

PRINCIPLES AND POLICIES FOR MANAGEMENT OF ANDOVER CONSERVATION LAND



Prepared for the
Andover Conservation Commission

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October 2022

Mass Audubon protects more than 40,000 acres of land throughout Massachusetts, saving birds and other wildlife, and making nature accessible to all. As Massachusetts' largest nature conservation nonprofit, we welcome more than a half million visitors a year to our wildlife sanctuaries and 20 nature centers. We believe in protecting our state's natural treasures for wildlife and for all people—a vision shared in 1896 by our founders, two extraordinary Boston women. Today, Mass Audubon is a nationally recognized environmental education leader, offering thousands of camp, school, and adult programs that get over 225,000 kids and adults outdoors every year. With more than 135,000 members and supporters, we advocate on Beacon Hill and beyond, and conduct conservation research to preserve the natural heritage of our beautiful state for today's and future generations.

Mass Audubon's Ecological Extension Service (EES) assists cities and towns, land trusts, state and federal agencies, and other conservation partners with natural resource inventories, habitat restoration and management planning, and conservation planning. Through EES we can share the experience we have gained in managing our own network of wildlife sanctuaries across the Commonwealth. For more information on EES, contact 781-259-2159 or jcollins@massaudubon.org. Special thanks to Susan Hegarty for her research contributions to this plan.

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Introduction

As of 2022, Andover has over 2,360 acres of conservation land under the care and custody of the Andover Conservation Commission. This land is managed and stewarded by the Conservation Division, with the assistance of the Department of Public Works and a large network of dedicated volunteer overseers. Andover’s conservation areas and green spaces are critical to supporting clean air and water, wildlife habitat, and recreational amenities for the community.

In the past, land management activities have been undertaken on a case-by-case basis, without the benefit of a body of principles, policies, and plans to guide these decisions at both the individual property level and on the larger scale of all conservation lands in Andover. To better manage and steward its conservation land the

Conservation Commission has created this guide to serve as a comprehensive, long-term set of land management principles and policies more thoughtfully.

This document aims to provide overarching best practices, principles and strategies for land management that can be applied to the conservation land found in Andover – parcels of varying sizes in a suburban setting with high passive recreation usage, protected either by fee simple ownership or conservation restrictions. The development of these management guidelines and procedures for Andover conservation land is an acknowledgement of the critical need for cohesive stewardship and active management against an increasingly complex backdrop of climate change, land conversion and development, pollution, and the invasion of non-native species. This document is informed by input from the Conservation Commissioners, the Department of Conservation staff, the Department of Public Works, and the Department of Parks and Grounds/Forestry. It can serve as a reference point for more detailed land management plans written subsequently for individual conservation areas.

The Conservation Commission has ultimate decision-making authority over management activities on Andover conservation lands owned in fee. Conservation Division staff members are responsible for interpreting and implementing decisions of the Conservation Commission. Throughout this document, the phrase “Andover conservation land” will be used to refer to the properties that are held in the care and custody of the Andover Conservation Commission.

Land Acknowledgement

Land that is well managed sustains us in many ways – often referred to as ecosystem services. A few examples of what land provides when it is managed sustainably include:

- The air we breathe
- The water we drink
- The food we eat
- Sequestration of carbon

Andover at a Glance

- Total Area: 20,578 acres (32.2 square miles)
- Human Population in 2020: 33,210
- Open space protected in perpetuity: 4,104 acres, or 19.9% percent of total area*
- Conservation Commission managed land: 2,360 acres

* Calculated using MassGIS data

- Climate moderation
- Protection from flooding
- Recreation that renews our spirits
- The lumber we use to build our shelters
- Filtration and decomposition of our wastes
- Habitats for a diversity of plants and animals

The land in Andover is part of the traditional, contemporary, and unceded territory of the Pennacook (sometimes called Pawtucket or Merrimack), Massachuset, and Naumkeag nations. These lands were taken from the Indigenous people, creating a legacy of trauma that persists to this day. Indigenous stewardship of the land kept its ecological communities vibrant, strong, and interconnected for thousands of years, but far from being relics of the past, Indigenous peoples, including 37,000 individuals who currently reside in Massachusetts, are still at the forefront of environmental protection, ecological stewardship, and climate mitigation. This land has helped sustain them for thousands of years before its occupation by Europeans. How we care for the land will determine how well it will sustain us and our descendants.

The Andover Department of Conservation and Andover Conservation Commission respectfully acknowledge that this document discusses the management of land that was once the territory of many Indigenous peoples, who stewarded this land for hundreds of generations. Andover was home to the Pennacook people as early as 6,000 BCE, and we honor their past, present, and emerging leaders. We further acknowledge the harmful effect that colonization and violent systemic and cultural inequities have had on our understanding of Indigenous identity and terminology.

General Character and Landscape Context of Conservation Land in Andover

Andover has protected more than 2,360 acres of conservation land in perpetuity under the care and custody of the Conservation Commission. More than eighty of these conservation areas across town – spanning forests, fields, and wetlands – have trail networks that provide access for visitors seeking to explore local open spaces. Andover’s conservation areas range from relatively large swaths of land connected to other open space, such as the Bald Hill Conservation Area, to small parcels tucked away in neighborhoods, such as the Molly Road Green Area.

