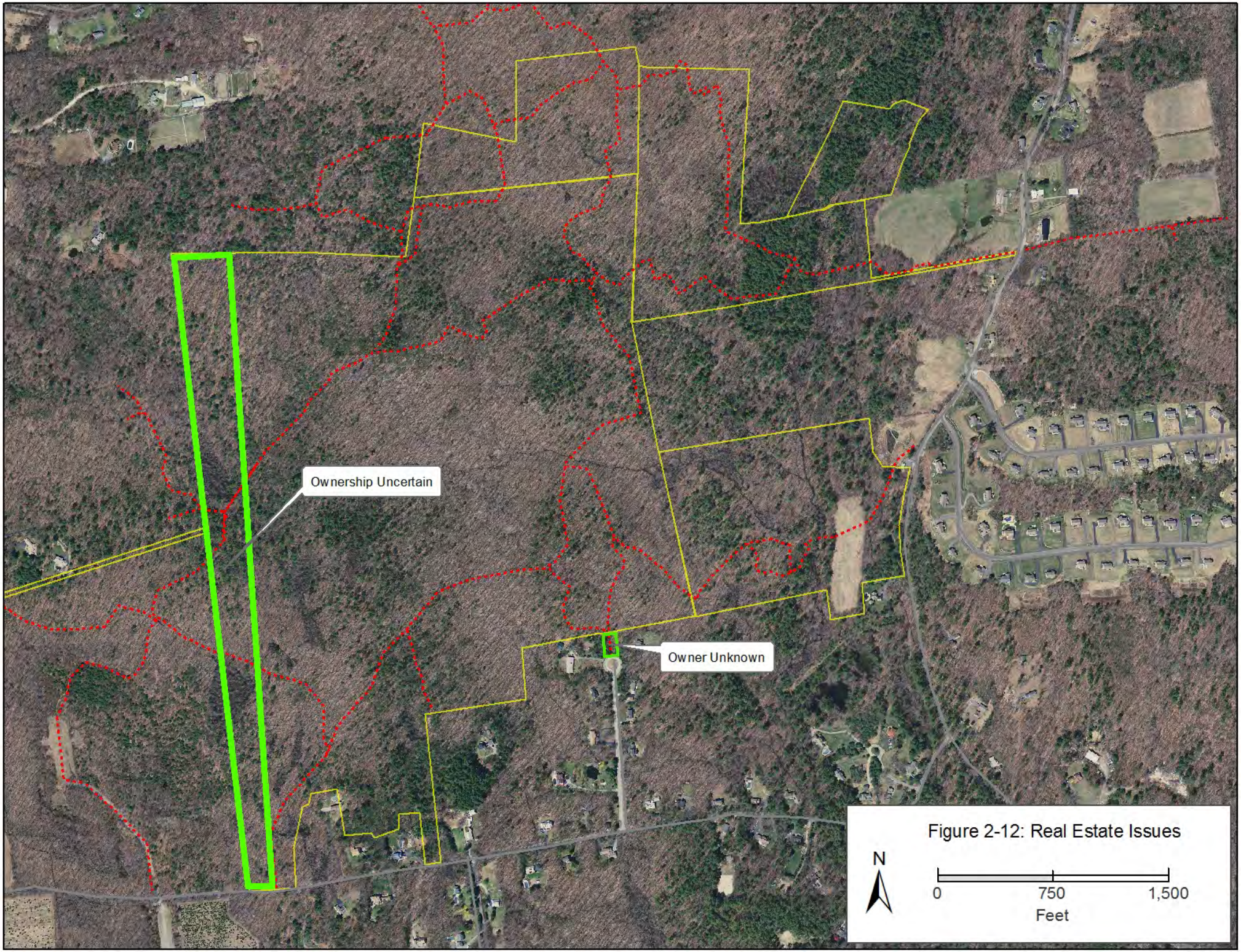
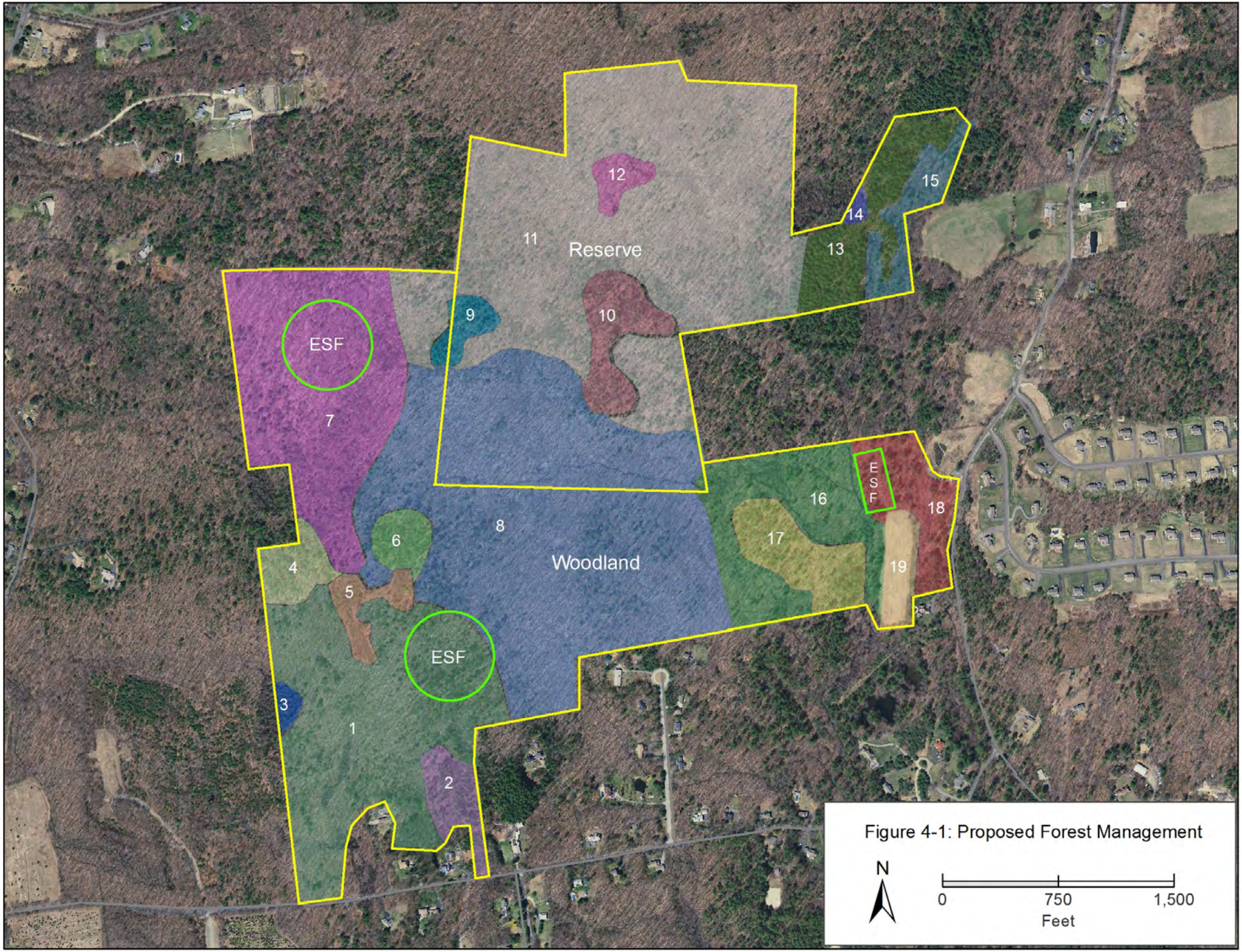


Figure 2-11: Existing Infrastructure

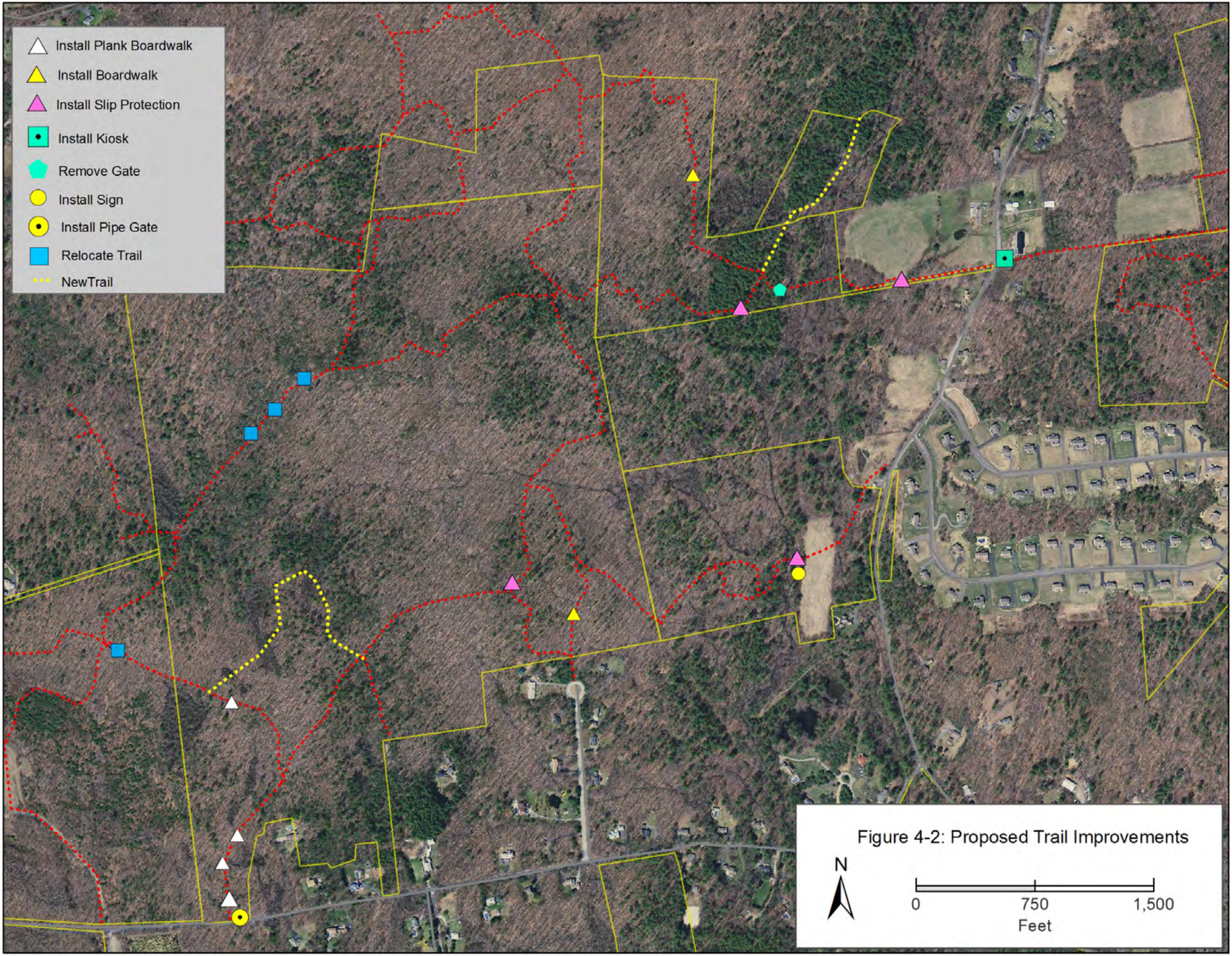
Upton Land Stewardship Committee, Jan 2018



Upton Land Stewardship Committee, May 2017



Upton Land Stewardship Committee, May 2018



Upton Land Stewardship Committee, May 2018

APPENDICES

Appendix A

Upton Forest Management Policy and Guidelines

Upton Conservation Commission
Forest Management Policy and Guidelines

Approved June 12, 2013

The Upton Conservation Commission and Land Stewardship Committee currently manage approximately 800 acres of land. These properties include six conservation areas, Stefans Farm, and Goss Pond. The purpose of this document is to establish general goals and guidance for management of forests on these lands and on properties subsequently placed under the care and custody of the Conservation Commission. This information will guide the Land Stewardship Committee and professional foresters tasked with developing land stewardship and forest management plans for the properties.

The policy and guidelines are intended to promote ecologically, economically, and socially responsible land stewardship and forestry. Primary goals include the following:

- Manage forests to enhance wildlife habitat and biodiversity;
- Manage forests for sustainable production of timber and fuel wood;
- Encourage development of late successional forests and forests with late successional or old growth characteristics;
- Manage forests to mitigate climate change through the forests ability to sequester atmospheric carbon;
- Where possible, manage forests to enhance resilience to climate change;
- Protect surface water resources and aquifers;
- Maintain or create early successional habitat in appropriate locations;
- Utilize Best Management Practices (BMPs) to minimize impacts of forestry operations on wildlife habitat, vernal pools, rare species habitat, soils, surface waters, wetlands, and cultural resources;
- Control occurrence and spread of invasive plants;
- Engage and encourage community forest stewardship. Educate the public and solicit public input regarding management of town owned land;
- Protect and enhance opportunities for passive recreation, outdoor education, and hunting;
- Protect stone walls, ancient ways, and other cultural resources;
- Invest in funding land stewardship activities and land conservation.

The overall objective is to assure the long-term viability of the forests while allowing for responsible human use. We recognize our role as land stewards for future generations, the intrinsic value of a forest independent of human needs, the value of ecological services provided by forests, and the need for forest products. We acknowledge that absolutes are rare and that successful stewardship requires site-specific flexibility, both science-based and commonsense oversight, and adaptive management. Finally, we acknowledge that our understanding of forest ecosystems is limited and responsible management requires a careful,

measured approach, attention to lessons learned, and continued openness to new ideas and scientific information.

Policy and Guidelines

1. Forest Classification

Forests shall be classified in one of the following categories:

Forest Preserve: Parcel with unique or rare forest community (i.e., ranked S1, S2 or S3 by Massachusetts Natural Heritage Program) where no timber or fuelwood or timber harvesting will be conducted unless it is necessary to protect the forest community.

Forest Reserves: Parcels managed primarily to encourage development of late successional forest structure (i.e. old growth characteristics). Harvesting of timber and fuelwood from these areas is permitted only to enhance development of late successional characteristics.

Woodlands: Forests managed for multiple resource uses, including economically and ecologically sustainable production of timber and fuelwood, wildlife habitat, and recreation. Woodlands may contain patch reserves and legacy trees to protect or promote development of late successional characteristics.

Undesignated: Forests which are not categorized as Forest Preserve, Forest Reserves, or Woodlands.

Currently all town-owned forests are classified as "Undesignated". Over time, land stewardship and forest management plans will be prepared and shall classify forestland as Forest Reserves, Forest Preserves, or Woodlands. The long-term goal is to designate no less than twenty-five (25) percent of forest occurring on town conservation land as Forest Reserves.

Because late successional forest structure require decades to develop, designation of land as Forest Reserves is intended to be permanent but may be reconsidered for ecological reasons.

2. Plans

Land Stewardship Plan

A Land Stewardship Plan is a plan developed by or for the Land Stewardship Committee to guide management of a parcel or contiguous parcels for a period to time (usually ten years). The plan will typically include a description of the property, goals, existing resources and land use, problems and needs, an implementation plan, and funding requirements. Plans shall be reviewed and approved by the Conservation Commission. Where appropriate, forest management plans prepared to Massachusetts Department of Conservation and Recreation (DCR) standards maybe

incorporated into land stewardship plans. Where possible land stewardship plans shall combine contiguous town owned parcels into one larger landscape management unit. Management of adjacent public and private land shall be considered when developing land stewardship plans (landscape level approach). Opportunities for partnerships with adjacent land owners should be explored.

A public hearing, advertised in a local newspaper, is required prior to Conservation Commission approval of all Land Stewardship Plans.

Forest Management Plans

Forest management plans shall be developed under direction of the Land Stewardship Committee by a Massachusetts licensed consulting foresters according to MA DCR "Directions for the Preparation of Forest Management Plans".

Goals and objectives for a parcel shall be provided to the forester by the Land Stewardship Committee and/or Conservation Commission. Plans shall be reviewed and approved by Conservation Commission. Where possible the forest management plan shall combine contiguous town owned parcels into one larger landscape management unit. Management of adjacent public and private land shall be considered when developing a forest management plan. Opportunities for partnerships with adjacent land owners should be explored.

A public hearing, advertised in a local newspaper, is required prior to Conservation Commission approval of all Forest Management Plans.

Forest Cutting Plans

Forest management activities and Forest Cutting Plans shall be prepared for bid by a Massachusetts licensed forester and approved by the Land Stewardship Committee and Conservation Commission. Timber harvesting activities proposed in a Forest Cutting Plan (M.G.L. Chapter 132) shall be consistent with approved Forest Management Plans.

Timber harvesting activities will be conducted by a Massachusetts Licensed Timber Harvester

Abutter notification pursuant to state regulations and a public hearing, advertised in a local newspaper, is required prior to Conservation Commission approval of all cutting plans.

3. Resource Protection

When harvesting timber and fuelwood the Land Stewardship Committee and Conservation Commission will use best management practices (BMP's) for sustainable forestry. High priority will be given to "low impact" and "low disturbance" logging, and all logging practices shall be designed to have minimal impact on the forest floor, forest soils, heritage trees, wetlands, streams, vernal pools, rare species habitat, and other sensitive sites.

Recommended setbacks to protect wetlands, vernal pools, and streams are provided in the attached table. These recommendations are intended to be flexible and variances due to site conditions will be considered. Setback guidance may be updated from time to time.

Other protective measures include:

Rare Species Habitat: Massachusetts Forest Conservation Practices for Rare Species, or more stringent protective measures deemed appropriate by the Conservation Commission shall be practiced.

Special Trees: Stewardship and cutting plans shall normally identify, locate by GPS (Global Positioning System) and protect heritage and legacy trees and patch reserves.

Cavity Trees and Snags: Cavity trees and snags shall generally be left standing, consistent with other forest management objectives, unless they pose a safety hazard near established trails.

Invasive Species: Harvested areas shall be monitored for colonization by invasive species and necessary post harvest control measures implemented. All machinery shall be thoroughly cleaned prior to introduction on any parcel in order to prevent introduction of invasive plant species. Herbicides shall be applied by a Massachusetts licensed pesticide applicator pursuant to the Commission's herbicide use policy.

Slash: All slash (coarse woody debris generated by logging operations) shall normally remain on site, but shall not be left higher than 3 feet off the ground. Limbwood greater than 3 inch diameter may be removed for firewood. All slash will be treated in accordance to the Massachusetts Slash Law (M.G.L. Chapter 48, Section 16).

Replanting and Regeneration: Natural regeneration is expected to occur after harvest and replanting will normally not be required. Soil scarification to assist tree regeneration is permitted. Once plant material is available, opportunistic replanting of disease or insect resistant cultivars of American chestnut, American elm, and other native species may one day be included in cutting plans.

Recreational Trails: Avoid and minimize impacts to the existing trail system and trail use during harvesting operations as much as possible.

Cultural Resources: Avoid impacts to stone walls, other stone features, ancient ways, ceremonial stone landscapes, and other cultural resources. An inventory of cultural resources is required prior to development of a cutting plan.

4. Other Provisions

Deed Restrictions

Property deeds shall be reviewed to assure that land stewardship or forest management plans do not violate any recorded deed restrictions.

Consultants

Hiring of Massachusetts licensed foresters and other experts to prepare forest management plans are encouraged. Measures must be taken, however, to assure that unbiased advice is provided. To this end, management plans and cutting plans may be prepared by different entities if the Conservation Commission or Land Stewardship Committee feels this is in the best interest of the town. Full service contracts in which one individual or company is hired to support all aspects of forest management on a parcel or parcels are to be entered into cautiously. Consultants should not benefit directly from the proceeds (i.e. volume) of a timber cut.

Timber Harvesting

No timber harvesting on lands managed by Upton Conservation Committee and Land Stewardship Committee, regardless of volume, may occur without an approved forest management plan and state forester approved cutting plan.

Resident Home Fuelwood Harvests

The Land Stewardship Committee may hold occasional resident home fuelwood lotteries or fuelwood sales for Upton residents. Small fuelwood cuts may occur on parcels without a forest management plan or professionally prepared forest cutting plan with Conservation Commission approval provided such cuts are in accordance with the land stewardship plan.

Income from Timber and Fuelwood Sales

The Conservation Commission shall maintain a revolving fund for proceeds from timber and fuelwood sales. The fund shall be used to support land stewardship activities and possibly land conservation (acquisition).

Sample Town Meeting Article: Land Stewardship Committee "Land Stewardship Fund" – the purpose of this fund shall be to pay costs associated with management of conservation areas and open space parcels owned by the Town, to include, preparation of forestry and land stewardship plans, habitat management, trail development and maintenance, installation and maintenance of parking areas, bridges, boardwalks, fences, kiosks, and signage, and snow removal from parking areas. Monies to be deposited into this fund shall be fees and other receipts received in connection with the sale and harvest of timber and other agricultural or forestry products derived from properties managed by the Land Stewardship Committee. Expenditures from this fund shall be authorized by the chairperson of the Land Stewardship Committee and be limited to xx thousand dollars for fiscal year 20xx; or take any other action relative thereto.

Early Successional Habitat

Creation, expansion, and maintenance of early successional habitat (grassland, shrubland, or young forests) is encouraged. Clearing of areas which may never have been cleared for pasture or farmland should be avoided. Forested areas to be managed to include early successional habitat shall be identified in approved Land Stewardship or Forest Management Plans.

Tree Nurseries

The Land Stewardship Committee may establish a tree nursery for use by town to replace shade trees along roadsides, cemeteries, and other public places. If revolving fund is in place, nursery stock may also be sold to raise funds as described above.

American Chestnut and American Elm Restoration

Efforts and partnerships to establish disease resistant American chestnut and American Elm on town conservation land are encouraged.

Biomass (Bioenergy) Harvesting

Management of town lands for bioenergy production is not authorized. Incidental removal of slash, and non-merchantable trees for wood chips may be permitted so long as it does not compromise other management objectives.

Invasive Species Control

Use of herbicides to control invasive plants following a cut is permitted by a Massachusetts licensed pesticide applicator pursuant to the Commission's herbicide use policy.

5. Policy Review & Reassessment

This document is intended to be reviewed and updated as the Conservation Commission and Land Stewardship Committee gains experience with forest management. A public hearing is required for any proposed updates.

Definitions

Biomass Harvesting

Biomass harvesting refers to vegetation removed from the forest for bioenergy use, including logging slash, small-diameter trees, tops, limbs, and whole trees not considered merchantable in traditional markets.

Biomass Harvest

Refers to the harvest of additional woody material (non-merchantable/poor quality trees) beyond traditional timber harvests to provide the raw material for energy (electrical generation) or heat (wood pellets) production.

Cavity Tree

Dead, dying, or live trees with cavities large enough to provide nesting habitat for birds and mammals. Typically these trees will be larger than 4" dbh and taller than 10 ft

Conservation Management Forestry Practices

Forestry Conservation Management Practices (CMPs) are specific, science-based guidelines for conservation of rare species during forest harvesting. CMPs are somewhat analogous to Forestry Best Management Practices (BMPs), except whereas BMPs focus mainly on protection of water resources, CMPs specialize in protection of rare wildlife. The primary objective of CMPs is to guide harvesting activities such that rare species listed under the Massachusetts Endangered Species Act (MESA) are not impacted in a way that jeopardizes long-term viability of local populations.

Forest Cutting Plan (MA Forest Cutting Practices Act)

Forest Cutting Plan means a plan for the cutting of trees on forest land prepared and submitted in accordance with M.G.L. c. 132, §§ 40 through 46 and 304 CMR 11.00. A forest cutting plan shall meet the requirements for a notice of intent to cut under M.G.L. c. 132, §§ 40 through 46. The Massachusetts Forest Cutting Practices Act was created to ensure the long-term public benefits provided by forests. Applicable to timber harvesting on both public and private forestland, the Forest Cutting Practices Act regulates any commercial timber cutting of wood products greater than 25 thousand board feet or 50 cords on any parcel of land at any one time.

Forest Stewardship Plan (Forest Management Plan)

A forest stewardship plan is a 10-year forest management plan based on defined goals. It documents management options and practices designed to maintain the land in a productive and healthy condition for the next generation. Soil and water quality, wildlife and fish habitat, timber and other wood products, and outdoor recreation are among the many factors taken into account. It recommends actions that will protect or increase the environmental values of the land while yielding desired social or economic benefits. The plan is prepared by Massachusetts licensed forester in accordance with MA DCR standards.

Forest Reserve

Parcels managed primarily to encourage development of late successional (i.e. old growth characteristics). Harvest of timber and fuelwood from these areas is permitted only to enhance development of late successional characteristics.

Forest Preserve

Parcel with unique or rare forest community where no timber or fuelwood harvesting is permitted. Forest communities classified as S1, S2 or S3 by the Massachusetts Natural Heritage Program are considered rare communities.

Fuelwood

Fuelwood, more commonly referred to as firewood or cordwood, is any wooden material that is gathered and used for heating and/or cooking. Firewood is not highly processed and is in some sort of recognizable log or branch form, compared to other forms of wood fuel like pellets or chips.

Heritage Tree

A notable specimen because of its size, form, shape, beauty, age, color, rarity, genetic constitution, or other distinctive features; A prominent community landmark; A specimen associated with a historic person, place, event or period; A tree associated with local folklore, myths, legends, or traditions; A tree that is a remnant of different climate conditions or cultural practices.

Land Stewardship

Stewardship is the recognition of our collective responsibility to retain the quality and abundance of our land, air, water and biodiversity, and to manage this natural capital in a way that conserves all of its values, be they environmental, economic, social or cultural. It is the active long-term management of lands and natural resources by focusing on specific land management practices. Elements of land stewardship include:

- *Establishing goals and objectives for the land and developing measures and metrics of success.*
- *Defining strategies, including science-based actions, to meet goals and abate threats.*
- *Developing the capacity to implement through funding, cooperation, personnel, and commitment.*
- *Monitoring progress towards goals and adjusting actions according to results.*

Land Stewardship Plan

Comprehensive land management plan for a parcel or parcels prepared by or for Upton Land Stewardship Committee and approved by Upton Conservation Commission. The plan may or may not include a MA DCR approved forest management/forest stewardship plan.