While these parcels vary in size and in the natural and cultural resources they harbor, each contributes to the network of open spaces that define Andover as a wooded suburb where residents have ready access to conservation land for renewal and enjoyment, where natural resources are protected, and where beneficial ecosystem services contribute to the overall health of the community.

Andover lies at the boundary of the urban-suburban interface, between the denser development of Lawrence and the less developed suburbs. Many of Andover’s conservation parcels are relatively small, and even most of the larger properties are characterized by a high ratio of edge to area, meaning that the interior areas less impacted by surrounding development, are generally small. As a result, the wildlife of Andover’s conservation lands are generally species that do well in suburban settings; common species that are well adapted to a human-shaped landscape. Despite this proximity to human

development, the natural areas of Andover do provide stopover and foraging areas for a variety of migratory bird species and habitats for a variety of other plant and animal species.

Geology, Soils, Climate.

During the last Glacial Maximum, the Laurentide Ice Sheet constituted the largest ice mass on Earth, with an area of ~13,000,000 km² (~5,000,000 sq. mi.) that covered most of the northeastern United States (Bromley et al., 2015). As this ice sheet advanced and retreated across the landscape, it scoured the earth and left behind distinct glacial features, such as erratics, moraines, and eskers (such as Indian Ridge). As a result of its glacial past, Andover is underlain with glacial drift deposited by the ice sheet or rivers of melted ice.

The topography of the town gently undulates, with four prominent hills that were formed by the movement of the glacier on glacial till. The names and elevation of these hills are:

- Prospect Hill; 421.5 feet
- Pole Hill: 210.5 feet
- Wood Hill: 373.3 feet
- Bald Hill: 272.0 feet

The soils of Andover are similarly glacial in nature; the most extensive soil type in town was formed from glacial till, an unsorted mixture of sand, clay, and stones. The better drained soils in Andover, which are predominantly sandy in character, are related to glacial melt water and are typically found in valleys or flat areas in the region related to valleys. The Merrimack River flows along the border of the town for five miles along its northerly edge, following a course that may be unrelated to its pre-glacial location. The Shawsheen River transects the town from southwest to northeast, following a shallow valley underlain by glaciofluvial material to greater than average depths.

Andover is in the Merrimack River Basin, which has a variable climate characterized by frequent but short periods of heavy precipitation averaging 41.73 inches according to a USGS station in neighboring Lowell. In winter, the average annual snowfall is 55.7 inches. Andover lies in the path of the "prevailing westerlies," which bring hot dry weather that can lead to occasional summer droughts. The basin is also exposed to intense rainfall due to coastal storms of tropical origin that travel up the Atlantic seaboard, as well as to protracted storms during all seasons colloquially called "nor'easters". Andover and the rest of Massachusetts is also experiencing more extreme climate events due to climate change; for example, a severe drought was declared in the town by the State of Massachusetts during the summer and fall of 2016.

The Human History of Andover

Prior to European colonization, northeastern Massachusetts was inhabited by indigenous communities for thousands of years. It is estimated that there were between 70,000 and 100,000 Native Americans living in New England at the beginning of the 17th century¹. According to the Native Land Digital

¹ National Geographic Society (2020, April 30). New England Native Groups. Retrieved from <https://www.nationalgeographic.org/encyclopedia/new-england-native-american-groups/>

Website, the area that is now known as Andover was once occupied by four nations: the Wabanaki (Dawnland Confederacy), the Pennacook, the Naumkeag, and the Massa-adchu-es-et (Massachuset). However, Native populations were drastically reduced in eastern Massachusetts to an estimated 5,000 individuals in 1616 as the result of a disease brought to North America by early European explorers and traders, suspected to be leptospirosis carried by rodents.²