Legacy Tree

A legacy tree is defined here as a mature overstory tree which is generally larger and older than most trees within the local landscape. Legacy trees may provide large hollows or cavities that can be used for shelter and nesting sites, have large branches which provide horizontal and vertical structure within the canopy, and have dead branches which provide foraging habitat. They may provide habitat for uncommon insects, lichens, and other biota. They may be of aesthetic value and provide insights into land use history. When they die, legacy trees may provide habitat value as a large snag or downed log on the forest floor for decades.

Old Growth Characteristics

Characteristics that are generally more abundant in old-growth forests include the following: a diversity of tree ages and sizes, including very large trees (> 25 inches in diameter); large downed logs, and gaps in the forest canopy.

Patch Reserve

An array of legacy trees located in a well defined geographic location.

Rare Species

Species of plants and animals that are officially listed as Endangered, Threatened or of Special Concern in Massachusetts and tracked by the Natural Heritage and Endangered Species Program. These are species considered to be at risk, or potentially at risk, of extirpation from Massachusetts, or at risk of global extinction. The Conservation Commission may choose to consider other uncommon species as "rare" when implementing this policy.

Snag

A standing dead or dying tree.

Slash

Slash", tops, branches, damaged trees, slabs, sawdust from milling operations, or debris left from logging or land clearing operations.

Sustainable Forest Management

The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems (definition adopted by Food and Agriculture Organization (FAO)).

Timber

Wood in any of its stages from felling to readiness for use as structural material for construction. In general, it refers to felled trees, later milled into boards referred to as lumber.

Woodland

Forest managed for multiple resources, including sustainable production of timber and fuelwood, wildlife habitat, and recreation.

Setback Guidelines

Resource	Recommended Protection	
	Management Zone (feet)	No Harvest Zone (feet)
Intermittent Stream	25 - 100	0 - 25
Perennial Stream	50 - 100	0 - 50
Wetland (BVW)	0 – 50	-
Isolated Wetland	0 - 50	-
Vernal Pool	100 - 600	0 - 100
Pond	25 – 100	0 - 25

Notes:

1. No harvesting within vernal pools and within 100 feet of vernal pools.
2. Within wetlands and the stream, wetland, and pond management zones maintain greater than 50% basal area and cut no more frequently than once every 20 years. A Variable width management zone (based on slope percent) shall be used when slopes adjacent to resource areas are greater than 10% (see MA Forestry BMP Manual).
3. Within the 100 to 600 foot vernal pool management zone maintain a minimum of 70% of the area greater than 75% canopy cover (or equivalent basal area) composed of trees at least 30 feet tall and a moist forest floor with deep litter and abundant coarse woody debris. Any portion of this zone containing less than 75% canopy cover shall retain at least 10 square feet basal area per acre of dominant/co-dominant tree at least 10 inches dbh. Harvesting shall occur only during frozen or dry ground conditions.
4. Additional restrictions may be required to protect rare species habitat. For purposes of this policy, rare species include but are not limited to, blue-spotted and marbled salamander, and wood and Eastern box turtle.
5. Follow all relevant BMPs recommended in the most recent edition of the MA Forestry Best Management Practices Manual and restrictions required by MA DCR forest cutting regulations.
6. Forest management may be considered in “No Harvest Zones” for eradication of introduced forest pests (e.g., Asian Long-horned beetle) and/or ecological restoration purposes.

Appendix B

2015 Forest Stewardship Plan

FOREST STEWARDSHIP PLAN
North Upton Open Space
Town of Upton

WALDEN
FOREST CONSERVATION
June 2015

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This Forest Management Plan Fulfills Requirements of The Massachusetts':

- Forest Stewardship Program
- Forest Stewardship Council Green Certification

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APPENDIX I	Glossary
APPENDIX II	Upton Forest Management Policy

dcr

FOREST MANAGEMENT PLAN

Submitted to: Massachusetts Department of Conservation and Recreation
For enrollment in CH61/61A/61B and/or Forest Stewardship Program

JUN 17 2015

CHECK-OFFS					Administrative Box	
CH61	CH61A	CH61B	STWSHP	C-S	Case No. 303-10381	Orig. Case No.
cert. ☐	cert. ☐	cert. ☐	new ☒	EEA ☒	Owner ID 504026	Add. Case No.
recert. ☐	recert. ☐	recert. ☐	renew ☐	Other ☐	Date Rec'd 6-17-15	Ecoregion 221Ag
amend ☐	amend ☐	amend ☐	Green Cert ☒		Plan Period 2016-2025	Topo Name Grafton
			Conservation Rest. ☐		Rare Spp. Hab. yes	River Basin Blackstone
Plan Change: ____ to ____			CR Holder Upton		Marbled Salamander	

OWNER, PROPERTY, and PREPARER INFORMATION

Property Owner(s) Town of Upton
Mailing Address Conservation Commission, 1 Main St, Upton, MA 01568 Phone 508-529-6286

Property Location: Town(s) Upton Road(s) Grafton Rd. & North St.

Plan Preparer **Rupert Grantham** -Walden Forest Conservation Mass. Forester License # 371
Mailing Address P.O. Box 3371 Westport, MA 02790 Phone 508-493-3973

RECORDS

Assessor's Map No.	Lot/Parcel No.	Deed Book	Deed Page	Total Acres	Ch61/61A 61B *Excluded* Acres	Ch61/61A 61B **Certified** Acres	Stewshp *Excluded* Acres	Stewshp Acres
4	12	28308	193	22.0	0.0	0.0	0.0	22.0
5	4	47516	123	34.45	0.0	0.0	0.0	34.45
5	5	2977	278	7.44	0.0	0.0	0.0	7.44
7	27	17634	246	202.92	0.0	0.0	0.0	202.92
5	20.65	40532	220	36.57	0.0	0.0	0.0	36.57
				303.38				303.38

Excluded Area Description(s) **(if additional space needed, continue on separate paper)**
None

HISTORY

Year acquired ____ Year management began 2015

Are boundaries blazed/painted? Yes ☐ No ☐ Partially ☒

What treatments have been prescribed, but not carried out (last 10 years if plan is a recert.)?
stand no. n/a treatment ____ reason ____
(if additional space needed, continue on separate page)

Previous Management Practices (last 10 years)

Stand #	Cutting Plan #	Treatment	Yield	Value	Acres	Date
none						

Remarks: (if additional space needed, continue on separate page)

Property Overview, Regional Significance, and Management Summary

The North Upton Open Space (NUOS) is one of a number of forests conserved and managed by the Town of Upton. This forest is made up of 5 conserved parcels including the Warren Brook Watershed Conservation Area, The Howarth Glen Conservation Area, The Whitney Conservation Area (western parcel), and two small, unnamed open space parcels (see Meets & Bounds Map). Together these parcels total 303.38 acres, with 300.1 acres of maturing forest and a 3.3 acre field. The parcels are managed by the Upton Land Stewardship Committee, a subcommittee of the Upton Conservation Commission. Forest management is guided by the Commission's "Forest Management Policy and Guidelines" (dated June 12, 2013 – Appendix II).

Upton is a relatively rural town with much forest. Although approximately 20 percent of the town is protected open space development is threatening forest fragmentation. The North Upton Open Space is one of several large contiguously owned parcels in the town. It abuts additional conservation land in Grafton (the Pell Farm) and hundreds of acres of undeveloped privately owned land.

The Forest is roughly 100 years old. The last 100 years has seen some thinning and harvesting. Stands 7 and 18 were thinned roughly 15-20 years ago. Prior to that we see evidence of scattered thinning in a 1938 areal photo. Stonewalls are found scattered throughout the forest suggesting most of this landscape had been cleared at one time for pasture. Some of the land was mapped as forest in ca. 1830 and may have been managed over the years as a woodlot but not cleared for pasture. A large fire burned part of the area in 1935. Today the forest is healthy, maturing even-aged forest, with good access and a substantial amount of timber in the form of cordwood and sawtimber that could be removed. The timber industry is still strong in the region and management of this forest would be an important addition to the sustainably managed land-base supporting that industry, the local economy and local jobs.

The forest is characterized by tall, sawtimber-size oak. Stands 1, 7, 8 & 11, together comprising 260 of the 303.38 total acres, make up a large area of well-drained, mostly easily accessible, upland oak forest. Stand 8 supports the handsomest, tall, straight, large diameter oak, maple and other hardwoods. The western edge of stand 11 has steep slopes with interesting cliff and ledge terrain. White pine is quickly establishing itself in this hardwood forest. There are only a couple small mixed oak and pine stands now but pine regeneration is fairly wide-spread and the overall character of this forest will change dramatically in the next 50 years. Small wetland stands are found throughout the landscape adding species and habitat diversity while not adversely effecting accessibility. Warren Brook passes through the Whitney and Howarth Glen Conservation Areas, and the NUOS is drained by several intermittent tributaries of the brook.

Overall this forest is somewhat homogenous in terms of structural and biological diversity. Walking acre after acre of pure, even-aged oak makes this point. But this forest is at a turning point. It is right at the age where it will start to naturally break up, where more trees will naturally mature and decline, or succumb to disease or pests and die. As trees die, snags and canopy gaps will be created. Course woody debris on the forest floor will increase the diversity of micro site habitats. Forest gaps will provide good early-successional habitat and new young, resilient age-classes of trees.

Wetland habitats make up a small part of this forest but they are scattered throughout. Vernal pools occur on the Howarth Glen and Warren Brook Conservation Areas and several others occur nearby on adjacent privately owned property. Patches of thick pine regeneration provide a measure of winter cover for larger animals. This forest supports unbroken forest habitat for forest interior birds. The Howarth Glen Conservation Area is mapped as rare species habitat for marbled salamander. Invasive plants are uncommon, and occur mostly along field edges at the Whitney and Howarth Glen Conservation Areas. Some caterpillar herbivory was noted and this should be carefully monitored. Various combinations of the gypsy moth caterpillar, forest tent caterpillar and recently, the winter moth caterpillar, have caused and are causing significant tree and forest-wide mortality across southeastern Massachusetts.

Management of The North Upton Open Space will be focused on assisting this forest in its transition to a more mature, diverse and resilient multi-aged structure. The single tree and group selection method has been prescribed throughout to meet this goal. In the short term we can remove considerable volume and value while meeting this goal. Light improvement thinning will help make the healthiest trees more wind firm and provide them with room to grow. Harvested forest patches will start new cohorts of trees and provide early-successional habitat. Creating snags and intentionally leaving large-diameter course woody debris on the forest floor will specifically address these important components of late-successional forest while allowing for commercial harvesting. Slowly thru the combination of natural disturbances and active management that mimics natural small-scale disturbances, this even-aged forest will turn into a diverse multi-aged forest. Even-aged management techniques will be employed to maintain a component of larger, 3-5-acre, early-successional patches. Most of the larger stands will include a no-cut reserve as a way of comparing managed and unmanaged forest.

Landowner Goals

Please **check** the column that best reflects the importance of the following goals:

Goal	**Importance to Commission**			
	High	**Medium**	**Low**	**Don't Know**
Enhance the Quality/Quantity of Timber Products		x		
Generate Immediate Income			x	
Generate Long Term Income		x		
Produce Firewood			x	
Protect Wetlands and Vernal Pools	x			
Promote Biological Diversity	x			
Enhance Habitat for Birds	x			
Enhance Habitat for Small Animals	x			
Enhance Habitat for Large Animals	x			
Improve Access for Walking/Skiing/Recreation	x			
Maintain or Enhance Privacy/Visual Buffers	x			
Improve Hunting or Fishing		x		
Preserve or Improve Scenic Beauty	x			
Protect Water Quality	x			
Protect Unique/Special/ Cultural Areas	x			
Maintain or Enhance Carbon Storage	x			
Protect/Enhance Old Growth Characteristics	x			
Identify and Protect Legacy Trees	x			

1. In your own words please describe your goals for the property:

_____

_____

Stewardship Purpose

By enrolling in the Forest Stewardship Program and following a Stewardship Plan, I understand that I will be joining with many other landowners across the state in a program that promotes ecologically responsible resource management through the following actions and values:

1. Managing for long-term forest health, productivity, diversity, and quality.
2. Conserving or enhancing water quality, wetlands, soil productivity, biodiversity, cultural, historical and aesthetic resources.
3. Following a strategy guided by well-founded silvicultural principles to improve timber quality and quantity when wood products are a goal.
4. Setting high standards for foresters, loggers and other operators as practices are implemented; and minimizing negative impacts.
5. Learning how woodlands benefit and affect surrounding communities, and cooperation with neighboring owners to accomplish mutual goals when practical.

Signature(s): ---------- **Christine Scott, Chair Upton Conservation Commission** ---------- **Date**

Stewardship Issues

The overarching management goal for this property is to support a maturing, diverse, multi-aged forest cover. By using techniques designed to mimic small-scale natural disturbances management will be focused on assisting the forest in this natural transition to a mature, late-successional structure. This will have a number of impacts on the forest. Revenues will be generated by the harvest of forest products. Revenues that can be used for the benefit of management, public access and long-term ecological health of this forest and other town forests; the average health and vigor and quality of trees will improve by removing poor growing stock; patch cuts will greatly improve the diversity of forest structure by fostering regeneration, and new cohorts of trees; management of forest stocking and the levels of sunlight hitting the forest floor will increase diversity of tree species; this will in turn improve habitat values and increase habitat types thereby attracting a greater number and diversity of wildlife.

Habitats:

There are a number of general and specific habitat values provided by this property.

Habitat Types

	Multi-aged Forest	Upland Forest	Wetland Forest	Possible Vernal Pool	Early-Successional	Forest Edge	Deeryard/ winter cover
Stand 1		x	x	x			x
Stand 2	x	x					x
Stand 3			x	x	x		
Stand 4	x	x					x
Stand 5			x	x	x		
Stand 6			x	x			x
Stand 7		x			x		x
Stand 8		x	x	x			
Stand 9		x					
Stand 10		x					x
Stand 11		x					
Stand 12			x	x			
Stand 13		x					x
Stand 14			x	x			
Stand 15			x				
Stand 16	x		x	x		x	
Stand 17	x	x					x
Stand 18		x	x	x		x	

Forest Age Structure:

Most stands on this property are around 100 years in age and are even-aged. This forest is dramatic in the large acreage of relatively similar and relatively homogeneous upland oak forest. Most stands if not all are replacement forests, having become established on abandoned pasture. Most of the stands supporting some multi-aged forest characteristics are stands that have seen some thinning in the past. Stands 2 and 4 were thinned approximately 80 years ago. The residual stand from that thinning, along with the new cohorts of trees that have become established in the last 80 years, have given those stands increased structural diversity. Stands 7 and 18, saw some thinning in the last 15-20 years and show more

of a 2-aged structure. As these stands mature over the next few decades those age-classes will mature and new age-classes will naturally become established and can be encouraged through further thinning.

Even-aged forests are defined as having two or less established age-classes. **Uneven-aged** or **multi-aged** is defined as three or more established age-classes. **Even-aged forest** habitat varies depending on the forest type and region. Even-aged forests are generally young (under100 years) and have grown up from abandoned field or from a large-scale disturbance like clear-cutting, crown fires or hurricane winds. General habitat amenities include large living trees and some dead standing trees with dens and cavities for nesting and feeding, and a number of hard and soft mast producers in the overstory, midstory and understory. Vertical diversity, created by the different living and feeding levels, is somewhat limited by the even-aged structure of the overstory, and the corresponding limit to tree age-classes. **Multi-aged forest** habitat varies depending on the forest type and region, but is generally more diverse than even-aged forests. Multi-aged forests are generally older (>80 years), and are formed as even-aged forests start to lose trees and form gaps in the canopy. These gaps become patches of new age-classes. The development of gaps, and new age-class patches, greatly increases the vertical diversity of a forest. Habitat amenities include large living and dead trees with dens and cavities for nesting and feeding, and a number of hard and soft mast producers in the overstory, midstory and understory. The gaps provide patches of vigorous young tree, bush and herbaceous growth, and open areas for birds and bats to feed.

Upland Forest Habitat:

Upland forests can provide a number of different habitats. Habitat Types include hardwood or softwood cover, deeryard/winter cover habitat, edge and early-successional habitat. One of the most important habitats provided by uplands is **Wetland supporting habitat.** This habitat is provided by uplands that are adjacent to wetland communities. Wetlands are the critical spawning grounds for many small animals but the neighboring uplands are where most of those same creatures spend the majority of their life cycle.

Wetland Forest Habitat:

Forest Wetlands contain vital habitat and perform essential ecosystem functions. Wetlands can be highly variable. Most serve the function of collecting water, allowing sediments to be deposited, and promoting biological filtration of both water and sediment. Wetland also hold and process flood waters that might otherwise damage property. Wetland habitat provides spawning grounds for vast numbers of invertebrates, amphibians and reptiles. This in turn attracts many predators that feed on these creatures and their eggs.

Wetlands can be managed but only under specific conditions. Rutting and compaction of soils, as well as disruption of water flow and soil penetration are the biggest dangers when operating in wetlands. Heavy equipment should only access wetlands with an approved cutting plan and when grounds are either very dry (usually late summer months) or frozen.

Possible Vernal Pool Habitat:

Vernal pools are areas that hold water for at least a few months, most years. These depressions dry seasonally and cannot support fish. The lack of fish predation creates an ideal spawning ground for a number of reptiles and amphibians. Vernal pools are vital wetland habitat and can be certified with the MA Natural Heritage Program by identifying indicator species. An area would be confirmed as being a vernal pool by identification of specific indicator species.

A no-cut/no-activity buffer of at least 150 feet should be maintained around vernal pools.

Early-Successional Habitat:

Early-successional habitat is one of the most biologically diverse types. 'Early-successional' refers to this cover type being among the first or youngest that could occupy a site. As trees mature and the vertical structure of the site changes, so does the essential character and habitat values of that site. Early-successional cover types are more diverse because they contain most of the tree species that will be present in later years, plus, pioneer tree species that grow fast and die-out of more mature forests, and a diversity of herbaceous, shrub and bush species.

This habitat can be managed for by implementing small group selection harvesting. Group selections a.k.a. patch cuts, implemented in conjunction with single tree selection improvement thinning, is the best way to foster mature, multi-aged forest structure.

Forest Edge Habitat:

Edge habitat, much like early-successional habitat, is one of the most diverse types. The edge is a transitional zone between forest and comparatively open land, and contains some of the habitat values of both. Forest habitat values include full canopy cover, den, cavity, nesting, perching and dead standing trees, as well as hard mast (oak/hickory) and soft mast (black gum, cherry) production. Open land offers an abundance of light for grasses, sedges, herbaceous plants, fruiting shrubs and young regenerating tree species.

Deeryard/Winter Cover Habitat:

Winter cover habitat is generally best in thick, young conifer stands but can be provided by American holly or just thick brush. The thick cover reduces the amount of wind and precipitation that reaches the forest floor and can maintain warmer temperatures than surrounding forest or open land. This habitat can be managed for by promoting thick softwood regeneration and is usually a byproduct of successful white pine management.

Late Successional or "Old Growth" Forest Characteristics:

Habitat components that will be managed for in all stands include dead standing trees (snags) and large-diameter course woody debris (CWD). Snags provide important habitat components in the form of feeding, nesting and perching sites, and are indicative of mature forests. Specific targets for numbers of snags per acre are not available, however a baseline target of >10/acre ensures that this habitat component is present and actively contributing to the forest ecosystem. Like snags, course woody debris is indicative of mature forests. Emphasis is placed on large diameter logs. These logs rot over many years providing habitat for microbes including mycorrhizal fungi that break down woody material into nutrients, and directly assist plants in uptake of water and nutrients. Specific targets are not available but regional field evidence suggests 10 cords per acre with average diameters over 10 inches as a baseline. As much as anything, these numbers provide information, at a glance, along with tree diameters and basal area, of the relative maturity of various stands on a property.

The chart below shows the current distribution and volume of snags and CWD. The low levels of both highlights the homogeneity and structural immaturity of this forest.

	St-1	St-2	St-3	St-4	St-5	St-6	St-7	St-8	St-9	St-10	St-11	St-12	St-13	St-14	St-15	St-16	St-17	St-18	Targets
Snags	0	0	0	0	0	0	4.44	0	22.2	0	5.55	0	5.55	0	0	0	0	0	10/acre
Snag Diam	n/a	n/a	n/a	n/a	n/a	n/a	11	n/a	15	n/a	12	n/a	12	n/a	n/a	n/a	n/a	n/a	>10 inches
CWD cds/ac	1.7	2.8	0.0	4.4	0.5	2.8	2.7	3.0	2.0	1.1	2.6	0.7	4.6	1.2	1.4	0.4	6.3	1.4	10 cds/acre
CWD Ave/D	5.6	8.1	0.0	6.9	4.1	4.9	5.7	5.5	7.5	4.6	5.0	4.8	6.6	7.8	4.8	2.4	8.1	3.6	>10 inches
# tally points	4	2	1	2	2	2	5	9	1	2	8	1	4	1	2	2	2	2	

The number of inventory points has been listed on the bottom of the chart. There are a few stands that only had 1 tally point. This is not enough data to provide statistically reliable information. These stands are either 1-2 acre unmanageable swamps or other small anomalies in forest composition, stands too small to effectively manage separately. These stands were not delineated so much as to enable management, as to highlight small areas of diversity.

Carbon Dioxide (CO2) is the most abundant greenhouse gas in the world. Societal use of fossil fuels has increased atmospheric CO2 to levels never seen before by human beings. Rapid reduction of greenhouse gas emissions is vital to avoiding rising temperatures and climate change. Carbon is readily sequestered by a number of sources including terrestrial plants. Forests sequester significant amounts of carbon. The protection of forestland, the promotion of healthy, vigorous, mature forests, and the harvesting of wood products are all important tools in increasing the earths ability to sequester and store carbon (Stern Review on the Economics of Climate Change 2006).

The North Upton Open Space carbon inventory was based on a variable-radius plot sampling method, using a 10-factor prism. All merchantable timber was tallied up to a minimum 4-inch top end diameter. Data collected includes: DBH (Diameter at Breast Height, 4.5 ft), SED (Small-End or Top Diameter), and Number of 8-foot pieces of merchantable wood. Using the Area of a frustum (a cone with different diameter top and bottom), we are able to calculate total volume of merchantable wood in cubic feet. Course woody debris (CWD) was also tallied using a 25-foot fixed radius plot. All sticks greater than 3-feet in length and greater than 3" in diameter were tallied.

Total Hardwood in Forest:	943,486	Cubic Feet
Total Softwood in Forest:	150,285	Cubic Feet
Total CWD in Forest:	61,741	Cubic Feet

We can calculate total tree biomass (Cubic Feet) using a ratio of merchantable wood to total live tree biomass (roots, trunks and tops) developed by Birdsey et. al. 1996. Using the Specific gravity of hardwood and softwood species we can calculate pounds of carbon per cubic foot of wood. Table 2 below shows the calculations. Region = NE & MA. Forest Types used = Pines, Oak-hickory, and Maple-beech-birch.

Table 2. Basic Factors for converting merchantable wood yield to carbon yield, by species. The basic formula is (merchantable timber volume (ft^3)) * (Multiplier) = (Total wood volume above and below ground). (Total wood volume) * (lbs. C per cubic foot of wood) = (lbs C in total wood volume).

Region	Forest Type	a. Specific Gravity	b. Lbs. per cu. foot (a*62.4)	c. Multiply from timber to Total biomass	d. Percent Carbon	e. Lbs C per cubic foot (b * d)
SE	Loblolly Pine	0.47	29.33	1.682	0.531	15.57
	Longleaf Pine	0.54	33.70	1.682	0.531	17.89
	Oak-Hickory (SI = 79)	0.61	38.06	2.233	0.479	18.23
NE & MA	Pines	0.41	25.58	2.193	0.521	13.33
	Spruce-fir	0.37	23.09	2.193	0.521	12.03
	Oak-hickory (all)	0.61	38.06	2.140	0.498	18.96
	Maple-beech-birch	0.61	38.06	2.140	0.498	18.96
NC	Pines	0.41	25.58	2.514	0.521	13.33
	Spruce-fir	0.37	23.09	2.514	0.521	12.03
	Oak-hickory	0.61	38.06	2.418	0.498	18.96
	Maple-beech	0.58	36.19	2.418	0.498	18.02
	Aspen-birch	0.46	28.70	2.418	0.498	14.29
West	Douglas-fir	0.45	28.08	1.675	0.512	14.38
	Ponderosa pine	0.38	23.71	2.254	0.512	12.14
	Fir-spruce	0.35	21.84	2.254	0.512	11.18
	Hemlock-Sitka sp.	0.43	26.83	1.675	0.512	13.74
	Lodgepole pine	0.42	26.21	2.254	0.512	13.42
	Redwoods	0.42	26.21	1.675	0.512	13.42
	Hardwoods	0.38	23.71	2.214	0.496	11.76

Source: Birdsey 1996 (See also Appendices 2 & 3, Sampson and Hair 1996)

Carbon Inventory and Analysis Continued…

The chart below shows the calculations. Total merchantable wood is multiplied by the specific hardwood and softwood multipliers (2.140 & 2.193 respectively). CWD is not included in this calculation. This gives us volume of total forest biomass (merchantable wood, roots and tops & CWD). Total hardwood and softwood biomass numbers are then multiplied by the relevant conversion for metric tons of carbon per cubic meter. This gives us total metric tons of carbon in forest. To convert carbon to carbon dioxide we multiply the carbon by 44/12, the ratio of the molecular weight of carbon dioxide to carbon. Annual growth, and thus annual sequestration, is based on the total biomass of the forest growing at 3% per year. 3% is a common and conservative number used for annual forest growth in New England.

Total CWD & Merchantable Wood In Forest

Total in CuFt		
	Hardwood	943486
	Softwood	150285
	CWD	61741
Total in m3		
	Hardwood	26716
	Softwood	4256
	CWD	1748
Total Exrapolated for Biomass (m3)		
	Hardwood	57173
	Softwood	9332
	CWD	1748
Total Carbon (Metric Tons)		
	Hardwood	28586
	Softwood	3733
	CWD	874
	TOTAL	33194
Total CO2 (Metric Tons)		
	Hardwood	104817
	Softwood	13688
	CWD	3205
	TOTAL	121710
Annual Sequestration of Live Wood (Metric Tons @3%)		
	Carbon	970
	CO2	3555

The forest is still young and will increase in biomass for many years. There are debates about how total biomass and forest sequestration are affected as forests mature. Over time it is possible that the forest reaches a relatively stable point where new carbon sequestered equals carbon released through decomposition.

Forest management can have a significant affect on the amount of carbon the forest has sequestered, and the sequestration rate. Harvesting is a direct removal of biomass from the system. Thinning can increase the growth rates and carbon sequestration rates. Future harvests can be tallied and those removals from the system adjusted for.

Snags, dead standing trees, make up an additional carbon pool that is not included in the carbon calculations. Snags are an intermediary pool between the live tree and CWD carbon pools. Management is designed to increase the number of snags per acre.

Management of the forest is designed to increase the amount of CWD. This will be in the form of large diameter wood intentionally left on the forest floor, the creation of snags thru girdling live trees, as well as slash, the tops of trees cut to lie low on the ground.

Wood products:

Carbon stored in wood that is harvested can be quickly released back into the atmosphere, or can become a good long-term carbon sink, depending on the final product. This chart gives an estimated half-life of forest products. The half-life is the time after which half the carbon has been released back into the atmosphere. Wood products removed from the North Upton Open Space will most likely include medium and high valued lumber for home building and various carpentry projects, low-valued lumber for pallets, and fuelwood. The former will have one of the longest half-lives while the later will have half-life of roughly 4-6 months.

Table 5.4—Assumed duration of carbon sequestration in end uses of wood and paper.

End use	Half-life of carbon (years)
Single-family homes (pre-1980)	80
Single-family homes (post-1980)	100
Multifamily homes	70
Mobile homes	20
Nonresidential construction	67
Pallets	6
Manufacturing	12
Furniture	30
Railroad ties	30
Paper (free sheet)	6
Paper (all other)	1

Table 5.4:
Carbon Sequestration in Wood and Paper
Kenneth E. Skog, USDA Forest Service, Forest Products
Geraldine A. Nicholson, Maryland Energy Administration, 2000

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	1	OM4A	12.1	12.8	125	6000 HW BF 1100 SW BF	24 HW CDS 2 SW CDS	60

Stand 1 is an even-aged, overstocked, upland mixed oak stand. This stand is nearly pure oak (90%), dominated by red oaks including northern red, black and scarlet oaks. White pine is the chief associate (8%), with other hardwoods such as red maple, hickory, black gum, sassafras and yellow birch present in locally wetter patches. Height growth and form quality are good in this stand with the overall character being one of tall, straight, sawtimber size oaks. Trees are overstocked and crowded. This stand is even-aged and with little structural or species diversity. There are few snags and little downed woody debris, both characteristics of maturing forests. Regeneration is patchy and moderate overall. American chestnut saplings are everywhere. Growing to about 4-5 inches in diameter before succumbing to the chestnut blight and dying, only to sprout again. Patches of white pine sapling and pole regeneration are scattered throughout and their distribution can be seen on the Aerial Photo Map. Elsewhere regeneration is dominated by scattered red maple with some sugar maple, black birch, and oak mixed in. It is characteristic across the region to have pure oak overstory with almost pure maple understory. Oak does not regenerate in full or even partial shade while maple is very shade tolerant. This is a major indicator of past land use. This stand is probably over 100 years old and almost certainly became established after a large-scale disturbance such as clearcutting or pasture abandonment. The 1938 ortho photos show some patchy thinning, primarily in northeastern areas now including white pine. In most areas regeneration is not sufficient to regenerate the stand and future thinning of the overstory will be important in creating the environment for robust and diverse regeneration. Underbrush is also variable on such a large stand. Lowbush blueberry dominates the uplands. Witch hazel dominates the edges and sweet pepperbush and highbush blueberry dominate the scattered lowland depressions. There is evidence of a recent ground fire near Inventory Point # 32. This is an interesting example of how fire affects a stand. Most small saplings were killed along with all the underbrush. The presence of dead pole-size oaks suggests the fire had enough fuel to burn hotter than it might if it were more common, and as a result killed more of the thicker bark oaks. A couple-acre area along Grafton Road was thinned 20-30 years ago and has a lower overstory stocking with an abundance of pole size hardwood.

Access for forest management is good. The terrain is flat to gently sloped and undulating. The soils are generally well-drained fine sandy loams. There is one small intermittent stream to be crossed, close to Grafton Road. There are isolated pockets of poorly drained soils, usually located within a distinct topographic depression, and including several potential vernal pools.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.
OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
CDS=cords BA= basal area VOL= volume HW=hardwood SW=Softwood

Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	2	WO4B	3.6	14.3	120	4200 HW BF 6700 SW BF	10 HW CDS 6 SW CDS	60/68

Stand 2 is a multi-aged, fully-stocked, upland mixed oak and pine stand. White pine dominates (50%), with a mix of red oaks (40%) and white oak (10%), filling out the stocking. Stocking is high for hardwoods but low for pine, so the mix is at the high end of adequately stocked, a.k.a. fully-stocked. Height growth and form quality are both good with tall, sawtimber-size trees present. This stand can be considered multi-aged. The oak along with some of the pine represent the primary age-class. There is a scattering of big pine that represents an older age-class, probably trees retained during a pre-1938 harvest. There is a third age-class present in the form of pine, and to a lesser extent red maple, saplings and poles. This regeneration is moderate throughout and in patches fully regenerated. That is, enough to occupy and fully regenerate the site in the event of an overstory removal. Underbrush is moderate and dominated by lowbush blueberry and witch hazel.

Access for forest management is good and would be off of Grafton road. The terrain is flat to gently sloped. The soils are a well-drained fine sandy loam.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes.

STEW	3	RM2C	1.0	10.3	60	350 HW BF	7 HW CDS	35

Stand 3 is a red maple swamp. This stand consists of scattered short, stunted pole and sawtimber size red maple over thick highbush blueberry, swamp azalea and sweet pepperbush. The forest floor holds standing water most of the year, with sphagnum moss hummocks. The soils are typed as a Woodbridge fine sandy loam. They are very poorly drained, swampy, with a layer of organic muck on top. Form quality is poor in this acidic and anaerobic environment.

This stand provides critical wetland forest habitat, including some early-successional forest characteristics where canopy gaps allow for a diversity of underbrush species. This stand also provides possible vernal pool habitat, as well as important ecosystem services in the form of floodwater retention and groundwater filtration.

This stand is essentially unmanageable. The wet, delicate soils are rarely if ever dry or frozen enough to be accessed for thinning. This stand will be allowed to grow, and will be a no-cut biological reserve.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.

OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
CDS=cords BA= basal area VOL= volume HW=hardwood SW=Softwood

Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	4	WO4B	3.6	12.3	135	3800 HW BF 5600 SW BF	19 HW CDS 6 SW CDS	60/68

Stand 4 is a multi-aged, fully-stocked, upland mixed oak and pine stand. White pine dominates (45%), with a mix of red oaks (57%) and red maple (3%), filling out the stocking. Height growth and form quality are both good with tall, sawtimber-size trees present. Like stand 2, this stand has started the transition towards multi-aged. The oak along with some of the pine represent the primary age-class. There is a scattering of big pine that represents an older age-class, probably trees retained during a pre-1938 harvest. There is a third age-class present in the form of pine, and to a lesser extent red maple, saplings and poles. This regeneration is moderate throughout and in patches fully regenerated. Underbrush is moderate and dominated by lowbush blueberry, witch hazel and some highbush blueberry.

Access for forest management is good and would be off of Grafton road or thru the deeded access corridor off George Hill Road. The terrain is flat to gently sloped. The soils are a well-drained, Woodbridge fine sandy loam.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes.

STEW	5	RM3A	3.3	8.8	125	1100 HW BF 1300 SW BF	26 HW CDS 2 SW CDS	45

Stand 5 is an even-aged, adequately stocked, wetland red maple stand. Red maple is almost pure with yellow birch, black gum and white pine noted. Form quality is poor on this acidic and anaerobic site. Regeneration is light and generally part of the overstory in this pole-size stand. Underbrush is variable and includes heavy patches of highbush blueberry, swamp azalea and sweet pepperbush, and other areas with little to no underbrush.

Access for forest management is limited by wetland soils. The terrain is flat. The soils are typed as a fine sandy loam. Soils are swampy and very poorly drained with a layer of organic muck above the loam. This stand forms the core headwaters for the primary unnamed perennial stream that bisects this property running west to east.

This stand is essentially unmanageable. The wet, delicate soils are rarely if ever dry or frozen enough to be accessed for thinning. This stand should be allowed to grow, and designated a no-cut ecological reserve.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.
OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
CDS=cords BA= basal area VOL= volume HW=hardwood SW=Softwood

Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	6	WH3B	3.3	12.0	115	200 HW BF 9200 SW BF	7 HW CDS 11 SW CDS	45/60

Stand 6 is an adequately stocked, even-aged, mixed hardwood/softwood stand. This stand is a grouping of several stand types that don't fit into adjacent stands. The core of this stand is a thin red maple riparian stand following the swampy, wetland corridor as it flows northeast and then east into the primary perennial stream. The wetland core of this stand quickly gives way to transitional wetland/upland soils that are moderately well-drained and support good quality pine with some maple and oaks intermixed. The southern wet edge of this stand, adjacent to stand 5, contains a handful of eastern hemlock. This species was not noticed elsewhere on the property and is being devastated regionally by the woolly hemlock adelgid. Hemlock in this stand seems to be untouched by this forest pest.

The terrain is flat. The soils range from well-drained to swampy. Access for forest management is limited by delicate wetland soils.

This stand should be managed for hemlock and allowed to grow for the next management period. In 10 years this stand can be assessed for the need for a light thinning to remove competition and encourage hemlock. The property-wide uniqueness of the hemlock and the dark, swampy nature of this stand may make it a point of interest in future trail construction.

STEW	7	OH4B	35.4	11.4	98	4000 HW BF 900 SW BF	24 HW CDS 1 SW CDS	60/65

Stand 7 is an adequately stocked, even-aged, upland, oak and maple stand. Red oaks including northern red, black and scarlet oak dominate (55%), with red maple (36%), and white pine (9%) present as the chief associates. This stand was thinned roughly 15-20 years ago and the residual stand is variable with areas significantly understocked and other areas overstocked. Soils are somewhat variable as well with somewhat poorly drained areas supporting the bulk of the maple while well-drained areas support oak. Overall form quality and height growths are good and this stand can grow some high quality oak and pine. Regeneration is moderate to heavy and includes some heavy patches of white pine saplings along with scattered maple saplings and poles and some oak saplings present where canopy gaps allow increased levels of sunlight to hit the forest floor.

Access for forest management is fair to good depending on truck access thru the deeded access corridor off of George Hill Road. The terrain is flat. The soils are a well drained to moderately well drained fine sandy loam.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning to overstocked areas, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.
OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
CDS=cords BA= basal area VOL= volume HW=hardwood SW=Softwood

Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	8	OH4A	75.88	12.2	124	8300 HW BF	27 HW CDS	62

Stand 8 is an overstocked, even-aged, upland oak and maple stand. This stand occupies the center of the property, contains the entire primary stream, and is very similar in stocking, volumes and growth form to the other two main, uncut stands, stands 1 and 11. The primary difference is that this stand supports a larger percentage of red maple in and around the many small pockets of wetland and poorly drained soils associated with the primary stream. This stand also supports the tallest and most beautiful hardwoods in the transitional upland/wetland soils found along the stream and its tributaries. Red oaks dominate (60%), with red maple (40%) filling out the stocking. Shagbark hickory, yellow birch, black gum, aspen, ash, white pine and sassafras were all noted. Regeneration is patchy in this large stand and on the light side of moderate overall. Patches of thick white pine saplings are found, along with a scattering of red and sugar maple saplings. American chestnut saplings are everywhere. This stand is in its first stages of transitioning from even-aged to multi-aged. The diameter class distribution shows a fairly even spread among sapling, pole, sawtimber and large sawtimber size classes. But canopy gaps, snags and downed woody debris are all scarce. Like stand 1, this stand must be roughly 100 years old. No signs of past cutting were seen on the ground but the 1938 areal photo shows some recent thinning primarily in areas now supporting pine regeneration. Underbrush is light to moderate and includes some heavy patches of witch hazel, generally found along the upland/wetland transitional zone, lowbush blueberry in the uplands and sweet pepperbush and highbush blueberry in wetter areas.

Access for forest management is fair. The terrain is flat to moderately sloped and the soils are a mostly well-drained, but the distance to either Grafton Road or George Hill Road may be prohibitive. The soils are a patchwork of fine sandy loams. Soils are well-drained with patches of somewhat poorly drained and wetland soils. The primary stream, a perennial stream, bisects this stand flowing west to east, with a number of feeder streams running north or south into this stream. Stream crossing during forest management will probably be minimized by most of the forest north of the stream being access thru stand 7.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.

OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
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Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	9	WO4B	2.2	16.0	110	8600 HW BF 4300 SW BF	HW CDS SW CDS	60/68

Stand 9 is an even-aged, adequately stocked, upland oak and pine stand. Red oaks dominate (70%), with white pine filling out the stocking (30%). Height growth and form quality are good. Regeneration is moderate with some thick patches of white pine sapling and pole regen. Underbrush is light and dominated by lowbush blueberry. This stand is very small and could have been folded into stand 11, except it represents the future of much of this forest. Pine has historically been a major component of forests in this region and it is coming back quickly. The areal photos show all the understory pine in and around this stand, and throughout the whole property. In 50 years most of this property will be mixed hardwoods and pine instead of pure oak. Pine is valuable economically and ecologically and this transition should be part of the property wide goals of managing for diversity.

Access for forest management is limited only by the long skid distance to potential landing sites near Grafton Road or George Hill Road. The terrain is flat to moderately sloped. The soils are a well-drained fine sandy loam.

This stand should be managed for white pine. Even-aged management is recommended to promote fast growing pine. This stands should be allowed to grow for the next management period. Assess in 10 years for the need to thin.

STEW	10	WO4A	6.0	15.6	165	6700 HW BF 8400 SW BF	14 HW CDS 9 SW CDS	60/68

Stand 10 is similar to stand 9, but stocking his higher. This is an overstocked, even-aged, upland mixed oak and pine stand. Whit pine and red oaks split the stocking 50:50. Height growth and form quality are good. Regeneration is heavy with some thick patches of white pine sapling and pole regen. Underbrush is light and dominated by witch hazel and lowbush blueberry.

Access for forest management is limited only by the long skid distance to potential landing sites near Grafton Road or George Hill Road. The terrain is flat to moderately sloped. The soils are a well-drained fine sandy loam.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.
OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
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Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	11	OM4B	75.7	12.4	101	6300 HW BF	20 HW CDS	58

Stand 11 is an even-aged, adequately stocked, upland mixed oak stand. Red oaks including northern red, black and scarlet oak are almost pure across this stand. Red maple, white pine, hickory, aspen, ash, yellow birch, black gum and sugar maple were all noted. Regeneration is moderate overall and characterized by scattered red maple and white pine with thicker white pine patches found. American chestnut saplings are everywhere. Most of the tree species noted above were seen in the regenerating layer and can be encouraged by future management. Underbrush is patchy, with some heavy patches of witch hazel or highbush blueberry but mostly a fairly light lowbush blueberry ground cover. This stand occupies the highest hilltop on this property. The hill has a shoulder where the small wetland of stand 12 can be found. Moving east, the terrain drops steeply. These steep slopes contain interesting and scenic rock ledges and cliffs, with several small intermittent streams and seeps found.

Access for forest management to the western two-thirds of this stand is limited only by the long skid distance to potential landing sites near Grafton Road or George Hill Road. Access to the steep eastern slopes may prove difficult. There is no good access from the east. The slopes are steep enough that finding a good route to skid the wood up the hill will be hard. The soils are well-drained fine sandy loam except along the eastern slopes where it is typed as a Chatfield-Hollis-Rock outcrop complex.

This stand will be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method will be used to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes.

STEW	12	RM4B	1.8	11.4	80	4300 HW BF 400 SW BF	15 HW CDS 2 SW CDS	58

Stand 12 is an adequately stocked, even-aged, wetland red maple stand. Red maple dominates this small stand (50%), with red oaks (25%), ash (15%), and hickory (10%), present. Height growth and form quality are quite good for a wetland stand. This stand is located on a plateau found along the eastern shoulder of the large hill, just above the ledges and cliffs of stand 11. Regeneration is light and consists of scattered maple and pine saplings and poles. Underbrush is light to moderate and includes witch hazel and highbush blueberry.

Access for forest management is limited by the long skid distance and delicate wetland soils. The terrain is flat. The soils are a poorly drained fine sandy loam, most likely with a layer of organic muck built up on top.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. This stand provides important habitat diversity to the relatively homogenous upland oak cover of surrounding stand 11. Allow to grow. Assess in 10 year for the need to thin.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.
OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
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Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	13	WB4B	10.2	13.4	187	1300 HW BF 13,000 SW BF	8 HW CDS 37 SW CDS	68

Stand 13 is an adequately stocked, even-aged, upland white pine stand. White pine dominates (90%), with red and white oaks and red maple filling out the stocking. This stand is somewhat variable with the main portions southwest and north supporting the heaviest stocking and a 2-aged structure with a fully stocked overstory and a fully regenerated sapling understory. Along the edges and in between these areas, including the southeastern finger, stocking is lower and oaks and maple are more prevalent. Regeneration is heavy and dominated by white pine. Underbrush is light or absent.

Access for forest management is poor. Access off of North street is unlikely. The slopes are very steep and the wetland corridor of stand 15 is quite wide. Access from the west would involve a mile-long skid, negotiating the steep, ledgy slopes of stand 11 and at least one stream crossing. The terrain is gently sloped. The soils are a well drained fine sandy loam.

This stand should be managed for an even-aged pine forest with hardwood associates. The seed-tree cut in a shelterwood treatment is recommended, as soon as possible. This would remove 30-40% of the overstory, harvesting mature timber and poorly formed trees while allowing crop trees to put on more volume and value. Critically this would also release the thick regeneration to sunlight before it stagnates in the shade and starts to fall over and die. In 10-20 years most of the remaining overstory would be removed allowing the then pole-size regeneration room to grow, while retaining a component of mature pine as legacy trees. Steep slopes and wetland corridors limit access to this stand. Alternate management would include designating this stand as a no-cut ecological reserve.

STEW	14	RM2B	0.6	8.8	100	350 HW BF	17 HW CDS	20

Stand 14 is an adequately stocked, even-aged, wetland red maple swamp. Red maple dominates this wetland site with the occasional black gum, and oaks found along the edge. Height growth and form quality are poor. Regeneration is light and consists of scattered red maple saplings and poles. Underbrush is heavy and dominated by highbush blueberry.

Access for forest management is poor. The swamp soils make management impractical.

This stand should be preserved as a biological reserve. This wetland site provides critical ecological and wildlife amenities.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.

OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
CDS=cords BA= basal area VOL= volume HW=hardwood SW=Softwood

Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	15	RM4A	5.3	12.4	120	3500 HW BF 2300 SW BF	26 HW CDS 2 SW CDS	60

Stand 15 is a handsome red maple stand found alone a wetland drainage that follows Warren Brook. This is an overstocked, even-aged, wetland stand. Red maple dominates (80%), with white pine and the occasional oak filling out the stocking. Form quality is fair to good with some good quality sawtimber present in the large-diameter maples. This stand has pockets of 3-aged (multi-aged) structure. Along the trail entering from north street, the forest includes a scattering of large pine, pole to medium sawtimber size maple, over moderate white pine sapling regeneration. Upriver the maples are larger and regeneration is light. Underbrush is light overall.

This stand has similar access issues as stand 13. The terrain is flat. The soils are a somewhat poorly drained to poorly drained fine sandy loam.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes. Steep slopes and wetland corridors limit access to this stand. Alternate management would include designating this stand as a no-cut ecological reserve.

STEW	16	RM4A	14.0	12.4	175	10,000 HW BF	40 HW CDS	60

Stand 16 is a very overstocked, even-aged, wetland red maple stand. Red maple dominates (70%), with yellow birch (15%), red oaks (10%), and ash filling out the stocking. Height growth and form quality are good with much sawtimber value present. This stand has started transitioning to a multi-aged structure. The overstory contains a pole-size age-class and a small to medium-size age-class. Regeneration is moderate and forms a third age-class comprised of birch, maple and pine saplings.

Access for forest management is poor. Access off of North street to this part of the property is possible but would involve significant investment, road construction and numerous stream and wetland crossings. Access from the west has the challenges mentioned above of a very long skid and steep slopes. The terrain is flat. The soils are poorly drained fine sandy loams.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes. Steep slopes and wetland corridors limit access to this stand. Alternate management would include designating this stand as a no-cut ecological reserve.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.
OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
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Owner(s) Town of Upton Town(s) Upton

STAND DESCRIPTIONS

OBJ	STD NO	TYPE[1]	AC	MSD	BA/AC	BF/AC[2]	CDS/AC[2]	SITE INDEX[3]
STEW	17	WO4B	7.6	15.1	95	4700 HW BF 2000 SW BF	14 HW CDS 3 SW CDS	60/65

Stand 17 is an adequately stocked, even-aged, upland mixed pine, oak and maple stand. Red oaks dominate (53%), with white pine (25%), and red maple (20%), present as the chief associates. Height growth and form quality are good in both hardwoods and pine. This stand saw some selective thinning roughly 20 years ago. This stand has started transitioning to a multi-aged structure. Diameter distributions show a good spread. Regeneration is moderate and includes some thick patches of pine along with maple and birch saplings.

Access for forest management is poor (see stand 16). The terrain is flat to gently sloped. The soils are poorly drained fine sandy loams.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. The single tree and group selection method is recommended to provide an improvement thinning, removing poorly formed, diseases and dying trees to provide growing space for the healthiest individuals, and to assist this stand in its move towards a more diverse multi-aged structure. Patches will be opened to encourage regeneration of new age-classes. Steep slopes and wetland corridors limit access to this stand. Alternate management would include designating this stand as a no-cut ecological reserve.

STEW	18	WH4B	8.5	13.6	75	200 HW BF 2000 SW BF	4 HW CDS 16 SW CDS	58/65

Stand 18 is a variable mix of pine and hardwoods. This is a two-aged stand, the result of cutting roughly 20 years ago. Today the overstory is dominated by widely spaced, large sawtimber size white pine, with a component of sawtimber size maple. In and around these trees and filling in canopy gaps is a distinct pole-size age-class comprised of stump sprouted red maple, as well as oaks, ash, grey and yellow birch and white pine. Regeneration in the form of this pole size age-class is moderate to heavy and is successfully regenerating the stand. Underbrush is light and includes some witch hazel, lowbush blueberry, ferns and skunk cabbage. There is a cellar hole along North street and what seems to be an old well, near the water department building northeast of this stand.

This stand has the same access issue as stands 16 and 17, though less stream crossings. The terrain is flat to gently sloped. The soils are a well-drained fine sandy loam along North street and somewhat poorly drained to poorly drained fine sandy loams elsewhere.

This stand should be managed for mature, multi-aged forest characteristics, including a diversity of tree species and habitat types. Allow to grow. Assess in 10 years for the need to thin.

STEW	19	field	3.3

Stand 19 is an old agricultural field that is now maintained as field for ecological and aesthetic purposes. This field is mowed every 2-3 years and provides habitat values in the form of ground nesting bird habitat, browse for larger animals, cover for smaller animals and invertebrates, as well as feeding grounds for birds, bats, butterflies and other pollinators.

[1] See stand type descriptions in appendix I
[2] Volumes calculated using ten-factor prism, number 8 foot sticks, DBH and top end diameter, and frustum volume equation.
[3] Site index found using NRCS Web Soil Survey and field evidence.
OBJECTIVE CODE: CH61 = stands classified under CH61/61A STEW/GC= stands not classified under CH61/61A
STD= stand AC= acre MSD= mean stand diameter BF= board feet
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Owner(s) Town of Upton Town(s) Upton

RECOMMENDED MANAGEMENT PRACTICES
to be done within next 10 years

OBJ	STD NO	TYPE	SILVICULTURAL PRESCRIPTION	AC	TO BE REMOVED		TIMING
					BA/AC	TOT VOL	
STEW	1	OM4A	Single-tree & Group Selection	42.1	25	240 HW CDS	2016
						20 SW CDS	2016
						30,000 HW BF	2016
						5,000 SW BF	2016
STEW	2	WO4B	Single-tree & Group Selection	3.6	10	8 HW CDS	2016
						4 SW CDS	2016
STEW	4	WO4B	Single-tree & Group Selection	3.6	20	12 HW CDS	2016
						4 SW CDS	2016
						2000 HW BF	2016
						3000 SW BF	2016
STEW	7	OH4B	Single-tree & Group Selection	35.4	10	100 HW CDS	2016
						8000 HW BF	2016
STEW	8	OH4A	Single-tree & Group Selection	75.88	25	500 HW CDS	2016
						60,000 HW BF	2016
STEW	10	WO4A	Single-tree & Group Selection	6.0	25	15 HW CDS	2016
						10 SW CDS	2016
						3,000 HW BF	2016
						4,000 SW BF	2016
STEW	11	OM4B	Single-tree & Group Selection	75.7	10	175 HW CDS	2016
						25,000 HW BF	2016
STEW	15	RM4A	Single-tree & Group Selection	5.3	20	25 HW CDS	2016
						2,000 HW BF	2016
STEW	16	RM4A	Single-tree & Group Selection	14.0	40	115 HW CDS	2016
						15,000 HW BF	2016
STEW	17	WO4B	Single-tree & Group Selection	7.6	10	20 HW CDS	2016
						5 SW CDS	2016
						4,000 HW BF	2016
						2000 SW BF	2016

These stands will be treated using the single tree and group selection method. Management will be multi-purposed including the promotion of mature forest characteristics and the harvest of forest products.

This selective treatment has three main components. First is the maintenance of legacy trees and crop trees. Legacy trees are

OBJECTIVE CODE: CH61 = Forest Products (for Ch. 61/61A) STEW/GC = Stewardship Program practices
STD= stand Type= Forest type AC= acre MBF= thousand board feet BA= basal area VOL= volume

Owner(s) Town of Upton Town(s) Upton

RECOMMENDED MANAGEMENT PRACTICES
to be done within next 10 years

OBJ	STD NO	TYPE	SILVICULTURAL PRESCRIPTION	AC	TO BE REMOVED		TIMING
					BA/AC	TOT VOL	

healthy well-formed individuals that have the best chance of becoming long-lived old growth trees. Crop trees are the same, only they will be harvested when mature. Improvement thinning will thin between these trees to provide growing space and allow them to become large and wind-firm. Thinning should relieve crown competition while maintaining almost full canopy cover.