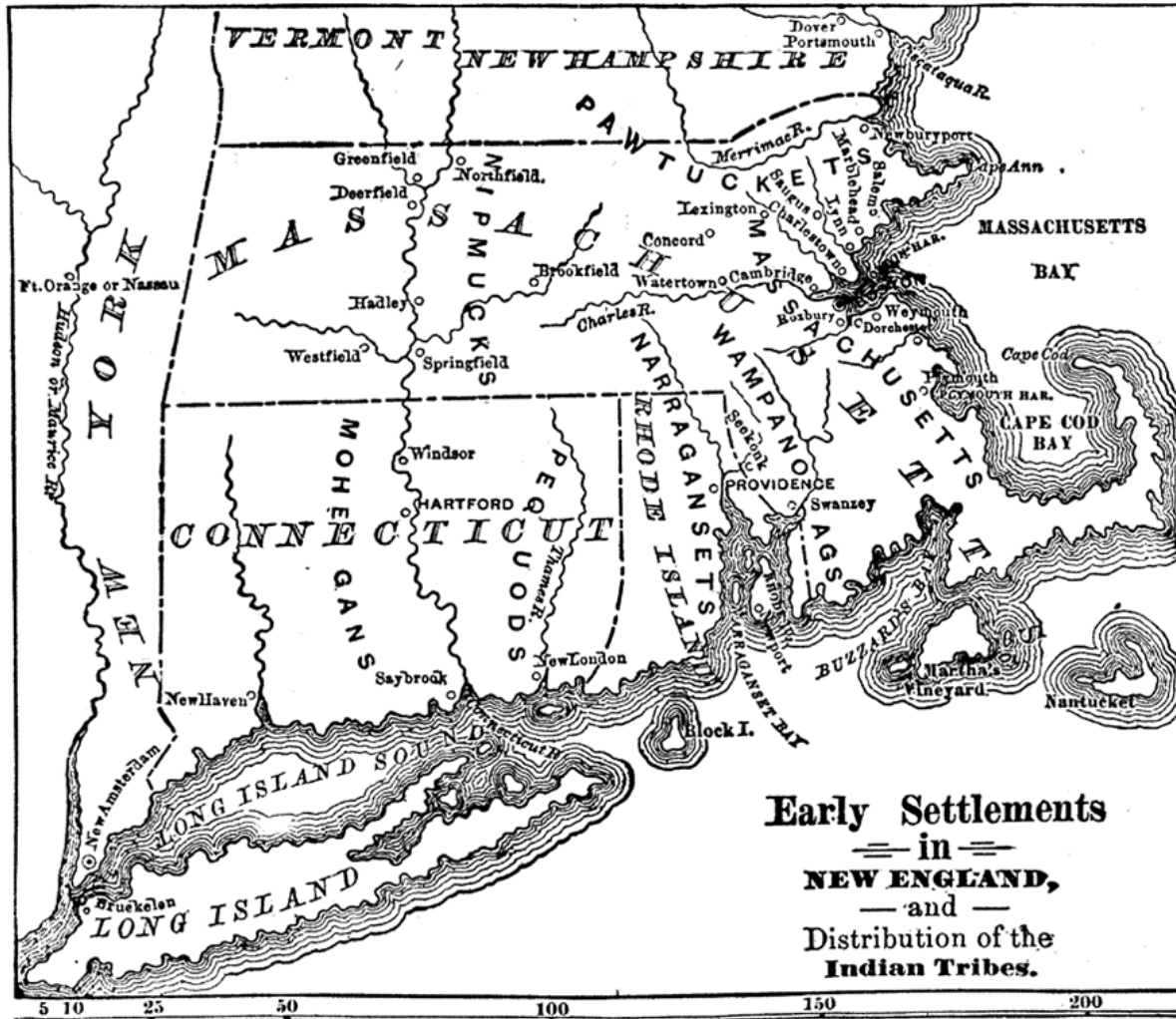


FIGURE 1 - EARLY SETTLEMENTS IN NEW ENGLAND AND DISTRIBUTION OF INDIGENOUS TRIBES, 1686.

Most villages in New England were semipermanent, with tribes moving to new areas once the nearby agricultural land became depleted of nutrients or because of seasonal changes. This resulted in fundamentally different perceptions of land ownership between Native people and European settlers

² Marr, J.S., & Cathey, J.T. (2010). New Hypothesis for Cause of Epidemic among Native Americans, New England, 1616–1619. *Emerging Infectious Diseases*, 16(2), 281-286. <https://doi.org/10.3201/eid1602.090276> .

who began encroaching on Native American lands in the 17th century after their arrival in 1620.³ European settlers reported “little resistance” from Native people when settling into the Merrimack Valley, likely due to the severely reduced population following the 1616 epidemic.⁴

In 1634, the General Court of Massachusetts reserved the land around Lake Cochichewick for an inland plantation. A group of Newbury and Ipswich residents then established the first permanent settlement in Andover in 1641, called Cochichewick (a Native American name) after the lake. Shortly afterward, the local Pennacook tribal chief Cutshamache “sold” the parcel of land that included what is now Andover to the European settlers. The Indigenous people believed they belonged to the land rather than it belonged to them and they were willing to “sell” the rights to use land without fully understanding the European concept of land ownership.

Manufacturing, such as powder, paper, and woolen goods, played a major role in the town’s early development.⁵ Today, Andover is a suburban town spanning 32.2 square miles and is home to an estimated current population is 36,356 individuals. As is typical of New England, the town has been highly subdivided over time. As a result, conservation land is comprised of a network of relatively small parcels in a suburban setting. These parcels have been acquired over time through donations, fee simple purchases, land swaps, conservation easements, and gifts.

Current Landscape

Over the past 50 years, the landscape of Massachusetts has been transformed by new residential and commercial development. Eastern and southeastern Massachusetts have undergone the most change, but virtually every community in the Commonwealth has experienced rapid growth driven by economic and demographic factors.

According to Mass Audubon’s [Losing Ground: Nature's Value in a Changing Climate \(Sixth Edition\)](#)⁶, in 2017 Andover had 40% of its land area classified as developed and 56% classified as natural.⁷ It had 21% of its area permanently protected (4,348 acres including land protected by Conservation Commission, Mass. Department of Conservation and Recreation (DCR), Andover Water Department, Andover Recreation, and AVIS Land Trust, etc.).

³ National Geographic Society (2020, April 30). New England Native Groups. Retrieved from <https://www.nationalgeographic.org/encyclopedia/new-england-native-american-groups/> .

⁴ Andover League of Woman Voters. (1994). The Andover Town Handbook. Retrieved from <https://andoverma.gov/386/Andover-History> .

⁵ Ibid

⁶ See <https://www.massaudubon.org/our-conservation-work/policy-advocacy/shaping-climate-resilient-communities/publications-community-resources/losing-ground/statistics/town/andover>

⁷ This classification is based on interpretation of air photo images where the forested area on a private lot will be classified as “natural”, roads buildings and lawns, etc. will be classified as “developed”.