The second component of this management regime is a regeneration component. Patches ranging from $1/10^{th}$ of an acre up to 5 acres will be harvested and allowed to naturally regenerate. Patches will be located where existing regeneration is established, releasing that regeneration by removing the overstory, or in areas with unhealthy or poorly formed overstory trees that should be removed. Where regeneration is not present the patch will be cleared of understory trees to allow even regeneration of the patch. Patches will cover roughly 10% of the stand (each 10-year management period). Patch cuts will be repeated every 10-20 years creating a diverse patchwork of different age-classes while maintaining legacy trees, snags, downed woody debris and a mature forest structure. A few larger patches (3-5) acres will be opened property wide each management period to ensure that high-quality early-successional habitat values are present on the property.

The third component is management for old growth characteristics. Other than maintaining a component of large, old trees, the main goal is a diameter distribution that shows a relatively even basal area distribution by age-classes. Also important is managing the number of dead standing trees (snags) per acre by girdling some live trees and protecting existing snags during harvest. This also includes managing downed woody debris with emphasis on large diameter downed wood. Downed wood will be created by naturally falling trees, trees cut and left on the forest floor, and trees girdled that will eventually fall. Create 2-5 snags per acre each 10-year management period.

Most stands over roughly 30 acres will have a no-cut area delineated and maintained as a forest reserve. This will provide a control by which to compare the affects of management activities. The North Upton Open Space is a public forest showcasing forest management styles including even and uneven-aged management, and the choice to leave a forest as is without any thinning or harvesting.

This management style will support a number of Landowner Goals as outlined in the Landowner Goals page. Goals specifically addressed by this management technique include; enhancing the quality and quantity of timber products, promoting biological diversity, enhancing habitat for birds, bats, small and large animals, enhancing carbon storage, enhancing old growth characteristics and protecting legacy trees.

The appropriate permits must be attained prior to accessing wetlands for forest management. Additional restrictions may apply to harvesting in or around vernal pools, streams, lakes or other water bodies. This plan does not outline all restrictions and it is recommended that you consult your forester or town conservation commission prior to the start of work.

OBJECTIVE CODE: CH61 = Forest Products (for Ch. 61/61A) STEW/GC = Stewardship Program practices
STD= stand Type= Forest type AC= acre MBF= thousand board feet BA= basal area VOL= volume

Owner(s) Town of Upton Town(s) Upton

RECOMMENDED MANAGEMENT PRACTICES
to be done within next 10 years

OBJ	STD NO	TYPE	SILVICULTURAL PRESCRIPTION	AC	TO BE REMOVED		TIMING
					BA/AC	TOT VOL	
STEW	13	WB4B	Shelterwood – Seed Tree	10.2	60	20 HW CDS	2016
						25,000 SW BF	2016
						100 SW CDS	2016

Remove poorly formed trees as well as 80% of economically mature trees (diameter > 18”), retaining 20% as reserves and potential legacy trees. Residual stand should be comprised of well-spaced pole and small sawtimber size trees (plus larger retention trees), trees that will respond to the increased growing space and put on volume and value. Canopy closure should be roughly 50% allowing sunlight to reach the forest floor and both encourage established regeneration and promote regeneration where it is absent.

STEW	3	RM2C	Ecological Reserve	1.0	--	--	--
STEW	5	RM3A	Ecological Reserve	3.3	--	--	--
STEW	14	RM2B	Ecological Reserve	0.6	--	--	--

These maple swamps are very delicate and provide important ecological and biological values. They should be designated as no-cut reserves and allowed to mature naturally.

STEW	6	WH3B	Allow to Grow	3.3	--	--	--

This stand will be managed for hemlock. Thinning may be warranted in 10 years to provide growing space to established hemlock and/or create site conditions to regenerate more hemlock.

STEW	9	WO4B	Allow to Grow	2.2	--	--	--

Stocking is adequate. Trees are not crowded. Assess in 10 years for need to thin. Consider using even-aged management techniques to favor pine.

STEW	12	RM4B	Allow to Grow	1.8	--	--	--

Stocking is adequate. Trees are not crowded. Assess in 10 years for need to thin. Favor wetland hardwood species.

STEW	18	WH4B	Allow to Grow	8.5	--	--	--

Stocking is adequate. Trees are not crowded. Assess in 10 years for need to thin. Manage area along North Street as a visual buffer.

STEW	19	FIELD	Mow	3.3

This field should be mowed every 2-4 years. Avoid primary bird nesting times.

STEW BOUNDARY MARKING

Boundaries unmarked should be marked before management activities commence.

OBJECTIVE CODE: CH61 = Forest Products (for Ch. 61/61A) STEW/GC = Stewardship Program practices
STD= stand Type= Forest type AC= acre MBF= thousand board feet BA= basal area VOL= volume

Owner(s) Town of Upton Town(s) Upton

Signature Page Please check each box that applies.

☐ **CH. 61/61A Management Plan** I attest that I am familiar with and will be bound by all applicable Federal, State, and Local environmental laws and /or rules and regulations of the Department of Conservation and Recreation. I further understand that in the event that I convey all or any portion of this land during the period of classification, I am under obligation to notify the grantee(s) of all obligations of this plan which become his/hers to perform and will notify the Department of Conservation and Recreation of said change of ownership.

☒ **Forest Stewardship Plan**. When undertaking management activities, I pledge to abide by the management provisions of this Stewardship Management Plan during the ten year period following approval. I understand that in the event that I convey all or a portion of the land described in this plan during the period of the plan, I will notify the Department of Conservation and Recreation of this change in ownership.

Signed under the pains of perjury:

Owner(s) _____ Date 16 June 2015

_____ Date 16 June 2015

TOWN OF UPTON SELECTMEN

I attest that I have prepared this plan in good faith to reflect the landowner's interest.

Plan Preparer _____ Date June 16, 2015

Walden Forest Conservation LLC.

I attest that the plan satisfactorily meets the requirements of CH61/61A and/or the Forest Stewardship Program.

Approved, Service Forester _____ Date 6-29-15

Approved, Regional Supervisor _____ Date 6/29/15

In the event of a change of ownership of all or part of the property, the new owner must file an amended Ch. 61/61A plan within 90 days from the transfer of title to insure continuation of Ch. 61/61A classification.

Owner(s) Town of Upton Town(s) Upton

APPENDIX I

GLOSSARY

SILVICULTURE - The theory and practice of controlling forest establishment, composition and growth.

FOREST STAND - A contiguous group of trees sufficiently uniform in species composition, arrangement of age classes, and condition to be a homogeneous and distinguishable unit.

FOREST STAND TYPE is an abbreviated descriptive code based on the Massachusetts Forest Land Classification System.(Refer to reference key below)

Stand Type	Stocking Density	Height Class
WP - White Pine	A - Over stocked	1 - 0-20'
WK - White Pine, Hemlock	B - Fully stocked	2 - 21-40'
WO - White Pine, Hemlock	C - Under stocked	3 - 41-60'
PP - Pitch Pine		4 - 61-80'
PO - Pitch Pine, Oak		
OH - Oak, Hardwoods		
OM - Mixed Oak		
OW - White Oak		
RM - Red Maple		
CD - Atlantic White cedar		
NV - No Vegetation		
AF - Abandoned Field		
PS - Plantation Softwood		
OP - Open		
SS - Shrub Swamp		

BASAL AREA (BA) - The total measure of the cross-sectional area of all or specified classes of standing trees per unit area of land, measured 4.5 feet above ground level. A useful characteristic of a forest stand in that it is directly related to stand volume and is a measure of stand density.

DIAMETER BREAST HEIGHT (DBH) - The location on a standing tree 4.5 feet above ground level established as a standard point to measure tree diameter.

SITE INDEX - A measure of growing site quality based on the relationship of tree height to age. This number refers to the average height that dominant and codominant trees will attain at the key age of 50 years.

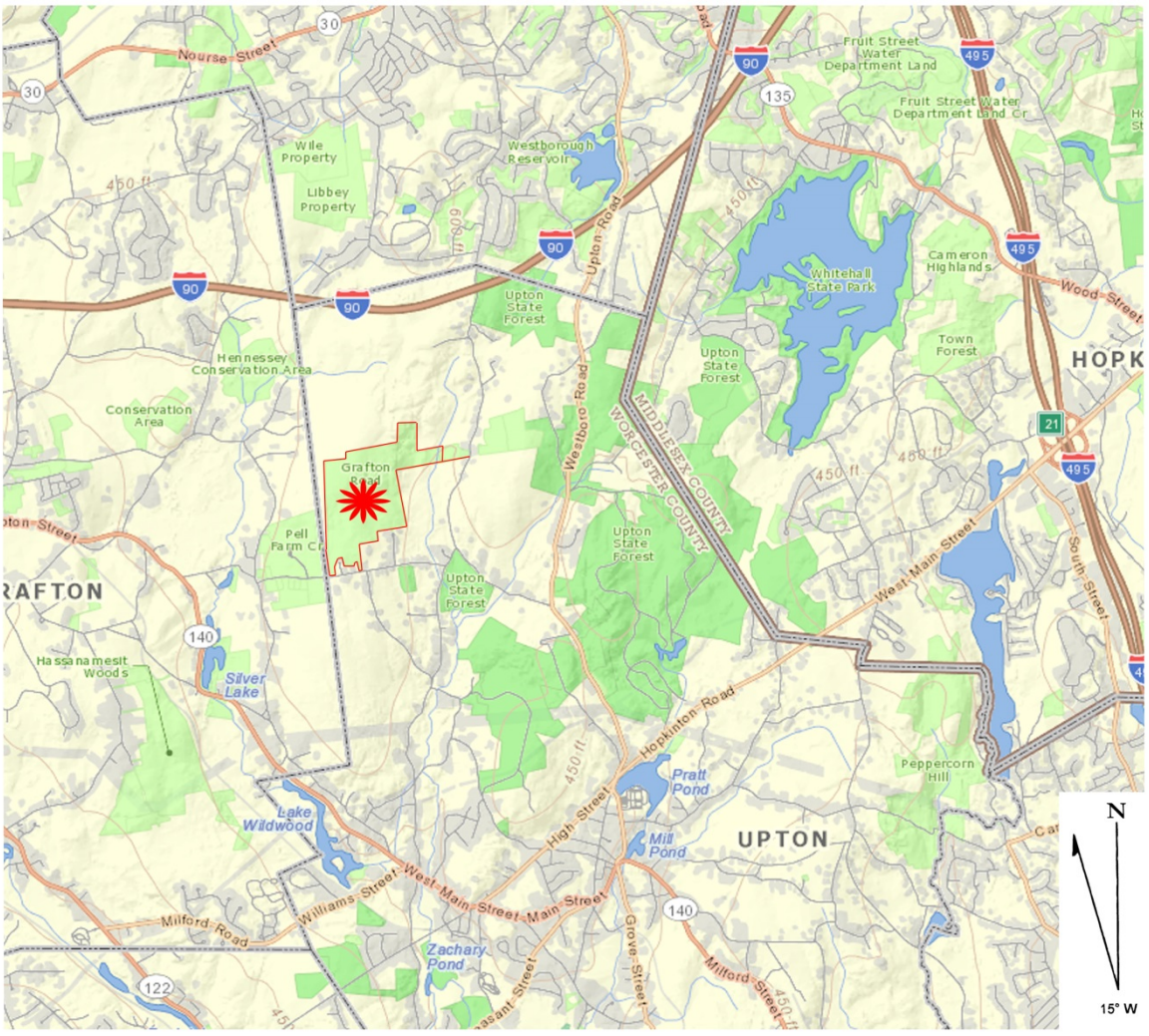
Locus Map

North Upton Open Space

Upton, MA

Warren Brook Watershed CA
Howarth Glen CA
Whitney CA
Open space x2

Town of Upton
One Main Street
Upton, MA 01568



0’ 4800’ 9600’

WALDEN
FOREST CONSERVATION
JUNE, 2015

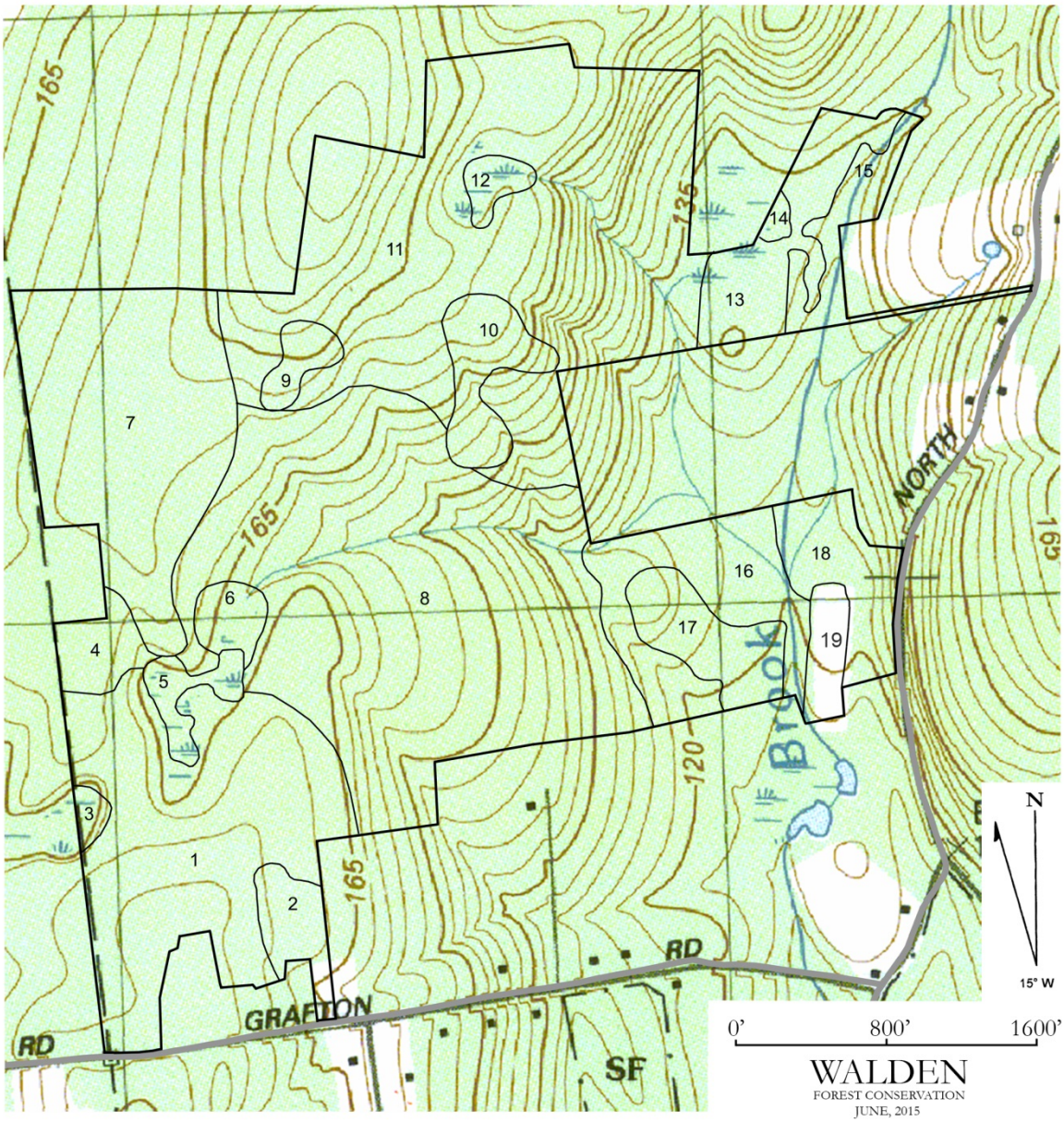
Topographic Map

North Upton Open Space

Upton, MA

Warren Brook Watershed CA
Howarth Glen CA
Whitney CA
Open space x2

Town of Upton
One Main Street
Upton, MA 01568



WALDEN
FOREST CONSERVATION
JUNE, 2015

Ortho Map

North Upton Open Space
Upton, MA

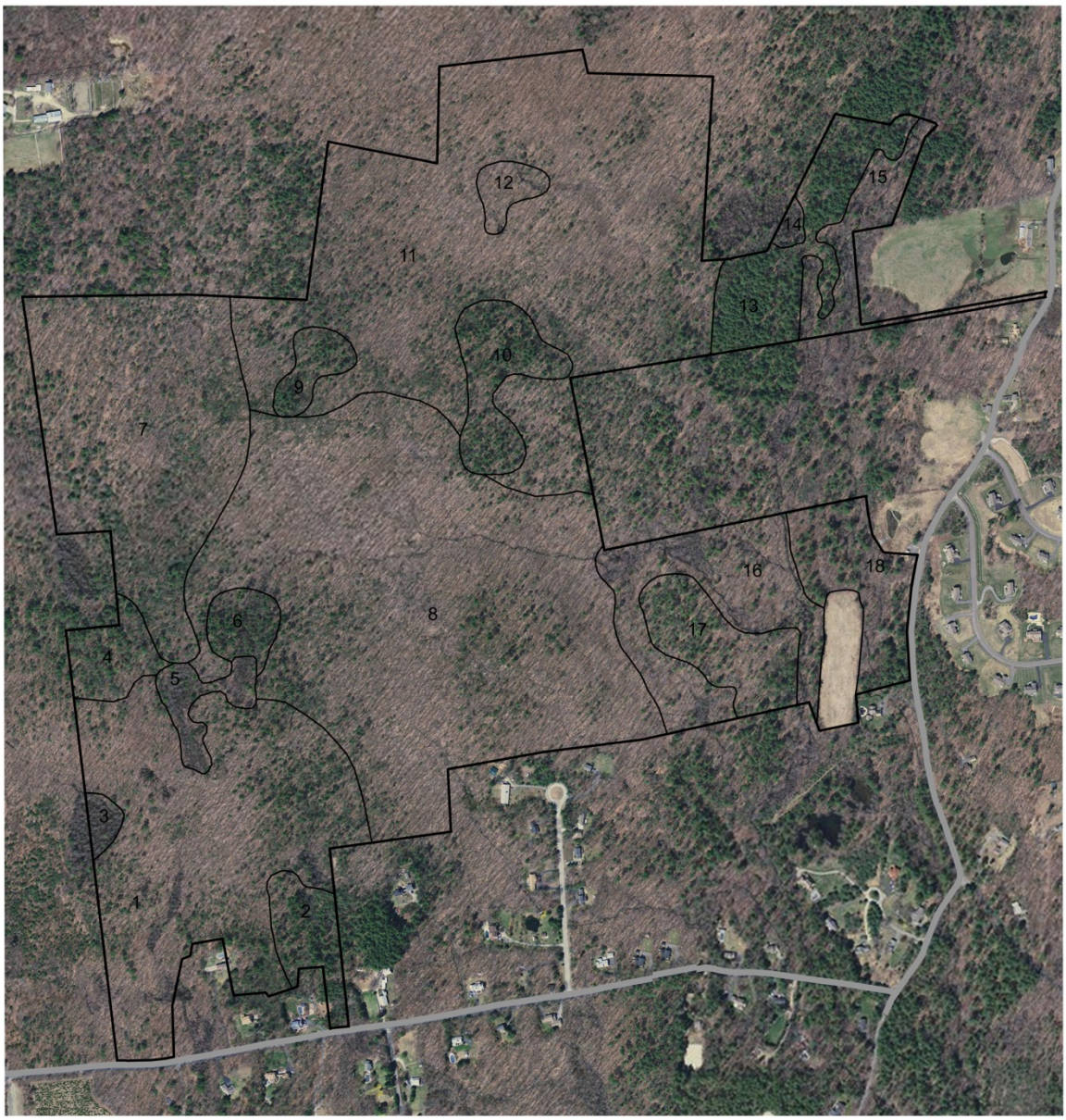
Warren Brook Watershed CA
Howarth Glen CA
Whitney CA
Open space x2

Town of Upton
One Main Street
Upton, MA 01568

0’ 800’ 1600’

WALDEN
FOREST CONSERVATION
JUNE, 2015

N
15° W



Soils Map
North Upton Open Space
Upton, MA

Warren Brook Watershed CA
Howarth Glen CA
Whitney CA
Open space x2

Town of Upton
One Main Street
Upton, MA 01568

Worcester County, Massachusetts, Southern Part (MA615)	
Map Unit Symbol	**Map Unit Name**
3A	Scarboro and Walpole soils, 0 to 3 percent slopes
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes
307B	Paxton fine sandy loam, 3 to 8 percent slopes, extremely stony
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony
102C	Chatfield-Hollis-Rock outcrop complex, 3 to 15 percent slopes
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony
254B	Merrimac fine sandy loam, 3 to 8 percent slopes
307E	Paxton fine sandy loam, 15 to 35 percent slopes, extremely stony
422B	Canton fine sandy loam, 3 to 8 percent slopes, extremely stony