Other Major Conservation Areas

The Massachusetts Department of Conservation and Recreation (DCR) permanently protects more than 1,166 acres in Andover with the Harold Parker State Forest, which offers 35 miles of trails, 11 ponds, and dozens of campsites. The Trustees of Reservations also owns the Charles W. Ward Reservation spanning a total of 704 acres. The Andover Village Improvement Society (AVIS) owns and manages 35 properties totaling over 1,250 acres.

eBird Hotspots in Andover

eBird is a project of the Cornell Lab of Ornithology that compiles bird sightings from volunteer birdwatchers. Andover has eleven hotspots including **Haggetts Pond** (137 species), **Fish Brook Wetlands** (101 species), Deer Jump Reservation (120 species), **Den Rock Park** (59 species), Rabbit Pond (at Andover Academy – 45 species), **Pomp’s Pond** (142 species), **Al Retelle Conservation Area** (112 species), Baker’s Meadow Reservation (126 species), Baker’s Meadow Trail (118 species), Ward Reservation (142 species), and Harold Parker State Forest (119 species).

Bold indicates hotspots that are owned at least in part by the Andover Conservation Commission.

Natural Heritage Priority Habitats and BioMap2 Areas

The current (15th) edition of the Massachusetts Natural Heritage Atlas includes thirteen Priority Habitat for Rare Species and three Estimated Habitats of Rare Wildlife in Andover.

The BioMap2 Project was developed by Natural Heritage and Endangered Species Program (NHESP) as a guide for 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. The Heritage Program’s *BioMap2* Andover town report lists areas along the Merrimack River, areas along the Shawsheen River, an area in Harold Parker State Forest, several areas at the Ward Reservation, and an area at Haggetts Pond as Core Habitats for the presence of a Species of Special Concern and an uncommon natural community, a level bog. Any access improvements should include a high level of sensitivity to the uncommon natural resources. See the map on the next page and Appendix A for a summary of the BioMap2 Town Report.

- *BioMap2* Core Habitat: 1,285 acres
- *BioMap2* Core Habitat Protected: 400 acres or 31.1%
- *BioMap2* Critical Natural Landscape: 1,060 acres
- *BioMap2* Critical Natural Landscape Protected: 522 acres or 49.3%.