WALDEN
FOREST CONSERVATION
JUNE, 2015

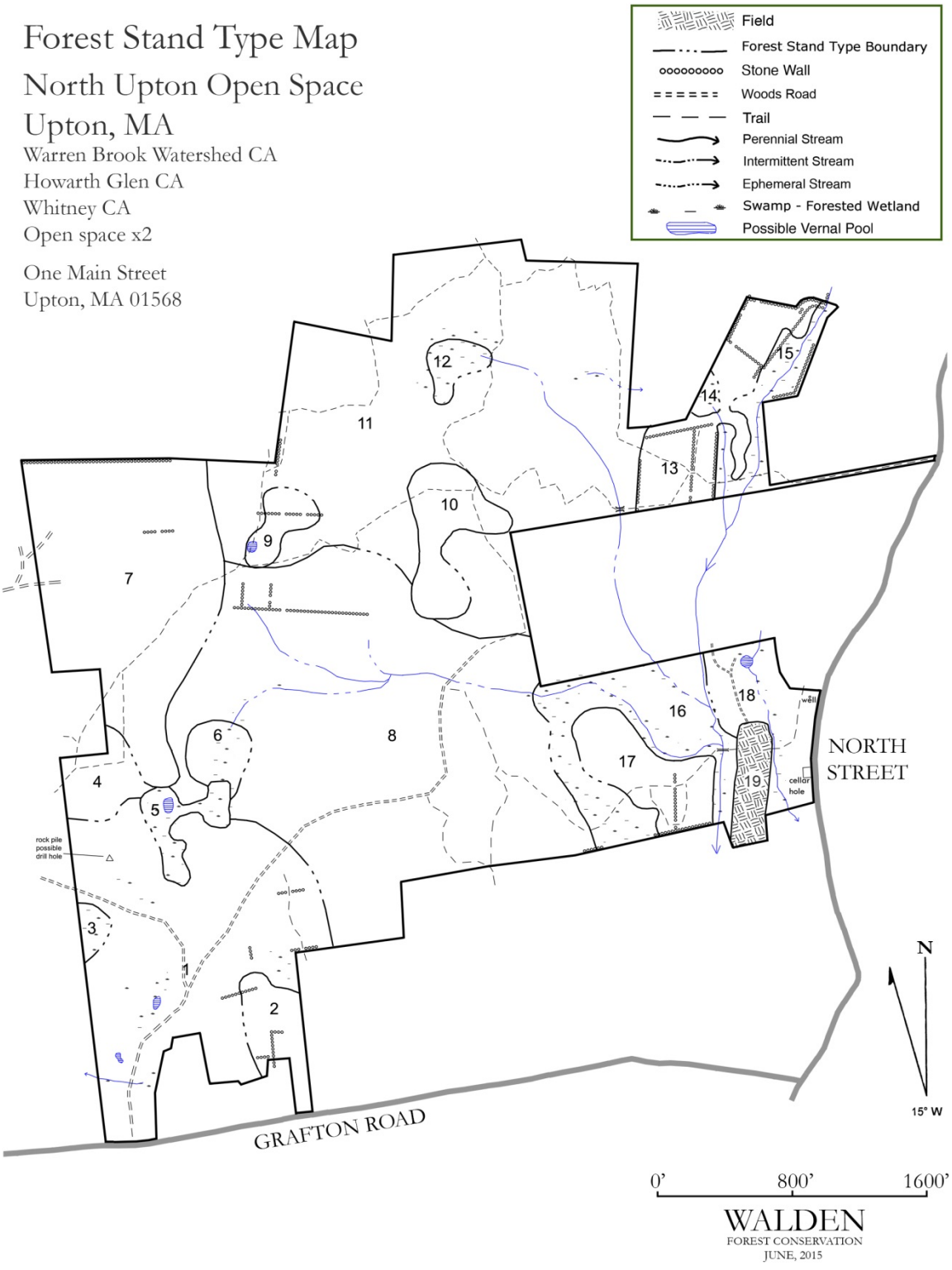
Forest Stand Type Map

North Upton Open Space

Upton, MA

Warren Brook Watershed CA
Howarth Glen CA
Whitney CA
Open space x2

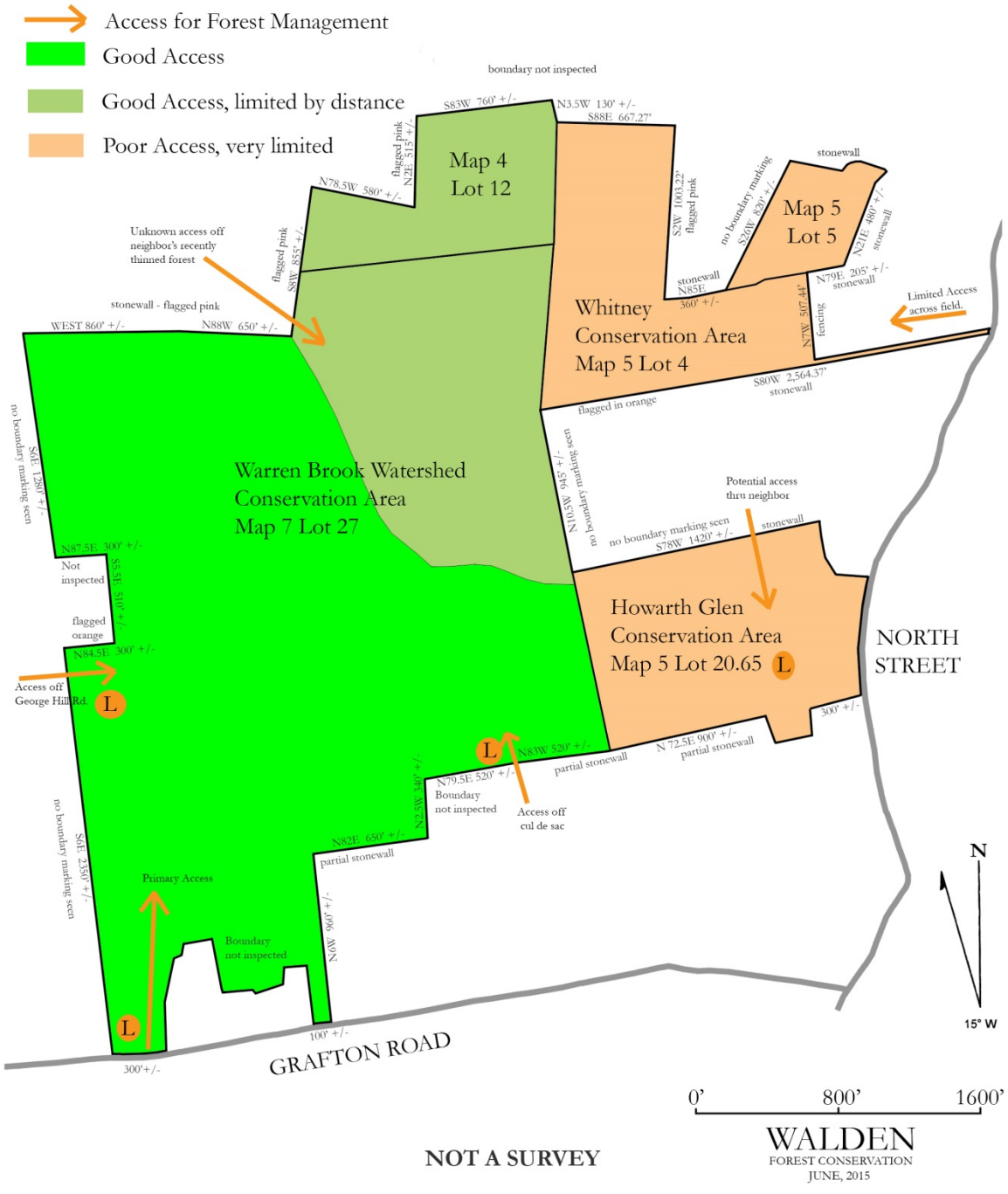
One Main Street
Upton, MA 01568



WALDEN
FOREST CONSERVATION
JUNE, 2015

Access & Meet & Bounds Map
North Upton Open Space

Town of Upton
One Main Street
Upton, MA 01568



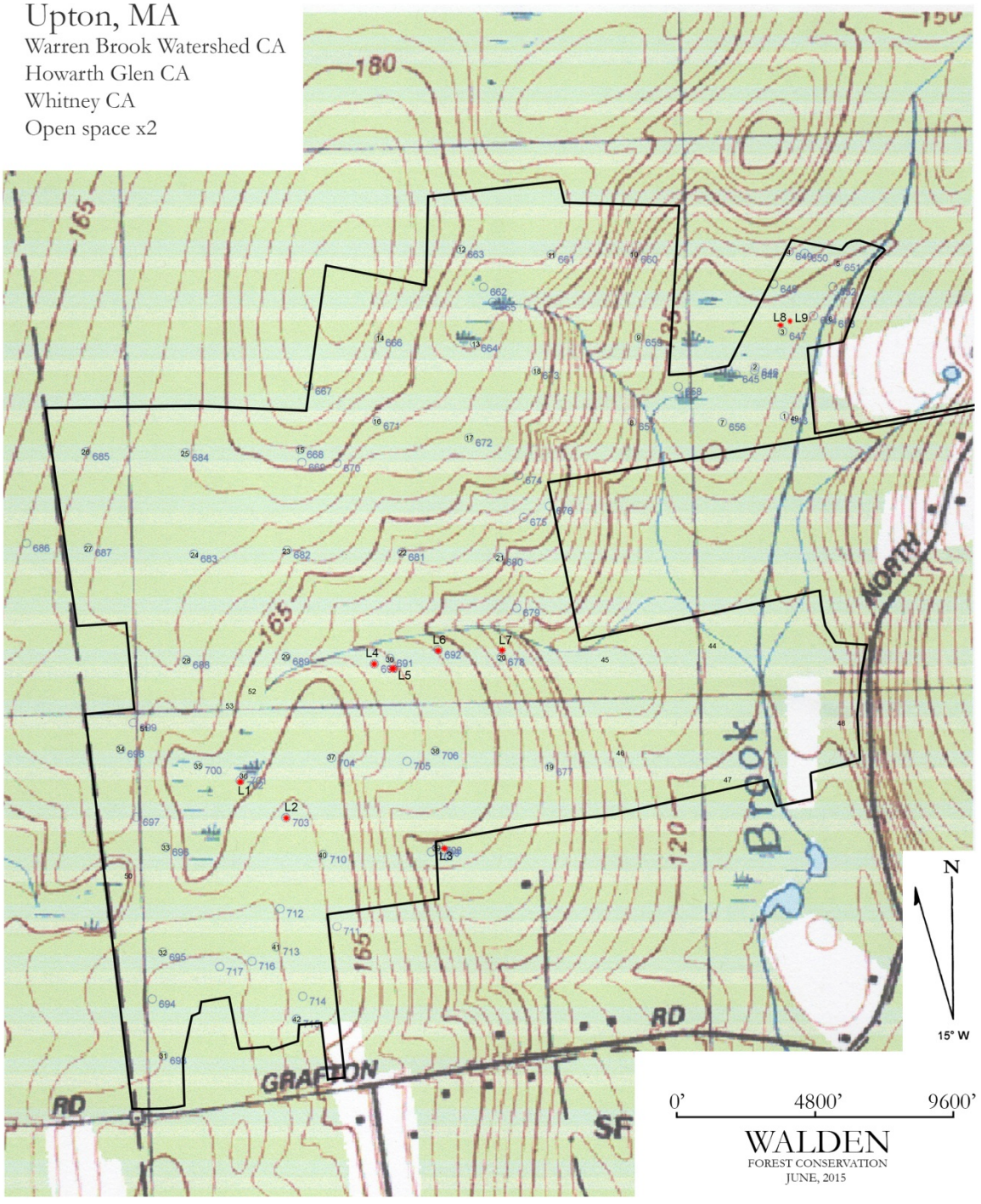
GPS Points & Legacy Tree Map

North Upton Open Space

Upton, MA

Warren Brook Watershed CA
Howarth Glen CA
Whitney CA
Open space x2

Town of Upton
One Main Street
Upton, MA 01568



WALDEN
FOREST CONSERVATION
JUNE, 2015

Appendix C

Massachusetts Division of Fisheries and Wildlife

Habitat Management Options

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Jack Buckley, *Director*

November 13, 2015

Matt Selby
Agent
Town of Upton Conservation Commission
1 Main Street, Box 9
Upton, MA 01568

RE: Habitat management options for the Warren Brook Watershed Conservation Area

Dear Matt,

Thank you for requesting input as you consider habitat management at the Warren Brook Watershed Conservation Area. Habitat is defined as an area which, due to its physical or biological features, protects or provides important elements for the growth and survival of plants or animals such as food, shelter, or living space, and includes without limitation, breeding, feeding, resting, migratory, or wintering areas. The Massachusetts State Wildlife Action Plan uses a habitat-based approach, linking 257 animal Species in Greatest Need of Conservation to 22 habitat types that are essential for the survival of the species. Habitat restoration and management is one of seven strategies outlined in the State Wildlife Action Plan to conserve the biodiversity of the Commonwealth and the Species in Greatest Need of Conservation so we are pleased to support your interest and efforts.

A section of the ~230 acre property along the southern boundary occurs in Priority Habitat (Figure 1). Priority Habitat is delineated based on records of state-listed species observed within the last 25 years prior to delineation and contained in the Natural Heritage & Endangered Species Program database. Data (NHESP Tracking No.: 14-33925) released by the Natural Heritage and Endangered Species Program on December 4, 2014 indicate that Marbled Salamander (*Ambystoma opacu*) inhabit the vicinity of the property. This species is largely terrestrial and generally occurs in deciduous to mixed woods of the southern hardwood type, dominated by oak and hickory species with White Pine. They can live in a variety of habitats including moist, sandy areas and dry hillsides. They hide beneath surface materials such as logs, bark, boards, stones, and drift that piles up along the margins of streams. Wooded vernal pools or shallow depressions are required for breeding sites.

One Potential Vernal Pool occurs on the Warren Brook parcel (Figure 2). Vernal pools are unique wildlife habitats best known for the amphibians and invertebrate animals that use them to breed. Vernal pools, also known as ephemeral pools, autumnal pools, and temporary woodland ponds, typically fill with water in the autumn or winter due to rising ground water and rainfall and remain ponded through the spring and into summer. Vernal pools dry completely by the middle or end of summer each year, or at least every few years. Occasional drying prevents fish from establishing permanent populations. Many amphibian and invertebrate species rely on breeding habitat that is free of fish predators.

Division of Fisheries and Wildlife
Field Headquarters, One Rabbit Hill Road, Westborough, MA 01581 (508) 389-6300 Fax (508) 389-7890
An Agency of the Department of Fisheries, Wildlife & Environmental Law Enforcement

This property also occurs in *BioMap2* Core Habitat and Critical Natural Landscape. The Division's Natural Heritage & Endangered Species Program released *BioMap2* in November 2010. It was designed to guide strategic biodiversity conservation in Massachusetts by focusing land protection and stewardship on the areas that are most critical for ensuring the long-term persistence of rare and other native species and their habitats, exemplary natural communities, and a diversity of ecosystems. *BioMap2* was also intended to include the habitats and species of conservation concern identified in the State Wildlife Action Plan. The specific subcomponents of *BioMap2* within which the property occurs are a 2,038 acre Landscape Block and 822 acre Forest Core (Figure 3).

Landscape Blocks are large areas of high quality intact and predominately natural vegetation. Large intact landscapes provide diverse habitats at a scale necessary to sustain healthy populations of wide-ranging species with large home ranges (the areas where an animal lives and travels over the course of a year). The integrated patchwork of wetlands, uplands, and rivers that are found in unfragmented landscapes allows animals to move freely among habitats, supporting daily movements, migration, dispersal, and colonization of new habitats. Intact landscapes also facilitate shifts in the geographic distribution of species, a process that is likely to accelerate in response to climate change in the coming decades.

The dynamic nature of landscapes, which can only occur in large intact areas, results in a mosaic of habitat types and patches that in turn support a wide array of species. For example, disturbances such as blowdowns, ice storms, tornadoes, and other weather events result in patches of young forest embedded within larger patches of older forest. Many species depend on these younger forests for breeding and foraging habitat. Another example of dynamic natural processes is the flooding of low-lying forests resulting from Beaver dams, converting former closed canopy forests into open canopy wetlands.

Forest Cores identify the best examples of large, intact forests that are least impacted by roads and development, providing critical "forest interior" habitat for numerous woodland species. Of the approximately 3 million acres of forest and forested wetland in Massachusetts, the largest and least fragmented forests in each ecoregion were selected. Minimum forest patch sizes in eastern Massachusetts are about 500 acres. Forest Cores are high priorities for land protection since they provide important habitat for forest interior and other species.

State Wildlife Action Plan habitat types currently offered on the property include Upland Forest, Forested Swamp, Shrub Swamp, Stream, Grassland, and the (potential) Vernal Pool. Increasing habitat diversity on the parcel by offering Young Forest/Shrubland would increase biological diversity. After visiting the property, evaluating Geographic Information Systems data, and reviewing the Forest Stewardship Plan, I am providing options for managing habitat that will benefit State Wildlife Action Plan Species. Please refer to the attached for these details, regulatory requirements, resources and references.

Sincerely,

Marianne Piché

Marianne Piché
Habitat Biologist

State Wildlife Action Plan Habitat Management Options

Young forest/shrubland habitat creation and abandoned field maintenance

Habitat type description: Young forests and shrublands are collectively referred to as "thicket" habitats (Litvaitis 2003), and provide important resources for several wildlife species of conservation concern. Young forest habitats are typically dominated by rapidly growing trees and shrubs, and generally occur when a mature forest canopy is disrupted, allowing sunlight to stimulate the growth of herbaceous and woody vegetation on the forest floor. Shrublands are defined here as relatively ephemeral, upland habitats that are dominated by low woody vegetation (generally <3 m tall), with varying amounts of herbaceous vegetation and sparse tree cover. Shrublands primarily include abandoned field sites and power line corridors that would ultimately revert to forest absent some human or natural disturbance (e.g., mowing or burning), and abandoned beaver flowages along forested stream courses, which typically succeed from wet meadow to drier herb/shrub habitat, and eventually revert to forest in the decades following abandonment.

Current habitat conditions: Currently, patches of young forest habitat large enough to support State Wildlife Action Plan Species dependent on them are not available on the property. Stand 19 of the Forest Stewardship Plan is described as a 3.3 acre abandoned agricultural field that is currently mowed every 2-3 years offering the only area of this habitat type on the property. It occurs within the portion of the property mapped as Priority Habitat for Marbled Salamander.

Proposed young forest habitat creation: The Forest Stewardship Plan prepared by Rupert Grantham prescribes "group selection resulting in a few larger patches (3-5 acres) of regeneration that will provide early successional habitat on the property." To support State Wildlife Action Plan Species dependent on this habitat type, young forest/shrubland (early successional) habitat must be a minimum of 5 acres. Smaller patches do not adequately accommodate nesting territory sizes for some of these species or enable birds to nest far enough from edges to reduce the potential for nest predation and parasitism. The locations chosen for creation of young forest habitat should be in upland areas with a high likelihood of regenerating densely growing young hardwood trees and native shrubs. Plan patches with rounded edges and corners to minimize distances to edges. These could follow topographic contours but avoid steep slopes and required minimum 50 foot or greater stream filters, and potential vernal pool buffers as depicted in Figure 4. Generally, the locations chosen to create young forest habitat are in areas where the majority of trees are poorly formed or diseased and if allowed to continue growing will not develop into marketable timber. Clearing these trees can meet both short term habitat management goals and long term forest management objectives. To provide young forest habitat on the property that will support State Wildlife Action Plan species, complete the following activities.

- In a minimum 5 acre area, clear nearly all trees greater than 4 inches in diameter at breast height unless being retained as seed trees for regeneration and then allow the patch to regenerate naturally. Retain no more than 10 trees per acre left in

groups or scattered throughout, and include both soft and hard mast producing species such as cherry and/or oak. Clearing woody vegetation in the dormant season will encourage vigorous regrowth the following growing season. Leave tree parts (slash) on site in accordance with slash laws to provide cover and nutrient replenishment.

- Consider planning young forest management rotations to maintain a minimum 10 acres in the less than 15 year age class at all times.

- Invasive species are recognized as one of the greatest threats to the integrity of natural communities and also as direct threats to the survival of many indigenous species. Some invasive exotic plants now dominate native communities and can alter ecological relationships. The following activities will minimize the risk of invasive species establishing in managed areas.

    - If any equipment used in management is brought on site from other locations, The Massachusetts Division of Fisheries & Wildlife Best Management Practices for Controlling the Spread of Invasive Plants should be followed. This involves thoroughly cleaning the exterior, undercarriage, and tires/tracks of equipment with a high pressure washer prior to arriving on the property to reduce the risk of invasives being carried on site from other locations. The complete document is located at: http://www.mass.gov/eea/agencies/dfg/dfw/wildlife-habitat-conservation/selected-habitat-management-documents-and-resources.html

    - Treat any invasive plant species currently present.

    - Assess the management units within the first growing season post-harvest for invasive species and treat any that become established.

Proposed abandoned field habitat maintenance: This field could be maintained as an herb/shrub or old field habitat by maintaining herbaceous vegetation and allowing clumps native shrubs to establish. Occasional patches of native shrubs would provide cover, perching sites, or nesting locations for more common species. Native shrubs would also offer sources of nectar and fruit. The following activities could be completed to maintain an herb/shrub habitat.

- Mow patches being maintained in herbaceous cover during the dormant season, October – March, a minimum of once every three years.

- Allow native woody shrubs to establish in clumps ranging in height from 3 to 15 feet and periodically cut them. This can be completed rotationally, by cutting a few patches at a time to provide some clumps at all times.

Species benefits: Young forest habitat is used by a variety of species for a twenty year period as it proceeds through succession (change in vegetative community over time).

The abandoned agricultural field would be beneficial to maintain it as display habitat for American Woodcock. Creating young forest habitat and maintaining the abandoned field would be beneficial to those State Wildlife Action Plan Species indicated in bold in the following table.

Species of Greatest Conservation Need in Young Forests and Shrublands

Taxon Grouping	Scientific Name	Common Name	*State Status
Reptiles	*Elaphe obsoleta*	Eastern Ratsnake	Endangered
	Coluber constrictor	**Black Racer**	**None**
	Heterodon platirhinos	Eastern Hognose Snake	None
Birds	***Bonasa umbellus***	**Ruffed Grouse**	**None**
	Colinus virginianus	Northern Bobwhite	None
	Buteo platypterus	**Broad-Winged Hawk**	**None**
	Falco sparverius	American Kestrel	None
	Scolopax minor	**American Woodcock**	**None**
	Caprimulgus vociferus	Whip-poor-will	Special Concern
	Empidonax traillii	Willow Flycatcher	None
	Toxostoma rufum	Brown Thrasher	None
	Vermivora pinus	**Blue-winged Warbler**	**None**
	Vermivora chrysoptera	Golden-Winged Warbler	Endangered
	Dendroica discolor	**Prairie Warbler**	**None**
	Oporornis philadelphia	Mourning Warbler	Special Concern
	Pipilo erythrophthalmus	**Eastern Towhee**	**None**
	Spizella pusilla	**Field Sparrow**	**None**
	Zonotrichia albicollis	**White-throated Sparrow**	**None**
Mammals	*Synaptomys cooperi*	Southern Bog Lemming	Special Concern
	Sylvilagus transitionalis	New England Cottontail	None
Lepidoptera	*Hadena ectypa*	A Noctuid Moth	None

* For the most updated information on state-listed species visit the Natural Heritage & Endangered Species Program webpage: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/

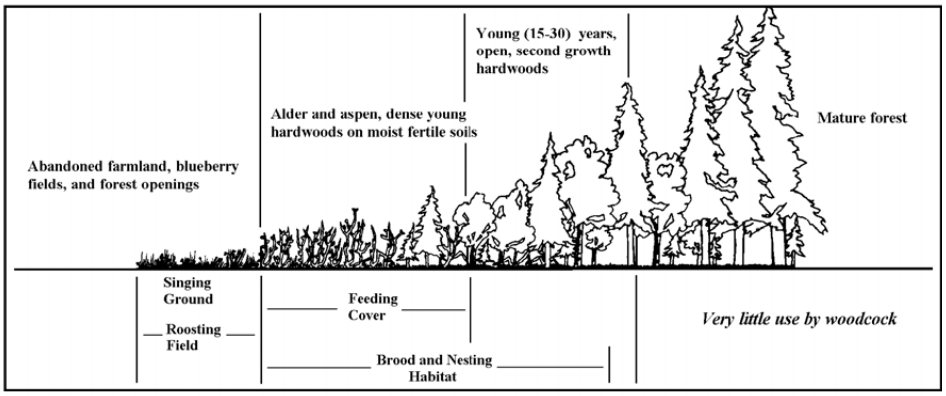
Black Racer is a generalist in terms of both habitat and prey, but in New England is probably most closely associated with dry, upland forest habitats. The most abundant numbers appear to reside in the scrub oak/pitch pine barrens and bordering habitats of Cape Cod and Martha's Vineyard. There are several known "artificial" hibernacula harboring numerous individuals in the central part of the state, all created when dams, dikes or mining waste resulted in the creation of very large (1+ acre) piles of rock and gravel. It is unclear if inland populations actually require deep crevice/talus slope hibernacula; they certainly do not in the southeastern portion of the state. The species feeds on a great variety of prey including small mammals, birds, eggs, insects, fish, amphibians and snakes.

Ruffed Grouse occupy a variety of different habitats in Massachusetts. They prefer early-successional mixed deciduous-coniferous forest, but inhabit mature deciduous mixed forest in the western part of the state and scrub oak forest on Cape Cod. Drumming logs are important for male breeding displays. Early-successional hardwood

forest with high stem densities and good visibility at ground level is important for male drumming sites.

Broad-winged Hawks occupy continuous hardwood and mixed conifer/hardwood forests with canopy openings, such as small clearings, lakes, ponds, or marshes (DeGraaf and Yamasaki 2001). They are generalist predators, catching amphibians, young birds, insects, and, especially, small mammals, by hunting from perches often located at the forest edge or in openings. Broad-winged Hawks construct nests in trees of many different species, but usually choose to nest in the most abundant locally available tree species (Goodrich et al 1996). Nests are built of twigs and sticks, usually at the main crotch of a deciduous tree, or on a platform of horizontal branches against the trunk of a conifer.

American Woodcock require a variety of habitat types each one to three acres in size with foraging habitat within 0.5 miles of nesting habitat. Old farms reverting to forest generally provide optimum habitat for woodcock. Singing grounds and roost sites are situated in forest openings, old pastures, brushy fields, or bogs. Nests are generally found close by in young open woodlands. Daytime feeding habitat includes areas with poorly drained soils such as alder swales near old fields, or second-growth hardwoods mixed with aspen, birch and alder, with rich, moist soils near ponds, streams, or wet areas. The following figure, from Sepik, et al, 1981, illustrates habitat use by American Woodcock.



Blue-winged Warbler nest in early to mid-successional habitat, typically choosing a nest site in habitats that include saplings at the forest edge of clearings comprised of dense shrubby thickets. The species is not sensitive to patch size, and often is found breeding in dense shrub vegetation associated with clearcuts and powerline right-of-ways. Patches with somewhat even structural diversity are favored, especially those composed of a mosaic of shrub, herb and woody vegetation (<15'). Suitable habitat can occur at the edges of wetlands and damp areas, or dry upland areas, independent of the presence or absence water. Defended territories of unmated males are usually in wetter habitat.

Prairie Warbler nest in areas of brushy second growth, dry scrub, low pine-juniper, pine barrens, and burned-over areas. The species is not sensitive to patch size, and often is found breeding in dense shrub vegetation associated with regenerating clearcuts and powerline right-of-ways.

Eastern Towhee is an edge-associated generalist that occupies varied mesic and xeric habitats characterized by dense shrub-small tree cover and a well-developed litter layer. This species occupies mid-to-late stages of secondary succession with the greatest densities occurring in open field thickets and later stages of second growth, but it is sometimes present in climax forest where the understory is well developed. In Massachusetts, Eastern Towhees are most numerous in the scrub-oak and second-growth forests of Plymouth County, Cape Cod and the Islands. They particularly favor areas where moorland is succeeding to scrub-oak barrens; however, as the oaks mature, towhee numbers decline. Elsewhere the species is found throughout the state wherever there is secondary growth or forest openings.

Field Sparrow inhabit old fields, pastures, and the edges of woods, including powerline rights-of-way. They prefer areas of grass interspersed with shrubs or small trees, tending to avoid both grasslands devoid of woody vegetation and wooded areas without significant grassy openings.

White-throated Sparrow breed in coniferous and mixed forests, especially those with low, dense vegetation. They are particularly attracted to areas of second growth, such as beaver meadows, open bogs, forests affected by logging, fire, or insect damage, and areas of low, dense trees near the tree line. Nest sites are generally on or near the ground under dense vegetation along the edge of a clearing. In Massachusetts, White-throated Sparrows are found in the coniferous and mixed forests of the western counties, and in the east, can occasionally be found breeding in Red Maple and White Cedar swamps.

Other State Wildlife Action Plan habitat types and associated species. Those species indicated in bold may inhabit the property based on information about their ranges within the state. State-listed species not known to occur within the vicinity of the property are not included. Active management for these habitat types is not currently being proposed.

Upland forest is land dominated by tree cover where soils are not saturated by water for extensive portions of the growing season. Two general types of upland forest occur in Massachusetts, namely northern hardwood (beech, birch, maple) forest (in western and north-central Massachusetts), and central hardwood (oak/hickory) forest (in eastern and south-central Massachusetts). Within each of these two general types, two "sub-types" occur, including northern hardwood, hemlock, white pine and spruce-northern hardwood, along with oak-hickory/white pine/hemlock and pitch pine-oak.

Species of Greatest Conservation Need in Upland Forests

Taxon Grouping	Scientific Name	Common Name	*State Status
Amphibians	*Ambystoma jeffersonianum*	Jefferson Salamander	Special Concern
	Ambystoma laterale	Blue-Spotted Salamander	Special Concern
	Ambystoma opacum	**Marbled Salamander**	**Threatened**
	Hemidactylium scutatum	Four-Toed Salamander	Delisted
	Scaphiopus holbrookii	Eastern Spadefoot	Threatened
Reptiles	*Terrapene carolina*	Eastern Box Turtle	Special Concern

	Carphophis amoenus	Eastern Wormsnake	Threatened
	Elaphe obsoleta	Eastern Ratsnake	Endangered
	Agkistrodon contortrix	Copperhead	Endangered
	Coluber constrictor	Black Racer	None
	Crotalus horridus	Timber Rattlesnake	Endangered
Birds	*Accipiter striatus*	Sharp-Shinned Hawk	Special Concern
	Asio otus	Long-Eared Owl	Special Concern
	Buteo platypterus	**Broad-Winged Hawk**	**None**
	Hylocichla mustelina	Wood Thrush	None
	Parula americana	Northern Parula	Threatened
	Dendroica striata	Blackpoll Warbler	Special Concern
Lepidoptera	*Erora laeta*	Early Hairstreak	Threatened
	Rhodoecia aurantiago	Orange Sallow Moth	Threatened
	Satyrium favonius	Oak Hairstreak	Special Concern
	Pieris virginiensis	West Virginia White	None
Mammals	*Lasionycteris noctivagans*	Silver-haired Bat	None
	Lasiurus borealis	Eastern Red Bat	None
	Lasiurus cinereus	Hoary Bat	None

Forested swamps are wetlands where trees dominate the vegetation and there is generally little buildup of peat. Soils are saturated for much of the growing season, often with standing water in the spring. Forested swamps are the most abundant types of all wetlands in the northeastern United States (Golet et al. 1993). They usually occur as patches or large patches within the surrounding upland matrix forest. They follow patterns of differences similar to the upland forests: in the northern hardwood zone of western and north-central Massachusetts, forested swamps are cold and often conifer dominated. In the warmer southern and eastern sections of the state and in the central hardwood area, forested swamps are dominated by red maple or Atlantic white cedar. As habitat, swamps are strongly affected by the type of tree, evergreen or deciduous, that forms the canopy.