BioMap2 Components

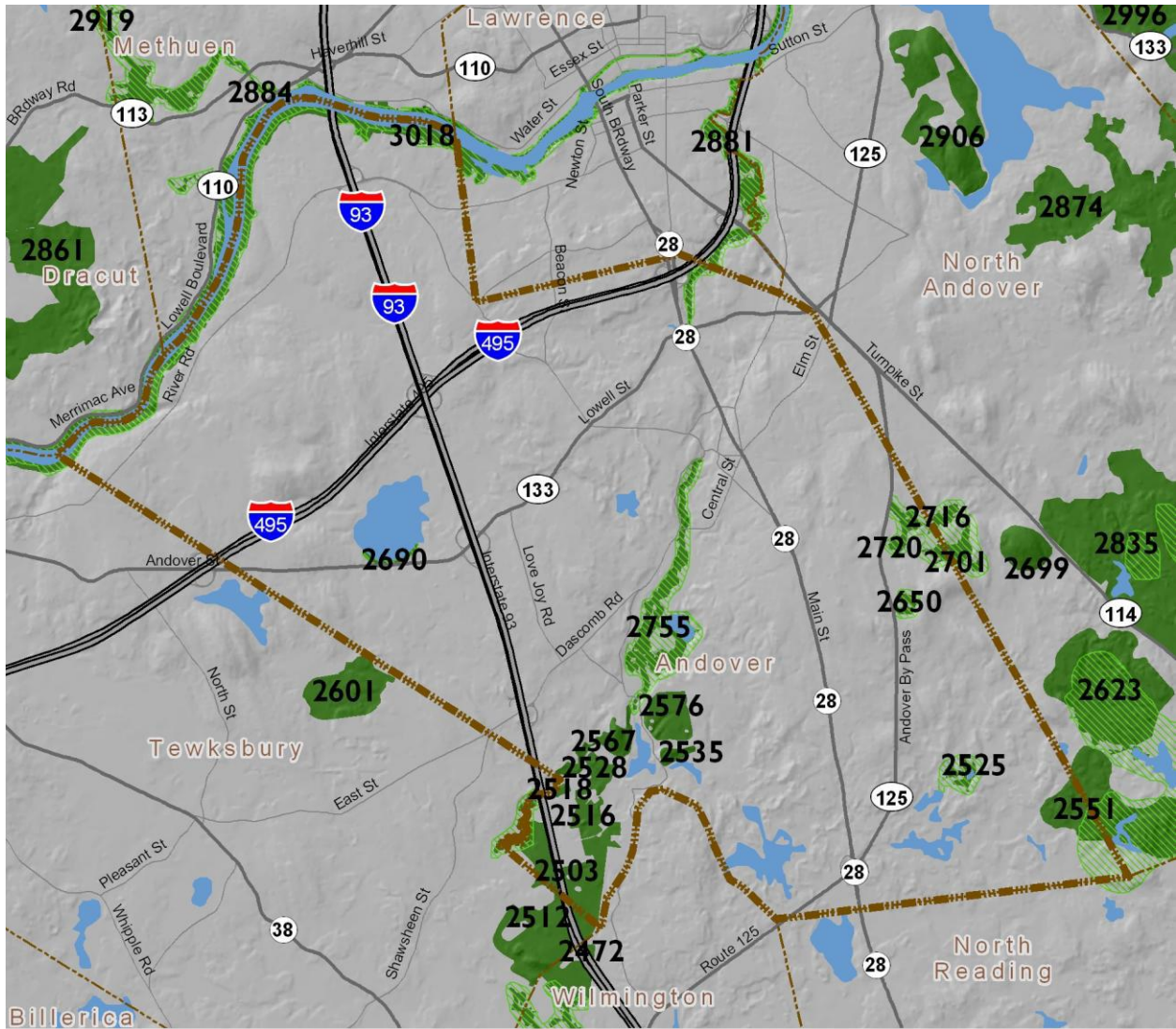
Core Habitat

- 1 Priority Natural Community
- 4 Wetland Cores
- 5 Aquatic Cores
- 1 Vernal Pool Core
- 11 Species of Conservation Concern Cores*
 - 1 bird, 6 insects, 1 mussel, 1 plant

Critical Natural Landscape

- 1 Landscape Block
- 3 Wetland Core Buffers
- 5 Aquatic Core Buffer

* See the Appendix A for a summary of the BioMap2 Town Report.



- BioMap2 Core Habitat
- BioMap2 Critical Natural Landscape

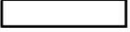
1 Mile




FIGURE 2 - MIO MAP2 AREAS

Goals for the Use and Management of Andover's Conservation Land

The following goals and objectives have been identified as critical to the Town's conservation objectives for land that is in the care and custody of the Conservation Commission. Many of these goals were also reflected in the Town of Andover Open Space and Recreation Plan from 2017.

The mission of the Conservation Commission is:

- to protect Andover's natural resources in accordance with the state law and the Town's Wetlands Protection Bylaw and
- to act as trustees in perpetuity of the Town's conservation land

Conservation land provides the space to experience fresh air, green leaves, and the pleasure of a stroll through the woods right here in our own community. It provides opportunities to walk, jog, bicycle, cross-country ski, and observe the wild plants and animals that share our natural surroundings with us. By protecting open space from development, conservation land also protects many beneficial functions that nature performs for us. These ecosystem services include flood protection, nutrient cycling, and the purification of air and water. And because all of Andover was once farmland, forest, or wetland, conservation land helps to preserve the historic and cultural character of our town.

While conservation lands will be managed collectively so that these community priorities are accommodated within Andover, not every use is appropriate for every property. Intended uses and management priorities for two individual properties will be articulated in brief property summaries in this report or in some cases more detailed ecological management plans in the future.

Goals and Objectives for Management of Andover Conservation Land

1. Protect river corridors
2. Build connectivity between protected areas and expand wildlife corridors
3. Protect the town's water supply and the integrity of other water bodies
4. Improve regional partnership and connectivity
5. Improve site accessibility for people with disabilities
6. Identify natural resources and any sensitive habitats to protect on each property
7. Identify and protect cultural resources on properties
8. Provide for agricultural protection (61A and 61B and agricultural preservation restrictions) and a community garden
9. Plan for the needs of the economic justice populations
10. Educate the public about the town's natural and cultural resources and recreational opportunities
11. Protect natural resources through bylaws and zoning regulations
12. Plan new recreation programs and maintain existing sites and facilities
13. Develop mixed use trail network for pedestrians, bicyclists, dog walkers, and more
14. Manage and expand bow hunting sites for white tailed deer population control
15. Plan for sustainability and build resilience to climate change and rising sea/river levels
16. Manage and minimize the spread of invasive species and protect native habitats (e.g., by installing signs stating the need to wash off boats)

17. Protect and enhance habitats for-species listed under the Massachusetts Endangered Species Act and other species of special concern (e.g., Watch List Plant and Species of Greatest Conservation Need in State Wildlife Action Plan)
18. Engage in active management to restore habitats and improve climate resiliency
19. Improve signage and educational materials at trailheads
20. Maintain structures and infrastructure on properties in good condition to provide a safe and clean environment for visitors

Achieving Management Goals Through Collaboration

Andover conservation land abuts parcels with a wide variety of ownerships, including private residences, commercial and industrial businesses, state organizations, and land trusts such as the Andover Village Improvement Society (AVIS), The Trustees of Reservations, and Essex County Greenbelt. To achieve land management goals and maximize positive impacts, management efforts and initiatives will be coordinated with adjacent property owners and local conservation groups when possible. Certain management activities, such as invasive species control, are more effective when they extend across property boundaries, and/or when abutting owners are involved and supportive. Collaborations can be particularly impactful for contiguous swaths of protected properties that are managed by different entities. In such cases, the Town of Andover and its partners may benefit by pooling resources, expertise, and volunteers. Examples of projects that may benefit from organizational collaboration include:

- Invasive species management
- Habitat restoration, particularly for rare species
- Trail connectivity
- Deer management/hunting policies
- Climate resiliency
- Training programs for volunteers and staff
- Educational programs

Integrating Land Management Guidelines and Procedures with Other Relevant Plans

There are several existing policies, plans, and procedures that directly relate to or impact the management of Andover conservation land. This information has been integrated into this document where applicable and will be considered when setting priorities or executing action items. Plans or other documents that are relevant to the management of Andover conservation land include:

- The Overseer's Handbook
- The Town of Andover Open Space and Recreation Plan 2018
- The Shawsheen River Master Plan (*in progress as of September 2022*)
- The Climate Action Plan (*in progress as of September 2022*)
- Forest Management Plans
- Andover Municipal Vulnerability Preparedness: Summary of Findings Report
- Town of Andover Massachusetts 2012 Master Plan
- Rare Species Management Plans

Informing, Educating, and Engaging the Public

Public support and engagement are crucial to ensuring the long-term preservation of the Andover's conservation land. To inform, educate and engage the public, the Town will:

- Provide information about the natural, cultural, and historic resources and features found on Town properties
- Provide information about human impacts that threaten natural habitats and species
- Educate the public about actions that help protect and preserve natural resources at home and in their everyday lives
- Provide opportunities for the public to participate in land management activities when appropriate
- Maintain partnerships with community groups, businesses, and others who are interested in participating in land management projects

Means used to inform, educate, and engage the public may include:

- The Town of Andover website
- Email news and updates
- Social media
- Signage at trailheads
- Guided walks
- Lectures or workshops
- Volunteer events

Allowable and Prohibited Uses

Land protection requires a careful balance of economic, social, and ecological values and goals. The allowable and prohibited uses of conservation land, adopted by vote in 2018, are centered on protecting Andover's natural resources, conservation values, and visitor safety. Visitors are welcomed to use conservation properties for passive recreation during daylight hours, with permission required for evening picnics, overnight camping, or large group activities.

Allowable uses of conservation land are as follows:

- Hiking
- Dogs held on leash only
- Running
- Non-motorized boating
- Picnicking
- Birdwatching and nature observation
- Skiing and snowshoeing
- Fishing
- Bicycling on designated trails
- Authorized community gardening activity as permitted by the Commission
- Parking on designated roads, parking areas, or trails

- Authorized maintenance or construction work

Prohibited uses of conservation land in Andover are as follows:

- Possession of alcoholic beverages
- Hunting or discharging of firearms (except for bow hunting by special town-issued permit only during deer hunting season on designated conservation land only)
- Trapping, except as previously authorized
- Cutting, defacing, removal of trees, bushes, plants, flora, or deadwood, except as part of an approved habitat management project
- Dumping of any material, including yard waste such as leaves and brush
- Littering or trash disposal
- All motorized vehicle types, except as authorized. Permits for motorized vehicle use may be granted to visitors with qualified disabilities who show appropriate documentation
- Fires and campfires, except as authorized
- Paintball or “war” games
- Construction of off-road bicycle BMX-style trails and jumps

Best Practices for Addressing Primary Land Management Issues Management of Natural Areas in a Time of Changing Climate

The management of natural resources has largely assumed a stable climatic background. Now there is widespread agreement among scientists and most of the public that the climate is changing due to human activities – largely attributed to the burning of fossil fuels resulting in the production of carbon dioxide. Massachusetts is already experiencing the effects of climate change, such as hotter summers, warmer winters with less snow cover, rising sea levels, more frequent severe weather events, and inland flooding.

Climate impacts that may affect open spaces are predicted to:

- increase the number of extremely hot days and degraded air quality
- compromise infrastructure like trails (e.g., more erosion, blowdowns, and flooding)
- increase the risks from storm events
- increase non-native plants and pests
- increase vector-borne illnesses (like West Nile and Lyme disease).

Some of these impacts are likely to affect the future management of conservation lands in complex ways. Manomet Center for Conservation Science and the Massachusetts Division of Fisheries and Wildlife have published a study⁸ promoting two primary objectives for the management of sites and

⁸ Manomet Center for Conservation Sciences & Massachusetts Division of Fisheries and Wildlife, Habitat Management, April 2010 (<https://www.manomet.org/wp-content/uploads/old->

habitats – managing resilience and managing change. Unfortunately, the report does not address the management of grasslands. Still, the concepts of resilience and managing change may be useful to keep in mind.

Management for Resilience and Managing Change

Mass Audubon generally pursues four principles for increasing the resilience of conservation land.

1. **Reduce Non-climate Stressors** – for example, controlling invasive plants and pests.
2. **Restore Form and Function** – for example, removing a dam to promote spawning of diadromous fishes.
3. **Increase Complexity** – for example, increasing diversity and microclimates.
4. **Create Linkages** – for example connecting to adjacent land and creating corridors.

The previously mentioned Manomet report does make recommendations for forests and freshwater wetlands that are relevant Andover.

Forested Habitats

- **Diversifying the age structure and species composition** of the forested landscape in advance of climate change could increase resilience of forested ecosystems and overall resistance to the impacts of a changing climate.
- **Control of white-tailed deer densities.** High levels of browsing by white-tailed deer have adversely affected the structure, composition, and functioning of Massachusetts forested ecosystems, particularly through the elimination of preferred food species such as Red Oak, and thereby reduced their diversity and resilience. Also, overgrazing by deer has opened the way for increased rates of infestation by non-native plants.
- **Control invasive species and pests.** Damage caused by non-native plants and insect pests will become more serious under climate change. Forest managers will need to:
 - detect and track infestations and outbreaks in their early stages, and
 - take aggressive actions to eliminate these problems before they escape control.
- **Manage change.** Past management has been primarily guided by the concept of preserving natural habitats and associated species. Adaptive management is recognizing that preserving the status quo may not always be possible. When preservation of a habitat or species is no longer feasible, we will need to adapt management practices to guide change. For example, one strategy may be to plant more southern species that will help maintain diversity or other ecological values within the context of climate change.