Species of Greatest Conservation Need in Forested Swamps

Taxon Grouping	**Scientific Name**	**Common Name**	***State Status**
Reptiles	*Clemmys guttata*	Spotted Turtle	Delisted
	Thamnophis sauritus	**Eastern Ribbon Snake**	**None**
Birds	*Parula americana*	Northern Parula	Threatened
Mammals	*Sorex palustris*	Water Shrew	Special Concern
Crustaceans	*Synurella chamberlaini*	Coastal Swamp Amphipod	Special Concern
Lepidoptera	*Callophrys hesseli*	Hessel's Hairstreak	Special Concern
	Callophrys lanoraieensis	Bog Elfin	Threatened
	Catocala pretiosa pretiosa	Precious Underwing Moth	Endangered
	Lithophane viridipallens	Pale Green Pinion Moth	Special Concern
	Pieris oleracea	Eastern Veined White	Threatened

Shrub swamps are shrub-dominated wetlands occurring on mineral or mucky mineral soils that are seasonally or temporarily flooded or saturated. They often occur as a successional area between freshwater marsh and forested swamp (Mitsch & Gosselink 2000) and occur in association with other wetland types in wetland complexes. These wetland shrub thickets are generally flooded in spring and early summer, with water levels dropping below the soil surface by late summer or early fall. Shrubs are perennial

woody plants that have multiple stems and are generally less than 20 feet tall. There are usually at most scattered trees in shrub swamps, and the shrubs themselves produce at least 25% ground cover.

Species of Greatest Conservation Need in Shrub Swamps

Taxon Grouping	Scientific Name	Common Name	*State Status
Reptiles	*Clemmys guttata*	Spotted Turtle	Delisted
	Clemmys muhlenbergii	Bog Turtle	Endangered
	Emydoidea blandingii	Blanding's Turtle	Threatened
Lepidoptera	*Catocala pretiosa pretiosa*	Precious Underwing Moth	Endangered
	Cingilia catenaria	Chain Dot Geometer	Special Concern
	Hemaris gracilis	Slender Clearwing Sphinx Moth	Special Concern
	Lithophane viridipallens	Pale Green Pinion Moth	Special Concern
	Metarranthis pilosaria	Coastal Swamp Metarranthis	Special Concern
	Papaipema stenocelis	Chain Fern Borer	Threatened
	Papaipema sulphurata	Water-Willow Stem Borer	Threatened
Birds	*Anas rubripes*	American Black Duck	None
	Buteo platypterus	**Broad-Winged Hawk**	**None**
	Butorides virescens	**Green Heron**	**None**
	Scolopax minor	**American Woodcock**	**None**

Small streams are the first locations in the upper reaches of the watershed where rainfall, runoff, and groundwater come together to form a defined stream channel, typically with year-round flow. Small streams account for the majority of the linear stream miles in Massachusetts and connect catchments to subwatersheds and mainstem rivers. They accumulate and assimilate all upstream inputs, perturbations, and degradations and transmit them to reaches downsteam. They are the capillaries of the aquatic circulatory system. It has long been realized that healthy small streams contribute to the integrity of the watershed by maintaining the soil, increasing infiltration, reducing the impacts of flooding, and maintaining summer base flow. Small streams are where the River Continuum Theory begins. River Continuum Theory works on several concepts to describe the metamorphosis of a narrow canopy-covered channel, often with fast flow, to a wider deeper channel with slower flows, which is naturally exposed to sunlight over most of its width. Consequently, the boundaries between small, medium and large streams are gradients, not absolutes.

Species of Greatest Conservation Need in Small Streams

Taxon Grouping	Scientific Name	Common Name	*State Status
Fishes	*Lampetra appendix*	American Brook Lamprey	Threatened
	Couesius plumbeus	Lake Chub	Endangered
	Phoxinus eos	Northern Redbelly Dace	Endangered
	Catostomus catostomus	Longnose Sucker	Special Concern
	Cottus cognatus	Slimy Sculpin	None
	Rhinichthys atratulus	**Blacknose Dace**	**None**
	Rhinichthys cataractae	**Longnose Dace**	**None**
	Salmo salar	Atlantic Salmon	None
	Salvelinus fontinalis	**Brook Trout**	**None**
	Semotilus atromaculatus	Creek Chub	None
	Semotilus corporalis	**Fallfish**	**None**
Amphibians	*Gyrinophilus porphyriticus*	Spring Salamander	Delisted (2006)

	Rana pipiens	Northern Leopard Frog	None
Reptiles	*Clemmys insculpta*	Wood Turtle	Special Concern
	Thamnophis sauritus	**Eastern Ribbon Snake**	**None**
Snails	*Pomatiopsis lapidaria*	Slender Walker	Endangered
	Physa vernalis	Vernal Physa	None
Crustaceans	*Cambarus bartonii*	Appalachian Brook Crayfish	Special Concern
Odonates	*Boyeria grafiana*	Ocellated Darner	Special Concern
Lepidoptera	Papaipema sulphurata	Water-Willow Stem Borer	Threatened
Misc. Invertebrates	*Somatochlora elongata*	Ski-Tailed Emerald	Special Concern
	Somatochlora forcipata	Forcipate Emerald	Special Concern
	Somatochlora georgiana	Coppery Emerald	Endangered
	Somatochlora kennedyi	Kennedy's Emerald	Endangered
	Somatochlora linearis	Mocha Emerald	Special Concern
	Alloperla voinae	A Stonefly	None
	Hansonoperla appalachia	Hanson's Appalachian Stonefly	None
	Perlesta nitida	A Stonefly	None
Birds	***Seiurus motacilla***	**Louisiana Waterthrush**	**None**

Vernal pools are ephemeral wetlands that fill annually from precipitation, runoff, and rising groundwater. Usually vernal pools in Massachusetts fill in the spring, and most years they become completely dry later in the season, losing water over the summer to evaporation and transpiration. This wet-dry cycle – a vernal pool's hydroperiod – prevents fish from becoming established permanently in these seasonal wetlands, and thus presents a fish-free, if temporary, habitat for many species. Fish can and do eat many of the species in vernal pools, if given the chance.

Species of Greatest Conservation Need in Vernal Pools

Taxon Grouping	**Scientific Name**	**Common Name**	***State Status**
Amphibians	*Ambystoma jeffersonianum*	Jefferson Salamander	Special Concern
	Ambystoma laterale	Blue-Spotted Salamander	Special Concern
	Ambystoma opacum	**Marbled Salamander**	**Threatened**
	Hemidactylium scutatum	Four-Toed Salamander	Delisted
	Scaphiopus holbrookii	Eastern Spadefoot	Threatened
Reptiles	*Clemmys guttata*	Spotted Turtle	Delisted
	Emydoidea blandingii	Blanding's Turtle	Threatened
Mammals	*Sorex palustris*	Water Shrew	Special Concern
Crustaceans	*Eubranchipus intricatus*	Intricate Fairy Shrimp	Special Concern
	Eulimnadia agassizii	Agassiz's Clam Shrimp	Endangered
	Caenestheriella gynecia	Feminine Clam Shrimp	None
Snails	*Phusa vernalis*	Vernal Physa	None
Beetles	*Hygrotus sylvanus*	Sylvan Hygrotus Diving Beetle	None

* For the most updated information on state-listed species visit the Natural Heritage & Endangered Species Program webpage: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/

Wildlife Monitoring: Documentation of state-listed species is essential to keeping the Natural Heritage & Endangered Species Program database updated and associated habitat protected. Monitoring for them is encouraged and any plants or animals observed can be reported to the Natural Heritage & Endangered Species Program via the Natural Heritage & Endangered Species Program online Vernal Pool & Rare Species (VPRS) Information System at:
http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/report-rare-species/vprs-information-system.html

Or, species observations can be submitted using Rare Species Observation Forms available at:
http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/report-rare-species/

In addition, Species in Greatest Need of Conservation utilizing habitat created or maintained through NRCS funded projects can be reported to the local NRCS office to be documented in the contract file and shared with the DFW Private Lands Program.

Regulatory Requirements

Massachusetts Endangered Species Act
http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/mass-endangered-species-act-mesa/

> According to the current (13th edition) Natural Heritage Atlas the property occurs in Priority Habitat and will not require review. Priority Habitat is defined as "the geographic extent of Habitat for state-listed species" as delineated by the Massachusetts Division of Fisheries & Wildlife pursuant to 321 CMR 10.12. Priority Habitat is delineated based on records of state-listed species observed within the last 25 years prior to delineation and contained in the Natural Heritage & Endangered Species Program (NHESP) database and codified under the Massachusetts Endangered Species Act (MESA). Habitat alteration within Priority Habitat is subject to regulatory review by the Natural Heritage & Endangered Species Program. Habitat management is exempt from MESA filing fees provided that a plan is submitted and approved prior to implementation.

Massachusetts Forest Cutting Practices Act
http://www.mass.gov/dcr/stewardship/forestry/service/cutprac.htm

> The Massachusetts Forest Cutting Practices Act regulates the cutting of timber throughout the state. Filing requirements under the Act are based on volume, cutting area, and the use of timber products. All landowners must comply with this Act. The Massachusetts Forest Cutting Practices Act (FCPA) was created to ensure the long-term public benefits provided by forests. The FCPA regulates any commercial timber cutting of wood products greater than 25 thousand board feet or 50 cords on any parcel of land at any one time. If an activity is not exempt, the FCPA requires filing a

Forest Cutting Plan with the Department of Conservation and Recreation and the local conservation commission at least ten business days before the proposed start date. Some landowners hire a consulting forester (a private MA Licensed Forester who works directly for the landowner to implement forest management), while others have a licensed timber harvester prepare the plan.

Massachusetts Wetlands Protection Act
http://www.mass.gov/dep/water/laws/regulati.htm#wl

Under the Massachusetts Wetlands Protection Act work conducted in and near jurisdictional resource areas including wetlands and perennial streams may require a permit from the local Conservation Commission and Department of Environmental Protection.

The Department of Environmental Protection and local Conservation Commissions have regulatory authority for the protection of vernal pools. The Wetland Protection Act (310 CMR 10.00) and Forest Cutting Practices Act (304 CMR 11.00) regulations also provide protection to vernal pools that have not been certified if their occurrence is adequately documented during permit review. The Massachusetts Forest Cutting Practices Act Regulations protect Certified Vernal Pools from certain forestry impacts. Harvesting requirements limit cutting to no more than 50% of the trees within 50 feet of a Certified Vernal Pool. They also require that trees or tree tops not be felled in Certified Vernal Pools, and restrict the use of pools as staging areas or skidder trails. Guidelines, similar to the regulations, are established for activities planned near uncertified vernal pools identified by consulting foresters.

Resources and References

The Young Forest Project
http://www.youngforest.org/

Massachusetts State Wildlife Action Plan
http://www.mass.gov/eea/agencies/dfg/dfw/wildlife-habitat-conservation/

BioMap2 Conserving the Biodiversity of Massachusetts in a Changing World
http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/land-protection-and-management/biomap2/

Massachusetts Audubon Society State of the Birds
http://www.massaudubon.org/StateoftheBirds/

Appendix D

Mass Audubon Forest Bird Habitat Assessment

Mass Audubon

Protecting the Nature of Massachusetts

Forest Bird Habitat Assessment

North Upton Open Space

Upton, MA

October 2015

Forest Bird
Habitat Assessment

Prepared for the Town of Upton
By Jeff Ritterson, Forest Bird Conservation Fellow, Mass Audubon
Assessment Date: September 29, 2015; **Report Date:** January 15, 2016

Property Information

Town where land is located: Upton, Massachusetts
Acres: 303.38
Forester: Rupert Grantham – Walden Forest Conservation
Enrolled in Chapter 61: No – publicly owned
Forest Management Plan(s): Yes (June 2015)

Introduction

The forests of Massachusetts are home to a high diversity of bird species, many which have a significant proportion of their global populations breeding in our region. Unfortunately, a lot of these species are experiencing long-term population declines. Conservationists recognize the need to manage our forests for the recovery and persistence of bird populations, and appropriate management actions can be achieved through common forestry practices. Because roughly 80% of the state's forests are private, these landowners are in a unique position to greatly affect the quality of habitat in our forested landscape. Even the smallest property can be a critical part of a large forest block of high-quality habitat. With this in mind, Mass Audubon partnered with the Department of Conservation and Recreation and the Mass Woodlands Institute to create the Foresters for the Birds program, which provides technical assistance to private landowners in managing their forest for birds. We manage specifically for birds because they are well studied, and we largely know how their populations respond to environmental changes. These responses are often mirrored by other types of wildlife, so generally what is good for birds is also good for a multitude of other taxa.

The Foresters for the Birds program focuses conservation efforts on 40 forest birds, known as Responsibility Species (Appendix 1). These species are a conservation priority in the Northern Forest Biome and the Eastern Deciduous Forest Biome of the Atlantic Flyway, which comprise Massachusetts. Twelve of these species make up the Birder's Dozen, which is presented in the Forester's for the Birds documents. These twelve species are relatively easy to identity by sight and/or sound and collectively use a wide range of forest habitat types. Being able to identify all 200 species of birds breeding in Massachusetts, and knowing their various habitat associations is difficult even for experts. Thus, the Birder's Dozen is a great starting point for landowners and foresters to become familiar with the forest birds of Massachusetts.

How to use this report

This assessment was conducted in order to (1) describe current forest bird habitat conditions on the property, (2) identify specific opportunities for protecting and/or enhancing habitat, and (3) suggest management options and/or considerations for improving bird habitat. Here are some suggestions for what to do with this report after you look it over:

- **Share and discuss this report with your forester.** Tell your consulting and/or state service forester that birds are important to you and that you want to prioritize protection of their habitat on your property. Ask your forester if they are already working with the Foresters for the Birds program. If not, suggest that they join.

- **Include information and recommendations in this report in your forest management plan** or attach the report as an appendix**.** This report is designed to supplement and inform a full forest management plan created by your forester in order to maximize positive impacts on breeding forest birds.

- **List protection and enhancement of forest bird habit as a management objective in your forest management plan.** Make your interest in birds clear and state it right up front. Example: *Protect and enhance habitat for breeding birds of conservation concern.*

- **Share this report with neighbors, family, and friends.** You can help spread the word about the importance of our forests for responsibility species and let others know about the services that Mass Audubon and the Foresters for the Birds program provides for landowners interested in making a difference for birds on their properties. When neighbors keep in touch about planning management activities across property boundaries they can increase the overall benefit to birds and forest health.

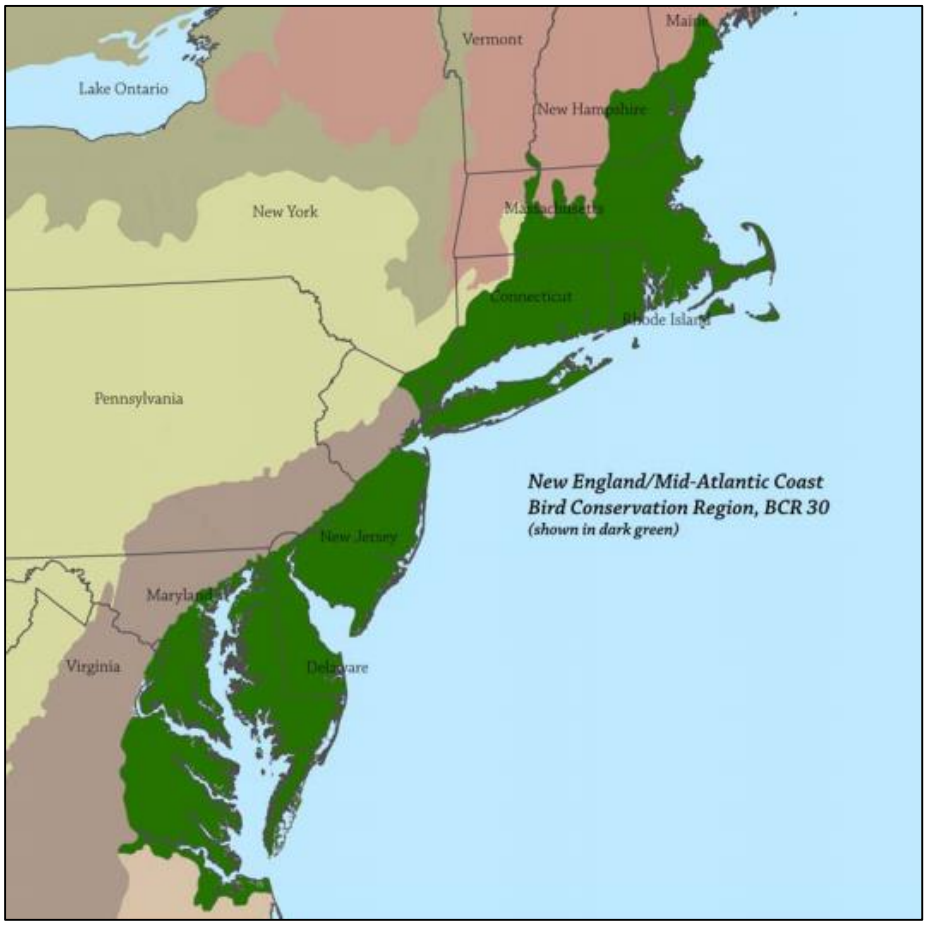
- **Learn more about birds and habitat on your property.** Whether you are a seasoned birder or only recognize a couple of songs, we hope that this report will show you something new about your property and leave you wanting to learn more.

- **Contact us and/or your forester with any questions or when you're planning management activities.** We'll be happy to follow up with you and provide additional assistance if and when you implement any of our recommendations.

Regional Context

The North Upton Open Space falls within the New England/Mid-Atlantic Forest Bird Conservation Region as delineated by the North American Bird Conservation Initiative. This region has a high density of human population, includes many large cities along the eastern seaboard, and has an extensive amount of land dedicated to agriculture. Therefore, the forest bird species of this region are highly dependent on large tracts of the remaining forest, such as the area containing the North Upton Open Space. This region also contains critical migration and wintering habitat as part of the Atlantic Flyway.

Figure 1. Regional Context. The New England/Mid-Atlantic Forest Bird Conservation Region is shown in green.



Landscape Context

The composition and structure of the 2,500 acre landscape that includes and surrounds the North Upton Open Space affects how wildlife will use the property and the quality of the habitat they find there. Understanding the landscape context can also help inform management decisions on the property.

Figure 2. Landscape Context. Note that the state (MassGIS) identified Stand 19 as cropland when it is in fact managed as a field habitat.

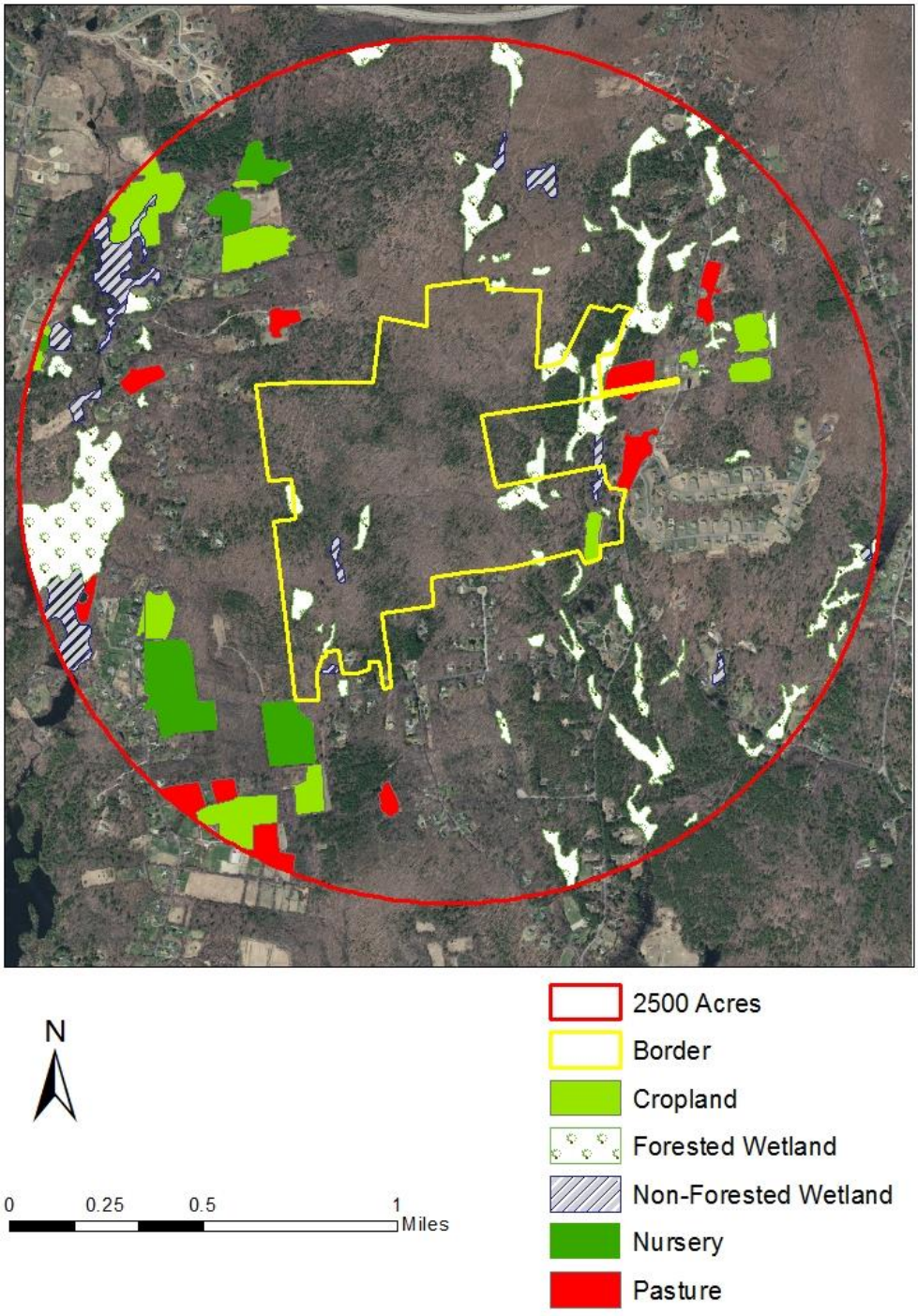


Table 1. Current Landscape Composition. The following table summarizes the composition of the 2500 acre landscape and its value for the suite of responsibility birds:

	Current Condition	Value for Birds
% Mature Forest	78%	**High -** Heavily forested landscapes (≥80% forest cover) provide the greatest quantity, diversity, and quality of habitat for responsibility birds compared to fragmented and/or developed landscapes. Including forested wetlands, the surrounding landscape is >80% forest.
% Young Forest	0%	**Low -** 2+ acre patches of young forest are important breeding habitat for several responsibility birds such as the Chestnut-sided Warbler, as well as post-breeding habitat for mature forest breeding birds. These areas are defined as having an open canopy (<30% cover) that is <20 feet high. Mass Audubon recommends that ~10% of a landscape be in this condition at any point in time. The wetlands in this area may provide low shrubby habitat that is similar to young forest, although they only represent <1% of the landscape.
Forest Patch Size	>300 acres	**High** - Even in a heavily forested landscape, large patches (>300 acres) of contiguous forest provide higher quality habitat for interior-nesting birds like Wood Thrush that reproduce more successfully away from edges and development. These large forest patches also provide habitat for source populations of birds that may recolonize smaller forest patches if they lose their original populations.
Interesting Features: Forested Wetlands	5.6%	The Canada Warbler is a responsibility species which uses swamps and riparian areas with dense understories. The forested wetlands in this landscape may provide good habitat for this declining species.

Recommendations

- **Keep forest on the property as forest.** The greatest threat to habitat for forest nesting birds is the conversion of it to a non-forested condition. Long-term conservation strategies can minimize the potential for this to occur.

- **Protect interior forest conditions.** Avoid creating new permanent openings or wide linear roads (> 20 feet).

- **Create some young forest early successional habitat.** Consider creating a one or several patches of young forest through application of appropriate silviculture, which would contribute to the landscape goal of 10% young forest cover. Specific details are discussed below.

Property Description

The town of Upton is relatively rural and heavily forested in an otherwise largely developed area. The North Upton Open Space is one of several conservation areas helping to maintain this forested character. Most of the property was likely converted to pasture in the 1800's. The forest is now roughly 100 years old, and is largely comprised of even-aged oak dominated forest. In general, these areas have low vertical structural diversity and room for habitat improvement. That said, existing forested and nonforested wetlands, and possible vernal pools, are good habitat features.

Habitat Units

For the purposes of this report, a habitat unit is an easily defined area that is relatively uniform in general cover type (e.g. hardwood, softwood, or mixed forest), canopy height and closure, and supports a particular suite of birds. See Appendix 2 for additional explanation of habitat types in general. Habitat units usually correspond closely to the forest stands delineated by a consulting forester. This report is primarily focused on the forest birds identified as our region's responsibility birds. Many other bird species will also be found in these same habitat types.

Habitat Unit 1: Upland Oak Forest – 222 acres

Unit 1 corresponds to Stands 1, 2, 4, 7-11, 17. This is the primary habitat type on the property and is characterized largely by upland oak forests, with some pockets containing a white pine component (e.g., Stands 2, 4, 9, 10). The desired future condition of this unit – and most of the property, as stated by the Forest Management Plan – is a mature multi-aged mixedwood forest. Currently, the entire unit has a poorly developed understory. High stem and foliage densities of woody plants in the understory provide nest sites, foraging substrates, and protective cover for many species of forest birds. Luckily, the lack of an understory can be remedied with the silviculture prescriptions detailed in the Forest Management Plan. It is suggested that the stands in Unit 1 receive single-tree and group selection, which will not only improve the timber quality, but also allow sunlight to the forest floor and stimulate regeneration and the development of a thick understory layer. Additional actions can be done during the forestry to improve habitat conditions, and are described in table below.