Freshwater Wetlands

The main threats to freshwater wetlands in Massachusetts are likely to be impaired hydrology and habitat loss, and ecological injuries caused by non-native pest species, the same threats that currently affect wetland quality and function. The regulations that currently protect wetlands have been extraordinarily successful. However, the Manomet report notes that climate change may require us to rethink how these regulations are applied. It goes on to say that active management of wetlands may

[files/Climate%20Change%20and%20Massachusetts%20Fisheries%20and%20Wildlife%20Reports,%20Vol.%203%20April%202010.pdf\)](#)

be an important tool under climate change. For example, it may become beneficial to alter wetland hydrology, or expand their boundaries. If such management is impeded by the way some regulations are currently applied, they may have to be modified to reflect changing circumstances.

Control of Invasives. It is likely that the problems that are currently posed by invasive plant species to wetlands will be exacerbated by the higher levels of environmental stress introduced by climate change (droughts, extreme events, etc.). To continue to protect valued wetlands will require three things:

- **More active monitoring.** It will be essential to detect pest outbreaks in their earlier stages, rather than later when they have secured a foothold. This can only be accomplished if active detection and monitoring schemes are implemented.
- **Aggressive control activities.** More resources will be needed to eliminate or control outbreaks of pests in their early stages.
- **Education on and enforcement of best management practices.** Many pests are transported from site to site by humans. To reduce this hazard, it will be necessary to educate users of wetland resources (e.g., anglers, hunters, nature viewers) about the dangers posed by invasives and to provide them with guidance and facilities to reduce off-site transport.

Watershed Protection. Wetlands are impacted by what happens within the entire watershed. The nexus of expanding human populations, land-use change, and climate change requires that we adopt a watershed focus when considering how to protect wetlands. Land protection within the watershed is also watershed protection.

Conservation Land Management Activities

Andover's conservation land management activities fall into four categories: monitoring and inventories, active management, infrastructure maintenance, and special projects.

1. **Annual Monitoring** of conservation land is important to assessing the health of natural resources, the presence and extent of any human impacts, and the condition of infrastructure. As resources allow, conservation land is also inventoried to compile information about the natural and cultural resources and environmentally significant features of each property.
2. **Active Management** includes ongoing activities such as invasive species removal, forestry, native plantings, habitat restoration, grassland mowing, and erosion control.
3. **Infrastructure Maintenance** is performed on an ongoing, as-needed basis for the protection and enhancement of natural and cultural resources, and to maintain recreational amenities such as trails, boardwalks, kiosks, picnic tables, benches, and fire pits for the benefit of the broader community.
4. **Special Projects** are carried out on an as-needed basis to provide improvements to conservation properties. Such projects may include the construction of bird blinds, public art installations, educational tree ID tags, StoryWalks, etc.

A schedule of annual management activities will be presented at the end of this section.

Historically, Andover conservation land has been managed passively with monitoring and little active management. However, the need for more active management is urgent to address escalating stressors like climate change, non-native species invasion, and human impacts on the land. Andover's leading

management priorities can be grouped into the following three categories: Habitat Conservation and Preservation, Recreation, and Management of Human Impacts.

Habitat Conservation and Preservation

Across Andover, habitat conservation and preservation priorities are established based on the presence (or absence) of priority habitats and state-listed species and other species of conservation concern. MassWildlife's Natural Heritage and Endangered Species Program (NHESP) maintains a list of all documented Massachusetts Endangered Species Act (MESA)-listed species observations and has delineated Priority and Estimated Habitats throughout the state to help protect rare species. Andover is home to several MESA-listed species, including vascular plants, amphibians, reptiles, and a variety of invertebrates. Furthermore, the Shawsheen River, which runs through Andover, is considered Priority Habitat for Rare Species and Estimated Habitat for Rare Wildlife. Other Priority Habitats of Rare Species in Andover include land to the west of Route 93, the riverbank of the Merrimack River, and land surrounding Haggetts Pond.

Habitat conservation and preservation comes in many forms, from annual maintenance to reactive restoration. For properties that provide habitat for MESA-listed species or other species of conservation concern, management activities should factor in the specific needs of these diminishing populations. Close collaboration with the NHESP and affiliated organizations, such as Zoo New England, can help to guide management actions to ensure maximum ecological benefit. See Appendix B for a listing of all the MESA species in Andover.

The following sections will discuss management of the variety of habitats included on Andover conservation land.

Early Successional Habitat Management

To support biodiversity in Andover, it is critical to maintain a variety of different habitat types. Certain existing habitat types such as upland forests, rivers and streams, forested swamps, ponds, marshes, and rocky areas require little active management. However, early successional habitats are rapidly dwindling due to a disrupted disturbance regime in the northeast. Grasslands, shrublands, and young forests were once maintained through frequent, variable-intensity natural events like windstorms and wildfires. As these disturbances created gaps of varying sizes across the landscape, the resulting early successional growth created habitat for species like the New England cottontail, American woodcock, and the chestnut-sided warbler. However, European colonization of the area marks the disruption of these processes—fire suppression has prevented most wildfires for years, and the changing climate has altered the pattern and intensity of historic windthrow events. As a result, early successional species are rapidly declining across Massachusetts.