Table 2. Desired habitat conditions – Unit 1.

Desired Future Habitat Condition	Satisfactory	Needs work	Birds that may benefit	Notes
Generally closed canopy (>70% cover on average)	X		Black-throated Green Warbler, Blue-headed Vireo, Ovenbird, Wood Thrush	Strive to maintain this metric when conducting future forestry. However, sometimes removing a larger percentage of the canopy is necessary to accomplish long term goals, and the canopy will reclose over time.
Abundant small canopy gaps (≤ ¼ acre each)		X	American Redstart, Eastern Wood-pewee	Putting in small ¼ acre cuts will help keep the understory vibrant and also be an important habitat feature for some mature forest bird species which associate with these gaps.
Moderate to high understory and mid-story density		X	American Redstart, Black-throated Blue Warbler, Veery, Wood Thrush	Strive to have an understory and midstory in the 50-100% cover range. This can be accomplished following your current forest management plan.
Abundant current and future snags and cavity trees (6 per acre with 3 larger than 16 inches DBH)		X	Northern Flicker, Yellow-bellied Sapsucker	Snags were generally sparse. However, they can be created and managed for, as detailed by your forester.
Abundant downed dead wood including large logs and branches, as well as tree tops and brush piles		X	Ruffed Grouse, White-throated Sparrow, Ovenbird	Not only is the abundance of coarse wood debris important, but having large piles (>1m wide) of fine woody material provides cover for some species.
Vigorous canopy trees	X		Scarlet Tanager	The large trees favored during the forestry will remain a prominent feature of the canopy, and eventually will be replaced through natural processes.

Diversity of native plants; lack of invasive, non-native plants		X	All	While there are many species of trees on the property, many are underrepresented. This can be addressed by the single and group selection as well as encouraging diversity during regeneration. Invasive woody plants are not common.

Figure 2. Habitat Unit 1 tends to have a poor understory throughout. Development of the understory through the prescribed forestry will create a much more desirable habitat for mature forest breeding birds.

Habitat Unit 2: Red Maple/Swamp Hardwoods – 26.0 acres

Unit 2 corresponds to Stands 3, 5, 12, and 14-16. This habitat type is characterized by red maple swamps with wet soils. Due to the wet soils and/or access issues, these areas are all difficult to perform forestry practices in. That said, several of these areas have good vertical structure with a dense understory. These will be particularly attractive to Veery and Canada Warbler, which both associate with a dense understory and wet conditions, especially Stand 5 with its larger area. The bulk of this unit consists of Stands 15 and 16. These areas do not have much of an understory, but they also happen to be the most accessible places in this unit – although difficult. Carrying out the recommended single tree and group selection here, and generally striving for conditions described in Table 2, would be of benefit to mature forest nesting birds. Some management options, such as the creation of snags, coarse woody debris, and perhaps small cut-and-leave gaps could be done by hand, without the use of large machinery. In general, this unit has an abundance of soft mast production in the form of blueberry.

Figure 3. Some areas in Unit 2 have a dense understory, which when combined with the generally wet conditions, provide particularly good habitat for Veery and Canada Warbler – both responsibility species.

Habitat Unit 3: Field – 3.3 acres

Unit 3 corresponds directly with Stand 19. This an old agricultural field that is occasionally mowed in order to maintain it in the current condition. This area is too small to accommodate grassland nesting bird species such as Bobolink and Eastern Meadowlark. Bobolinks, which have the smallest area-requirements of these species are generally absent from fields <5 acres in size. The following recommendations are for enhancing this habitat unit for grassland nesting species:

- Increase the area, perhaps into Stand 18, to a minimum of five acres – the bigger the better.
- Mow every 2-3 years, and/or after August 20th to not disturb nesting birds and their young. This will also allow late blooming wildflowers to develop and provide butterfly habitat.
- Avoid irregular shapes with a lot of edge, or a long narrow field – circles or squares are better to avoid negative edge-related effects.
- Get in contact with Mass Audubon's grassland bird expert for more information.

Continuing the current management of the unit still provides habitat to a variety of other wildlife, including mammals and butterflies. Small mammals that inhabit fields, such as meadow voles and meadow jumping mice, are an important food source for many birds of prey. This field could also be allowed to mature into an early successional young forest.

Summary and Further Recommendations

A trend throughout the property is the lack of a developed understory. Silvicultural practices such as single tree and group selection will help generate and understory and enhance the habitat for mature forest nesting birds while simultaneously improving the timber. Another group of forest birds are those that nest in young regenerating forests. Many of these species have been exhibiting strong declines over the past 40 years, likely due to habitat loss. The first bullet point in the following recommendations addresses conservation actions for these species:

- Consider creating some larger patch cuts for early successional breeding bird species.
    - To be of benefit to these species patches should be >2 acres in size and <30% canopy cover, which would benefit species such as the Chestnut-sided Warbler.
    - Increasing the patch to ≥ 5 acres may accommodate more than one breeding pair, and also more area-sensitive species like the Eastern Towhee.
    - Patch shape should be close to a circle (avoid irregular shapes) to reduce edge/area ratio and edge related effects.
    - Consider placing these near other open areas or wetlands to protect interior forest.
    - See 'Silvicultural Option 3C – Clearcut with Retention, Clearcut with Reserves' in the Silviculture with Birds in Mind document for more information.
- Maintain and encourage the presence of soft mast producing plants such blueberry and black cherry.
- Maintain softwood inclusions, which are important for Black-throated Green Warbler, Blackburnian Warbler, and Blue-headed Vireo. For example, in Stand 13.
- No invasive plant species were noted in the forest interior, however some surely occur nearby. Early detection and rapid treatment is key to keeping them at bay. As you walk your property, keep an eye out for invasive species.

Appendix 1: Responsibly Birds Breeding in Massachusetts

This list contains forest bird species that have been determined by the National Audubon Society to be of conservation priority in the Northern Forest Biome and the Eastern Deciduous Forest Biome in the Atlantic Flyway. These species are included because they have a large proportion of their global population within one of the biomes and many are declining in their breeding range. Massachusetts is part of both the Northern Forest Biome and the Eastern Deciduous Forest Biome.

Young Hardwood and Mixedwood Forest

American Woodcock
Canada Warbler*
Chestnut-sided Warbler*
Magnolia Warbler
Mourning Warbler
Nashville Warbler
Northern Flicker
Ruffed Grouse*
White-throated Sparrow*
Eastern Towhee*
Least Flycatcher
White-eyed Vireo
Blue-winged Warbler
Carolina Wren

Mature Hardwood and Mixedwood Forest

American Redstart
Blackburnian Warbler
Black-throated Blue Warbler*
Black-throated Green Warbler*
Blue-headed Vireo
Chimney Swift
Eastern Wood-Pewee*
Northern Parula
Ovenbird
Purple Finch
Scarlet Tanager
Veery*
Wood Thrush*
Yellow-bellied Sapsucker*
Black-and-white Warbler*
Northern Saw-whet Owl
Dark-eyed Junco
Red-shouldered Hawk
Tufted Titmouse
Red-bellied Woodpecker
Pine Warbler

Boreal/High Elevation Forest

Blackpoll Warbler
Yellow-bellied Sapsucker*

Wetlands and Watercourses

Alder Flycatcher
Swamp Sparrow
Louisiana Waterthrush

*Birder's Dozen species

Appendix 2: Terms and Explanations

Area-sensitive Bird Species: A bird species such as the wood thrush and scarlet tanager that increases in abundance and/or achieves higher nesting success with increasing forest patch size. A similar phenomenon occurs for birds breeding in young forest habitats.

Canopy: The combined cover of individual tree crowns.

> *Importance for Forest Birds:* Canopy height influences nesting site potential for responsibility birds in both young and mature forest habitats. For birds that nest in young forest habitats – such as Chestnut-sided and Mourning Warbler – once the regeneration attains a height of approximately 20 feet, overall conditions are no longer suitable as nesting habitat. For mature forest nesting birds, including Wood thrush and Blackburnian Warbler, nest site selection is strongly associated with increasing canopy height. Forest stands ≥ 1 acre in size with an open canopy (<30% closure) are likely to provide young forest habitat conditions. An intermediate canopy (30-80% closure) often promotes advance regeneration and shrub development suitable for understory and midstory-nesting birds. Canopy closure tends to be inversely proportional to understory development.

Downed Deadwood: Coarse woody material (CWM) is downed logs and branches >4 inches diameter. Fine woody material (FWM) is limbs and branches <4 inches diameter including slash.

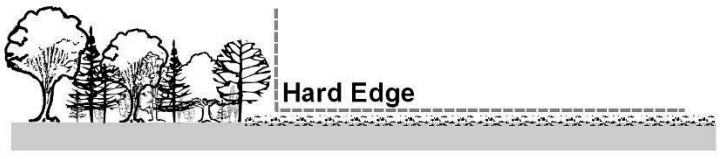
> *Importance for Forest Birds:* CWM provides perch sites for singing (e.g. by Ovenbird) and other male courtship displays, and provides habitat for the insects and other arthropods that are a significant part of the breeding season diet of many birds. Ruffed Grouse tend to use CWM >8 inches diameter as drumming perches. When aggregated in piles (e.g. tree tops or slash piles) FWM offers a nesting substrate and cover for White-throated Sparrows and Veeries. Scattered individual pieces have minimal habitat value.

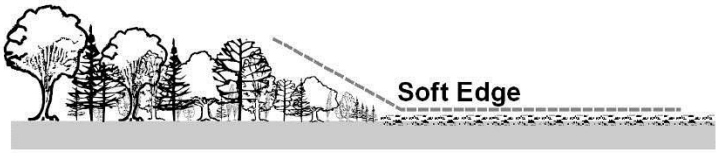
Early Successional Habitat: Areas regenerating after disturbance that provide dense low cover.

> *Importance for Forest Birds: See Young Forest.*

Edge: The boundary between forest and open land, such as a field or backyard.

> *Importance for Forest Birds:* The transition from low herbaceous vegetation to tree canopy can be considered either a "soft" or "hard" edge. A soft edge is a gradual change in vegetation height moving into the forest. This gradual transition is important for buffering interior forest specialists like the wood thrush from the incursions of nest predators (such as raccoons and skunks) and nest parasites (such as the brown-





headed cowbird) that are frequently found in open and developed areas. A gradually increasing canopy height helps to shield interior-nesting birds from view by predators and parasites. Additionally, the brushy conditions that often develop in a soft edge may provide breeding habitat for young forest habitat bird species including Chestnut-sided Warbler and White-throated Sparrow.

Fragmented Forest: Forest that is broken into small, unconnected patches primarily due to some form of development (e.g. residential, commercial, or major roads).

Importance for Forest Birds: A fragmented forested landscape is more likely to support "generalist" wildlife species, such as raccoons and skunks, which can decrease nesting success of interior-nesting forest birds through predation.

Hardwood Forest: A forest dominated by broad-leaved trees which lose their leaves in the fall.

Importance for Forest Birds: Some breeding birds are associated with hardwood forests, such as Chestnut-sided Warbler, Eastern Wood-pewee, and Scarlet Tanager.

Horizontal Structure: The arrangement of different habitat types across the landscape.

Importance for Forest Birds: A landscape with mature and young forest habitats, open fields, and wetlands would be rich in horizontal diversity. Landscapes with greater horizontal diversity support a greater diversity of breeding forest birds and other wildlife.

Interior Forest: Forest condition that occurs with increasing distance from a forest edge.

Importance for Forest Birds: As perceived from a bird's perspective, interior forest conditions begin to occur approximately 200-300 feet from a forest edge. At this distance, negative edge-associated effects such as nest predation and parasitism generally no longer occur. Interior-nesting species, such as Scarlet Tanager, Wood Thrush, Ovenbird, Black-throated Blue Warbler, and Blue-headed Vireo, have greater reproductive success when they nest away from forest edges.

Invasive Plant: A plant that is able to establish on many sites, grow quickly, and spread to the point of disrupting native ecosystems. Often non-native.

Importance for Forest Birds: Non-native, invasive plants, such as bush honeysuckles, buckthorn, and Japanese barberry, present a variety of threats to forest health in Vermont and the northeast. Although some species of native forest birds successfully use these shrubby, woody plant species as nesting sites and eat their fruits, the fruits generally have low nutritional value and the invasive plants reduce the diversity of other nesting and foraging options in forest ecosystems. Overall, non-native, invasive plant species degrade the quality of native forest bird habitat in our region.

Leaf Litter: Dead plant material such as leaves, bark, and twigs that has fallen to the ground.

Importance for Forest Birds: An abundant layer of moist leaf litter is home to an array of insects, mites, and spiders. These arthropods make up a significant component of Ovenbird, Veery, and

Wood Thrush diets during the breeding season. Ovenbirds also rely upon a deep layer of deciduous litter for constructing their ground nests, and nest site selection is strongly associated with this habitat variable.

Mature Forest Habitat: Forest with a canopy greater than 20 feet tall.

Importance for Forest Birds: Many responsibility birds breed in mature forest habitats where they find nest sites, cover, and food. Typically, the quality of mature forest habitat increases for forest birds as a forest ages and structure diversifies. Pole stands – the youngest type of mature forest habitat - are typically structurally simple and attract a small suite for forest birds including ruffed grouse and American redstart. Older stands with understory and midstory layers, canopy gaps, large trees, snags, and logs, attract a much greater diversity of birds including black-throated blue warbler, wood thrush, Canada warbler, and black-throated green warbler.

Midstory: Live, woody vegetation in the 6-30 foot height range including trees and shrubs.

Importance for Forest Birds: High stem and foliage densities of woody plants in this forest layer provide nest sites, foraging substrates, and protective cover for many forest birds. Stand-wide coverage is desirable but not necessary; well distributed patches are sufficient. The majority of responsibility bird species nest and/or forage within the first 30 feet of the forest. Nests of Wood Thrush, American Redstart, Black-throated Green Warbler, and Blue-headed Vireo are most commonly found in the midstory level.

Mixedwood Forest: A forest made up of hardwood and 25-75% softwood tree species.

Importance for Forest Birds: Some breeding birds are associated with mixedwood forests, such as Black-throated Blue Warbler, Canada warbler, and White-throated Sparrow.

National Audubon Society WatchList: An analysis by the National Audubon Society and American Bird Conservancy which uses the latest available research from the bird conservation community along with citizen science data to identify bird species in the continental U.S. and Hawaii that are in need of immediate conservation help. It is a call to action to save species fighting for survival amid a convergence of environmental challenges, including habitat loss, invasive species and global warming. Wood Thrush and Canada Warbler are Audubon WatchList species.

Snags and Cavity Trees: Snags are standing dead or partially dead trees that are relatively stable. Cavity trees may be alive or dead.

Importance for Forest Birds: Snags provide opportunities for nesting cavity excavation by Yellow-bellied Sapsuckers and Northern Flickers, and existing cavity trees provide potential nesting cavities for Chimney Swifts. Aspen and birch species are frequently chosen as trees to excavate. Cavities are often made in trees with the heartwood and sapwood decay fungi. Suggested targets for snags and cavity trees combined in are ≥ 6 per acre, with one tree >18 inches DBH and 3 >12 inches DBH. Branches on snags may be used as foraging perches and nest sites.

Soft Mast: Soft fruits.

Importance for Forest Birds: Fruits including cherry, apple, *rubus* species (e.g. blackberry and raspberry), dogwood, and others are important food sources for forest birds. In the late summer and early fall, after fledging and before migrating, many birds feed on these fruits and the insects that are attracted to them in order to build up critical fat reserves needed to endure long fall migrations.

Softwood Forest: A forest dominated by coniferous trees, usually "evergreen" (the exception being tamarack), with needles or scale-like leaves.

Importance for Forest Birds: Some breeding birds are associated with softwood forests, such as Magnolia Warbler and Blue-headed Vireo. Other birds, such as Blackburnian and Black-throated Green Warbler, are associated with small clusters of softwood trees called inclusions in hardwood stands. For this reason, maintaining or increasing the softwood component of hardwood stands increases their overall habitat value.

Understory: Live vegetation in the 1-5 foot height range, including tree seedlings and saplings, shrubs, and herbaceous vegetation.

Importance for Forest Birds: High stem and foliage densities of woody plants in the understory provide nest sites, foraging substrates, and protective cover for many forest birds. Stand-wide coverage is desirable but not necessary; well distributed patches are sufficient. Herbaceous plants may also be used by songbirds for foraging and nesting, but generally less so than woody plants. Species in this layer frequently used by birds include sugar maple, American beech, hobblebush, red spruce, *rubus* species, and striped maple. Black-throated Blue Warbler and Wood Thrush place nests in this layer, and Canada Warbler and Veery tend to nest on or near the ground, concealed by dense understory growth. The best breeding habitats for Mourning Warbler and Chestnut-sided Warbler are patches of dense, low growth with <30% overstory cover in patches >1 acre in size (young forest habitat conditions).

Vertical Structure: The complexity of vegetation and other structures as they are vertically arranged in the forest.

Importance for Forest Birds: A forest with a well-developed understory, midstory, and canopy exhibits complex or diverse vertical structure, which offers habitat for a greater array of bird species compared with a structurally simple forest. Non-living features, such as coarse woody material and the microtopography of the forest floor, add to the complexity of vertical structure as well.

Young Forest Habitat: Forest patches greater than one acre in size dominated by a high density of seedlings, saplings, and shrubs less than 20 feet tall.

Importance for Forest Birds: Several responsibility birds and many other wildlife species use young forests during all or part of their life cycle. Chestnut-sided Warbler, American Woodcock, and Magnolia Warbler all use young forests during the breeding season. Although these species may be found in patches smaller than one acre in size, research has shown that abundance and nesting success is greater in larger patches. Young forest habitats include regenerating patchcuts, clearcuts, and old fields. Early successional young forest habitats dominated by

intolerant species such as aspen and paper birch are particularly valuable for woodcock and grouse. Shrublands that will never mature into forest, such as those associated with beaver wetland complexes, can also attract species associated with young forest habitats since they have a similar vegetative structure. Recent research has also shown the importance of young forest habitats as post-breeding habitat for birds that nest in mature forest, such as Scarlet Tanager and Wood Thrush. Young forest provides dense, protective cover for juveniles, as well as abundant sources of soft mast, which are important pre-migration food sources. Young forest habitats are ephemeral; they generally only persist 10-15 years where forest regenerates after a patch or clearcut and slightly longer on old field sites. Due to natural forest succession and development, the amount of this habitat type is decreasing in our region, which is a threat to the species associated with it.

Appendix 3: Additional Forestry Terms

Adapted from Vermont Land Trust Forestry Glossary

Acre: A standard unit of area measure. One acre equals: 43,560 square feet; 4840 square yards; 10 square chains.

Advance regeneration: Natural regeneration that is established prior to a timber harvest.

Age Class: One of the intervals, commonly 10-20 years, into which the age range of trees are divided for classification.

Blowdown: A tree or trees that have been toppled by high winds. A common phenomenon along the edge of strip cuts and clearcuts.

Browse: Buds, leaves, and twigs of seedling and sapling regeneration that are utilized as a food resource by wildlife.

Clearcut: A silvicultural method which removes all trees from a designated area at one time for the purpose of creating a new, even-aged stand. This management system is usually used to regenerate shade-intolerant tree species. Variations include patch and strip clearcutting.

Crop Trees: Trees to be grown to the end of the rotation in even-aged management or trees to be favored for future growth in uneven-aged management.

Crown: The branches and twigs of the upper part of a tree.

Diameter at Breast Height (DBH): The diameter of a standing tree measured at 4.5 feet above the ground and expressed in inches.

Even-aged: An age class description of a stand in which the age of the trees is relatively close, usually within 20 years. Stands with two distinct age classes can also be referred to as even-aged.

Forest Management Plan (FMP): A long range plan designed to identify a landowner's goals and objectives and the silvicultural methods that will be employed to achieve those goals. FMP's in Vermont are typically written for a 15 year period and updated every 10 years.

Forest Type: A natural group or association of different species of trees which commonly occur together over a large area. Forest types are defined by one or more of the dominant species of trees in the type.

Forestry: The art and science of growing and managing forests and forest lands for the continuing use of their resources.

Girdle: To destroy the conductive tissue of a tree in a ring around the bole or trunk. A technique often used to create snags.

Harvest: A silvicultural treatment that is intended to establish regeneration. A harvest is generally a higher level of cutting intensity than a thinning.

High-grading: A liquidation cut in which only the best quality, highest value trees are removed. Cuts of this nature are short sighted and exploitative and result in the degradation of the forest ecosystem.

Individual Tree Selection: An uneven-aged harvesting method designed to favor tolerant species. Trees are removed individually to maintain a continuous and uniform crown cover. Also referred to as single tree selection.

Intermediate Treatments: The removal of trees from a stand between the time of establishment and the final harvest with the purpose of improving stand growth and/or species composition and/or health.

Intolerant Species: Trees unable to grow and develop in the shade of other species. Intolerant commercial species in Vermont include: paper birch and aspen.

Landing: Any place where logs are assembled for further transport.

Mast: Nuts, berries, and seeds utilized by wildlife as a food resource.

Overstory: Those trees making up the main canopy. The overstory is usually referenced as the larger trees in the stand.

Pole or Pole Timber: A tree or trees greater than 4.0 inches DBH and less than 10.0 inches DBH.

Prescription: A course of action to effect change in a forest stand (e.g. harvest, thinning, or planting).

Regeneration: Renewal of a tree crop by natural or artificial means.

Release: The freeing of well-established seedlings or saplings from surrounding growth.

Residual: Trees that are left to grow in a stand after a silvicultural treatment.

Rotation: The length of time required to grow an even-aged crop of trees to a desired age.

Rotation Age: The age at which an even-aged stand is considered ready for harvest.

Salvage Cut: The removal of dead, dying, and damaged trees after a natural disaster or insect or disease infestation to utilize the wood before it loses all of its commercial value.

Sapling: Trees taller than 4.5 feet but less than 5.0 inches DBH.

Sawlog: A log considered suitable in size and quality for producing lumber. Regional standards apply for diameter, length and freedom from defect. Sawlog is also used to refer to a tree that has reached sufficient size to produce a sawlog. Small sawlog trees are 12-16 inches DBH, medium sawlog trees are 17-20 inches DBH, and large sawlog trees are 22 inches DBH or greater.

Sawtimber: Trees that have obtained a minimum diameter at breast height that can be felled and processed into sawlogs. Typical minimum size limits for commercial species in Vermont are 8 inches DBH for softwoods and 12 inches DBH for hardwoods.

Seedlings: Trees that are less than 4.5 feet tall.

Shade tolerance: The ability of trees to reproduce and grow in the shade of other trees. Tolerance ratings are very tolerant, tolerant, intermediate, intolerant, and very intolerant.

Silviculture: Manipulation of the forest ecosystem to achieve specific goals and objectives.

Skid Trail: Any path in the woods over which multiple loads of logs are hauled, usually by a skidder or tractor. Primary skid trails are the main pathways that enter the landing.

Stand: A community of trees possessing sufficient uniformity in regards to composition, constitution, age, spatial arrangement or condition to be distinguishable from adjacent communities.

Stocking: An indication of the number of trees in a stand as compared to the optimum number of trees required to achieve some management objective, usually improved growth rates or increased timber values.

Tolerant Species: Trees that can grow satisfactorily in the shade of other trees. Tolerant species of commercial importance in Vermont include sugar maple, beech, red spruce, and hemlock.

Uneven-aged: An age class description of a stand of trees that contains more than two distinct age classes and a variety of size classe

Appendix E

Conservation Commission Land Use Regulations

Land Use Regulations
Town of Upton Conservation Commission

The following rules are established on December 13, 2006 by a majority vote of the Upton Conservation Commission under its authority (Chapter 40, Section 8C) to regulate use of town conservation areas and other land managed by the Conservation Commission.

Upton's conservation lands are open to all for hiking, nature study, biking, cross country skiing, snowshoeing, horseback riding, camping, and other pursuits that do not damage the land or impair other people's enjoyment. These are your lands. Please enjoy them and take care of them.

1) Conservation lands are open daily from one hour before sunrise until one hour after sunset. After hours use may be permitted by the Conservation Commission.

2) Horses and mountain bikes and permitted except in certain areas to prevent damage to resources or trails. A list of restricted use trails is available from the Conservation Commission.

3) Motorized vehicles are permitted only when authorized by the Conservation Commission or on designated trails.

4) Dogs must be leashed or under control at all times. Dogs must be leashed from April 1 through June 30 in grassland areas to protect ground-nesting birds.

5) No alcoholic beverages are permitted.

6) No person shall cut, break, remove, deface, or defile any natural or manmade object. Plants may not be collected or removed unless authorized by the Conservation Commission. Non-game wildlife, including vertebrates and invertebrates, shall not be harassed, collected, or removed.

7) Hunting and trapping is permitted pursuant to Massachusetts Department of Fish and Wildlife regulations. Treestands are permitted without written approval from the Conservation Commission provided treestand guidelines are followed. The guidelines are available from the Conservation Commission and the town of Upton website.

8) Discharge of firearms except during hunting season by licensed hunters is prohibited. Discharge of paintball guns is prohibited.

9) No fires are permitted except under conditions stipulated in a camping permit**.**

10) No disposal of waste material of any kind is permitted. All trash must be packed out.

11) Overnight camping may be permitted at the discretion of the Conservation Commission to groups having an adult leader present at all times. All campsites must be at least 50 feet from established trails and 100 feet from wetlands, ponds, or streams. Use of portable stove and open fires are allowed with written permission from Upton Fire Department. All wastes must be packed out.

12) Group use of conservation land for private, non-commercial functions such as for weddings, is allowed with prior notification and approval of the Conservation Commission. Applications for other group events will be accepted only from non-profit and governmental organizations.

VIOLATIONS HEREOF are punishable by a fine of $50 for the first offense and $100 for subsequent offences. The Commission may also require restoration of damages.

if there are questions please contact the Upton Conservation Commission at 508-529-6286 or at concom@upton.ma.us.

Upton Conservation Commission Treestand Guidelines

These guidelines describe Conservation Commission policy concerning use of treestands on Town of Upton conservation lands and other lands managed by the Conservation Commission and Upton Land Stewardship Committee at the request of the selectmen. The guidelines do not apply to other land owned by the town of Upton, Upton State Forest, or privately owned land.

Hunters may install and use treestands without prior written Commission approval, subject to the following conditions:

1. No person shall construct, maintain, or use a permanent treestand. A permanent treestand is one which is constructed using nails, screws, or other fasteners which intrude into the wood of the tree.

2. Treestands must not be visible from mapped hiking trails. This is to reduce the risk that a person (non-owner) will locate a treestand, climb it, and suffer a climbing injury.

3. Treestands may be installed no earlier than 30 days prior to deer hunting season and must be removed within 30 days after deer hunting season closes. Treestands installed outside this interval are subject to removal by the Commission (owners of confiscated treestands may claim them at the Conservation Commission office).

4. No trees shall be cut down to improve sight lines. Trimming of small branches (maximum 1.5” diameter) is permitted.

Adopted: October 24, 2007

Effective: August 1, 2008

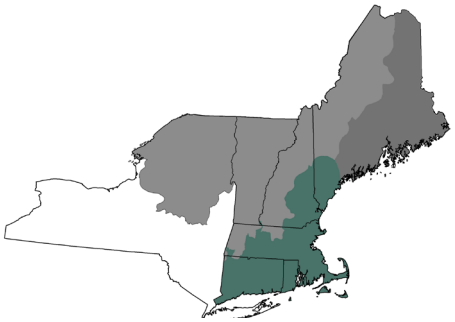
Appendix F

Climate Change Projection for Tree Species – Southern/Coastal New England

CLIMATE CHANGE PROJECTIONS FOR INDIVIDUAL TREE SPECIES

SOUTHERN AND COASTAL NEW ENGLAND

The region's forests will be affected by a changing climate during this century. A team of forest managers and researchers created an assessment that describes the vulnerability of forests in New England and northern New York (Janowiak et al. in press). This report includes information on the current landscape, observed climate trends, and a range of projected future climates. It also describes many potential climate change impacts to forests and summarizes key vulnerabilities for major forest types. This handout is summarized from the full assessment.



Remember that models are just tools, and they're not perfect. Model projections don't account for some factors that could be modified by climate change, like droughts, wildfire activity , and invasive species. If a species is rare or confined to a small area, Tree Atlas results may be less reliable. These factors, and others, could cause a particular species to perform better or worse than a model projects. Human choices will also continue to influence forest distribution, especially for tree species that are projected to increase. Planting programs may assist the movement of future-adapted species, but this will depend on management decisions.

TREE SPECIES INFORMATION:

This assessment uses two climate scenarios to "bracket" a range of possible futures. These future climate projections were used with two forest impact models (Tree Atlas and LANDIS) to provide information about how individual tree species may respond to a changing climate. More information on the climate and forest impact models can be found in the assessment. Results for "low" and "high" climate scenarios can be compared on page 2 of this handout.

Despite these limits, models provide useful information about future expectations. It's perhaps best to think of these projections as indicators of possibility and potential change. The model results presented here were combined with information from published reports and local management expertise to draw conclusions about potential risk and change in the region's forests.

SPECIES	ADDITIONAL CONSIDERATIONS
LIKELY TO DECREASE	
Balsam fir	Requires cold climate and susceptible to drought, fire, and insects
Eastern white pine	Good disperser, but susceptible to drought and insects
Paper birch	Early-sucessional colonizer, but susceptible to insects and drought
Quaking aspen	Early-sucessional colonizer, but susceptible to heat and drought
Red spruce	Needs a particular type of habitat, limited seedling establishment
Striped maple	Shade tolerant and easily established, but susceptible to drought
MAY DECREASE	
American beech	Affected by beech bark disease, extremely shade tolerant
Bigtooth aspen	Early-sucessional colonizer, but susceptible to drought
Eastern hemlock	Hemlock woolly adelgid causes mortality
Gray birch	Disperses easily, but susceptible to drought, fire, and insects
Red pine	Fire-adapted, but susceptiple to some insects
Yellow birch	Good disperser, but susceptible to fire, insects, and disease
NO CHANGE	
Black cherry	Susceptible to insects and fire, but tolerates some drought
White ash	Emerald ash borer causes mortality

SPECIES	ADDITIONAL CONSIDERATIONS
MAY INCREASE	
American elm	Affected by Dutch elm disease, grows across a variety of sites
Black oak	Drought-tolerant, but susceptible to insects and disease
Eastern hophornbeam	Grows across a variety of sites and tolerates shade
Eastern redcedar	Drought-tolerant, but susceptible to insects and fire
Pitch pine	Susceptible to some insect pests
Shagbark hickory	Susceptible to some insect pests
White oak	Fire-adapted and grows on a variety of sites
MIXED MODEL RESULTS	
Chestnut oak	Grows on a variety of sites, but susceptible to insects and disease
Northern red oak	Susceptible to some insect pests
Pignut hickory	Grows on a variety of sites, but susceptible to drought and insects
Red maple	Competitive colonizer tolerant of disturbance and diverse sites
Scarlet oak	Drought- and fire-adapted, but susceptible to insects and disease
Sugar maple	Grows across a variety of sites and tolerates shade
Sweet birch	Susceptible to drought, fire topkill, and insects

SOURCE: Janowiak et al. in review. New England and New York forest ecosystem vulnerability assessment and synthesis: a report from the New England Climate Change Response Framework. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. ***www.forestadaptation.org/new-england/vulnerability-assessment***

NIACS
Northern Institute of Applied Climate Science

www.forestadaptation.org

FUTURE PROJECTIONS

Data for the end of the century are summarized for two forest impact models under two climate change scenarios. The Climate Change Tree Atlas (www.fs.fed.us/nrs/atlas) models future suitable habitat, while LANDIS models changes in forest growth over time (future tree density presented in this table; additional data are available in the assessment).

▲ **INCREASE**
Projected increase of >20% by 2100

● **NO CHANGE**
Little change (<20%) projected by 2100

▼ **DECREASE**
Projected decrease of >20% by 2100

★ **NEW HABITAT**
Tree Atlas projects new habitat for species not currently present

ADAPTABILITY

Factors not included in the models, such as the ability to respond favorably to disturbance, may make a species more or less able to adapt to future stressors.

\+ high
Species may perform better than modeled

· medium

– low
Species may perform worse than modeled

SPECIES	LOW CLIMATE CHANGE (PCM B1)		HIGH CLIMATE CHANGE (GFDL A1FI)		
	TREE ATLAS	LANDIS	TREE ATLAS	LANDIS	ADAPT
American basswood	●		▲		·
American beech	●	●	▼	▼	·
American chestnut	●		●		·
American elm	▲		▲		·
American holly	●		▲		·
American hornbeam	●		▲		·
American mountain-ash	●		●		–
Bald cypress	★		★		·
Balsam fir	▼	▼	▼	▼	–
Balsam poplar	▼		▼		·
Bigtooth aspen	●		▼		·
Black ash	▼		▼		–
Black cherry	●	●	●	●	–
Black hickory			★		·
Black oak	▲	●	▲	●	·
Black spruce	▼	▼	▼	▼	·
Black walnut	★		★		·
Blackgum	▲		▲		+
Blackjack oak			★		+
Boxelder	●		●		+
Bur oak	●		▲		+
Cherrybark oak			★		·
Chestnut oak	▲	▲	▲	▼	+
Chinkapin oak			★		·
Common persimmon	★		★		+
Eastern hemlock	●	●	▼	▼	–
Eastern hophornbeam	●		▲		+
Eastern redbud	★		★		·
Eastern redcedar	▲		▲		·
Eastern white pine	▼	▼	▼	▼	·
Flowering dogwood	▲		▲		·
Gray birch	●		▼		·
Green ash	●		▲		·
Hackberry	●		▲		+
Loblolly pine	★		★		·
Mockernut hickory	▲		▲		+
Mountain maple	●		▼		+
Northern red oak	●	●	▼	●	+
Northern white-cedar	▼	▼	▼	▼	·
Overcup oak			★		–

SPECIES	LOW CLIMATE CHANGE (PCM B1)		HIGH CLIMATE CHANGE (GFDL A1FI)		
	TREE ATLAS	LANDIS	TREE ATLAS	LANDIS	ADAPT
Paper birch	▼		▼		·
Pignut hickory	▲	●	▲	▼	·
Pin cherry	●		●		·
Pin oak	▲		▲		–
Pitch pine	▲	●	●	●	·
Pond pine	★		★		–
Post oak	▲		▲		+
Quaking aspen	▼	▼	▼	▼	·
Red maple	●	●	▼	●	+
Red pine	●		▼		·
Red spruce	▼	▼	▼	▼	–
Sassafras	▲		▲		·
Scarlet oak	▲	●	▲	▼	·
Serviceberry	●		▼		·
Shagbark hickory	▲	●	▲	●	·
Shingle oak			★		·
Shortleaf pine	★		★		·
Silver maple	▲		▲		+
Slippery elm	●		▲		·
Sourwood	▲		▲		+
Southern red oak	★		★		+
Striped maple	▼		▼		·
Sugar maple	●	●	●	▼	+
Sugarberry			★		·
Swamp chestnut oak	●		▲		·
Swamp tupelo	★				–
Sweet birch	▲		▼		–
Sweetbay	★				·
Sweetgum	★		★		·
Sycamore	▲		▲		·
Tamarack (native)	▼		▼		–
Virginia pine	★	●	★	●	·
Water oak			★		·
White ash	●	●	●	●	–
White oak	▲	●	▲	●	+
White spruce	▼		▼		·
Willow oak			★		·
Winged elm	●		▲		·
Yellow birch	●	●	▼	▼	·
Yellow-poplar	▲	▲	▲	●	+

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Appendix G

NUOS Area Cultural History
&
Sweetwilliam Farm History

NORTH UPTON OPEN SPACE (NUOS) AREA CULTURAL HISTORY

The Nipmuc Indians lived in the general area of the Warren Brook Watershed Conservation Area at the time of English contact. The Nipmucs were fresh water fishermen and are still here today. There is a 3-acre Hassenamessit Nipmuc Indian reservation in the town of Grafton to the west of Upton.

Nipmucs were noted fishermen and hunters, the women grew the three sister crops of corn and beans and squash, and they moved to different areas with the different seasons. Late spring was for the time for large gatherings at the waterfalls for the fish migrations up stream, easily caught with nets and dried for later use. There was spring planting, and summer and fall harvesting. Nuts and berries were gathered. Winter was a time for story telling.

There was a noted trail going through Upton called the Connecticut Trail that connected the harbor in Boston all the way to the Connecticut River north of Hartford. Today, remnants of the trail can be seen on Elm Street in both Upton and Hopkinton. In addition there were trails through what was once Sweet Williams Farm close to Warren Brook Watershed Preservation area.

English and Tribal use of the land was markedly different. Nipmucs depended on burning the land to help out with hunting deer and clearing the hills for ceremonial stone structures and berries cultivation. Nipmuc Indians grew the three sisters of corn, beans and squash and there was no need to fence their land. They often left some land fallow- a practice today understood to be helpful, but not understood at the time. The English had cows that needed fencing, and there were frequent complaints from the Indians about swine ruining cornfields. Hunting and fishing were primary for Indian men and Indian women tended the crops. The English demanded fenced in lots and constant cultivation of fields. The men were the farmers. The English liked living in one place all the time, while the Indians would move around an area by the season, having houses that were easily dismantled and carried.

There was also conflict because Europeans were making dams on all the rivers and streams for waterpower and mills. The Nipmuc people, the fresh water fishermen, had their fishing patterns disrupted. The anadromous fish came from the ocean and up river and stream to spawn. The fish would lay their eggs and then die. Then the new fish would hatch and get bigger and then begin their migration to the larger ocean waters. Late spring marked the time for gatherings at the big waterfalls to net the many fish swimming upstream.

What was first important in the interior was beaver. The trading post or trucking post was the place of exchange. However, 40 years of trapping beavers decimated the population and by King Phillips War in 1676, the beaver population was suffering. Natives were used to the exchange of European goods and started selling land when needed. There was never a concept of 'owning' land before this.

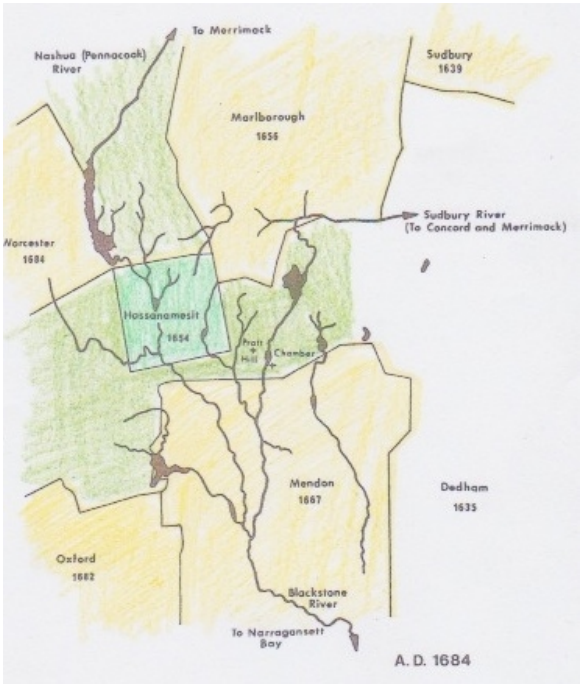
The early land deeds show us how the Native tribes tried to keep important ceremonial areas free of English occupation. By carefully exploring the land records a particular pattern emerges of preserving the most ceremonial areas as long as possible.

Byron Dix and James Mavor, authors of the book Manitou, the Sacred landscape of New England's Native Civilization, describe this process in chapter two, page 44: "Historical records

are useful not only for the direct information that they provide, be it fact or fancy, but also for the questions they raise about the gaps.“

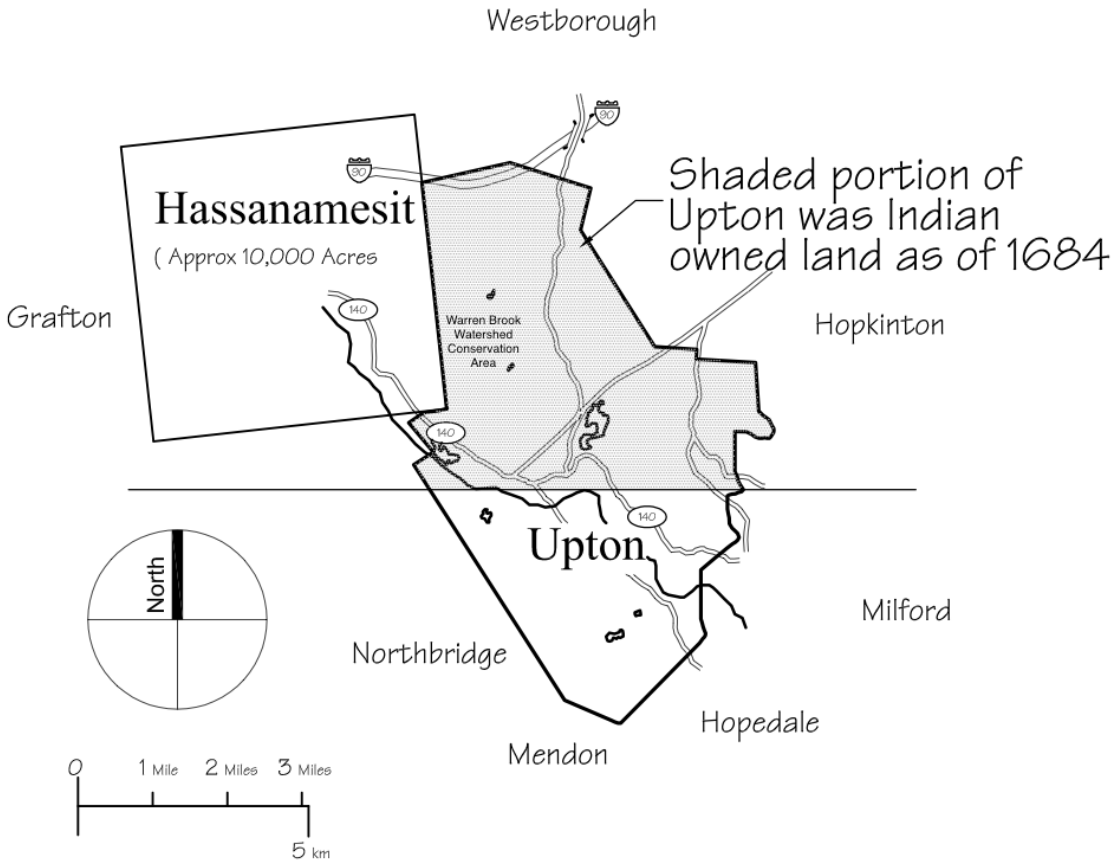
Also on page 44: “In 1948, Sarah M.C. Sullivan, a Nipmuc Indian, wrote from the Indian reservation in Grafton, “ Our people were great stone builders. Sometimes those caves came in very handy... Upton was once included in Hassanamesitt.”

“It is likely that Hassanamessitt, the seat and sacred center of the Nipmuc Nation, was, with the adjoining strips of land, retained by the Indians because of its special location at the source of the waters of Massachusetts, making this area a place of powerful Manitou.” (The beginnings of the Blackstone, Charles, Sudbury, and Nashua Rivers are in this special area.)



“ The map of Figure 2-8 from book Manitou shows the Upton Chamber, Pratt Hill, Hassanamessitt, and English towns in the region that had been established by the general court by 1684. A strip of land running east and west was still held and occupied by Indians, and not settled by European colonists...Another strip of Indian land ran north from Hassanamessitt. “

Mendon’s 1667 deed was for eight square miles. The Hassanamessit Praying Village’s deed in 1654 was for four square miles. The Praying Village of Okommakamesit and English town of Marlboro was established in 1656. Yellow on the map shows English claimed land, green is land still held by the Nipmucs.



The northern half of the town of Upton in which the chamber is located was owned by the Nipmuc Indians up to ca.1684-1704 according to a map created by Rebecca Wetzell and Mike Gorman and published in *Upton and Mendon Town Crier* (reproduced as supplemental figure S8 in Mahan *et al.* 2015). This is consistent with the historical findings in the archaeological report on the chamber by archaeologist Martin Dudek, who noted, "No notable colonial settlement took place during this period [1620-1675]" (Dudek 2012: 20).

Note Warren Brook Watershed Conservation Area abuts the former Hassanamesit Praying Village and was still Nipmuc land in 1684.

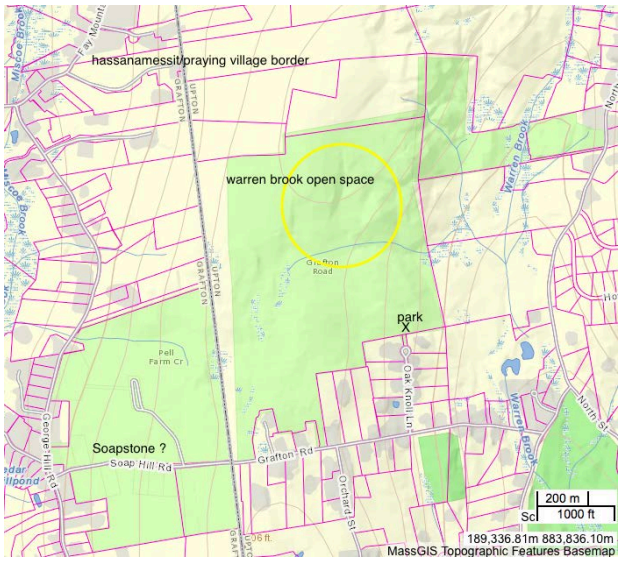
It was not until 1715, 40 years after King Phillip's War (1675-6) that the towns of Sutton and Hopkinton were formed from this 'leftover' land. Twenty years later in 1735 the Hassanamessit Praying Village became the town of Grafton and the former boundary point of the four towns of Mendon, Uxbridge, Sutton, and Hopkinton, got turned inside out and became the center of the new town of Upton.

The burning of the ceremonial hills is of particular importance in Upton. Pratt Hill along with the Upton Cave at Heritage Park were declared eligible for the National Register of Historic Places as a discontinuous district in 2011 by Stephen DelSordo, the federal preservation officer for the Federal Communication Commission (FCC). The cultural stone features described in the book Manitou, were confirmed, as well as many additional features, to be in relationship with the stone cave at the bottom of the hill. Pratt Hill has stone rows, stone groupings, stone effigies and a significant use of quartz along the spring fed hillside. The hill would have been burned off to allow clear viewing. Russell Woods, Upton Historical Commission and Society

member remembers fires from the town dump at the bottom of Pratt Hill escaping up to the top of the hill in recent times.

Warren Brook Conservation area has high elevation and also includes many ceremonial features including stone rows, stone groupings, Manitou stones, a turtle effigy and stone arrangements. There is a significant quartz outcrop high above the brook that when the hill was cleared by burning, would have been seen for some distance. This area is where Warren Brook begins, also a place of springs.

Bettina Washington, Tribal Historic Preservation Officer (THPO) of the Wampanoag Aquinnah of Gay Head confirmed the significance of the features in 2016 and 2017 during preliminary walkovers.



She would like to see a more careful walkover including other THPO's in the fall. Careful mapping to include possible connections with Pratt Hill and the Upton Cave and other identified cultural features in the overall area is recommended. Warren Brook Conservation Area is adjacent to the Hassanamessit Praying Village and consultation with the state recognized Hassanamessit Nipmucs is also recommended.

A Brief History of Sweetwilliam Farm

Sweetwilliam Farm's history reflects Upton's cultural and agricultural heritage. In the late 18th and early 19th centuries Upton consisted primarily of dispersed farms. In the later part of the 19th century, Upton's economy diversified from predominately agricultural into a mix of agriculture, primarily butter, cheese, milk and meat, wood products, and the manufacture of shoes and straw hats. It was common for the farmers of this era to supplement their dairy and meat income with the sale of lumber from their woodlots and for their sons and daughters to work in the shoe and straw-hat industries. It was also common for the farm to be kept in the family. Farms started to disappear in the late 19th and early 20th century and those that survived into the 20th century were largely dairy farms. Sweetwilliam Farm's history follows this pattern.

Sweetwilliam Farm's origin dates back to 1739 when Nathaniel Whitney of Westborough, Eli Whitney's grandfather, acquired 100 acres in Upton from one of the early Sutton proprietors. In 1750 and 1754 he gave this land to his two sons, Ephraim and Oliver, respectively. Ephraim's portion of the land was the beginning of what became Sweetwilliam Farm. Ephraim acquired more land and split it between his two sons, Ephraim Jr. and Amos. The three 18th-century homes clustered together on North Street are the original Whitney homes. The farm stayed in the Whitney family until 1890 through two more generations, Ephraim Junior's son, Moses, and Moses' son-in-law, Seth Chapin. During the time the Whitney family farmed the land, they used it primarily to raise milk cows, with some of the land in pasture, some in hay and some in Indian corn, Irish potatoes and other grains. They also had a woodlot, an orchard, one horse, two oxen, chickens, and probably had a kitchen garden. The size of the farm, about 100 acres, and its use were typical for the era.

The Whitneys were active in town affairs. Among other town positions held by them, Ephraim Senior and Junior served as Selectmen in 13 of the 46 years between 1754 and 1800. Ephraim Junior served in the Revolutionary War. Ephraim Senior was Town Clerk when Upton voted unanimously to approve the confederation of the thirteen United States of America.

In 1890, Seth Chapin's widow, Rowena (Whitney) Chapin sold the farm to James Colbert, an Irish immigrant, who owned a similar farm located between Warren Street and Lake Wildwood. James later sold the farm to his son, David. Judging from the length of time the Colbert's held the farm, they may have bought it for investment purposes (David went on to sell real estate in Rochester, NY.) In 1893, the Colbert family sold it to William Prowse, a farmer from Prince Edward Island. In 1898, William sold it to his son, Cornelius, after offering it for sale through an auction conducted on May 4th, 1898 (the advertisement for the auction offers a vivid description of the farm at that time.) Cornelius, who was not a farmer, lost it to foreclosure in 1904 to Lewis Allen, who sold it to Joseph Poirier, an immigrant from French Canada, in 1911. The places of origin for the three immigrants that bought the land between 1890 and 1911, Ireland, English Canada and French Canada, were common for immigrants to Upton. The Poirier family sold it to the Sweetwilliam Farm owner in 1994. As was common for Upton farms in the 20th century, it was used to raise milk cows and grow hay for much of the time between 1890 and 1994.

Appendix H

Comment Letters Received on Draft Land Stewardship Plan

Rec'd 3/14/18

March 14, 2018

I am interested in being involved in the North Upton Open Space Stewardship Plan.

I believe that by including my parcel in the cutting plan it would be beneficial to both Glen Echo Farm and the Town of Upton for the following reasons:

1. I have had four (4) timber sales since 1979 and would be in a position to be another person to over see the Main Project.

2. My property is on the northern end of the cutting plan; and therefore, could provide an additional landing (my field next to the barn could be further groomed by using the approximately 180 cubic yards of fill already on site). This fill would be spread to widen the landing for the space needed for various piles of logs and to lessen the grade near the barn. The empty trucks would enter the landing near the barn and leave loaded on the level portion on the west side of North Street. This site is already clear; and therefore, no large vegetation would need to be destroyed. This area is approximately the same size lot that was used for several timber harvests near the present day "Pump House".

3. By being involved with the Stewardship Plan, I would be using your consultants who are already aware of the sensitive conditions in the area; and therefore, would be aware of any issues on my land.

4. I would pay your consultants to prepare my Cutting Plan for state approval and to seek bids for my harvest.

5. I have several trails throughout my remaining property that could be regroomed and extended to the Town owned properties that are to be included in the cutting plan. Some of these trails already cross "Hard" surfaces over streams. Thus providing minimal damage to these wetland areas.

6. I trust that by including my parcel in this Stewardship Plan it will further enhance your goals to improve the forests in this area.

If you need any further information, please contact me at 508-529-6668 to set up a meeting.

Richard Howarth

Richard Howarth
133 North Street
Upton, MA 01568

Appendix I

List of Land Stewardship Plan Preparers

Scott Heim – Upton Conservation Commission, Land Stewardship Committee

Tom Jango – Upton Conservation Commission

Mike Penko - Upton Conservation Commission, Land Stewardship Committee

Marcella Stasa - Upton Conservation Commission, Land Stewardship Committee

Cathy Taylor - Upton Resident, Former Member Upton Historical Commission

Bill Taylor - Upton Land Stewardship Committee, Upton Historical Society