Disturbance dependent, early successional habitat can be created and supported through a variety of forest management techniques. While considered controversial for its application in old growth forests in the Western region of the United States, clearcutting can be applied to reset generalist stands and promote the growth of young forest and grassland habitats. Strategic small patch cuts in mature stands can also support biodiversity by providing discrete open, shrubby patches that support young forest and shrubland species alongside mature forest species. Early successional habitat is ephemeral and disappears in 10-20 years in New England as the regenerating trees mature, so ongoing management is required to maintain this habitat type.

Cultural Grassland Management

Periodic mowing of the vegetation at some areas is necessary to maintain open fields. To help support the increasingly rare cultural grassland habitats in Andover, an annual mowing schedule has been established through a partnership with the Andover Department of Public Works (DPW).

Grasslands can range from grass-dominated, frequently mown hayfields to infrequently mown, wildflower-dominated fields. Each type provides habitat for a different suite of species based on plant composition, size, moisture, and other factors. This open habitat type has become less common in Massachusetts as agricultural land has grown into forest or been developed for housing or commercial use. As a result, remaining grasslands are valuable habitat for a range of plants and animals that are also becoming less common. Several rare birds make use of grassland for nesting however they prefer very large fields, generally 50 acres or larger with the most uncommon grassland birds found only in sites over 100 acres. Fields as small as 10 acres will host breeding bobolinks and should be managed for bird habitat.

None of the fields in Andover's conservation lands are large enough to attract such species. Andover's smaller fields provide supplemental habitat for some birds and will generally be managed for plant and invertebrate (pollinator) habitat, and cultural and aesthetic values.

Challenges to grassland management include succession, encroachment, impacts to wildlife, and invasive species. In the absence of some form of disturbance, most New England grasslands will naturally transition to an 'old field', a young forest, and eventually a mature forest. This process is termed *succession*. *Encroachment* is a more insidious form of succession where even well-tended fields slowly shrink as shrubby vegetation on the field edge grows further into the grasslands year by year.

All fields need to be *disturbed* on a regular basis to avoid succession and encroachment. The ultimate tension in grassland management is that disturbance is required to maintain the habitat, yet the disturbance may result in an impact to wildlife making use of the field. The goal of management is to plan the disturbance in a way that minimizes impacts to grassland-dependent species.

The most common forms of disturbance are mowing, grazing, and burning. Since burning is logistically complex and expensive, grassland management on Andover



FIELD MOWING

conservation land will generally be limited to grazing and/or mowing. Grazing can be an appropriate method for grassland management; however, it requires a dedicated farmer willing to take on all aspects of animal husbandry including erecting and maintaining fencing and providing water for

livestock. A field being actively grazed would be inaccessible to the general user, and conflicts between livestock and dogs may arise. For these reasons, mowing will be the more likely grassland management technique.

Mowing variables include timing, frequency, type of equipment, blade height, and fate of the mown material.

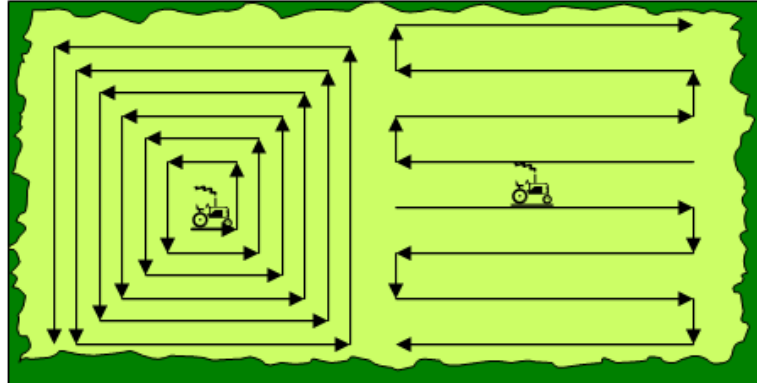
- Timing and Frequency – A field that is mown earlier in the season and more frequently in a season will tend to be dominated by grasses. A field mown once per year and later in the fall will tend to have a higher component of wildflowers. Mowing should be prohibited during bird nesting season, mid-May to the end of July. **Thus, any fields smaller than 10 acres can be mown in September or October or March to provide nectaring plants for invertebrates.** Mowing in March has an added benefit of providing more wintering habitat for invertebrate eggs and overwintering larvae.
- Type of equipment – Fields can be mown with a rotary deck mower or a sickle bar mower. A sickle bar, or hay mower, is preferred for larger fields to be managed as grasslands. A rotary mower tends to leave clumped material which can inhibit re-sprouting in the spring and smother insect larvae.
- Blade height – Any mowing should leave roughly 6 inches of standing material to provide habitat for invertebrate larvae.
- Treatment of mown material – Small wildflower fields, like those on Andover’s conservation lands, can be managed for invertebrate habitat and the clippings left in place.

Al Retelle Conservation Area (6.79 acres of mowed grassland), Pray Field (part of Fish Brook South Conservation Area, 1.89 acres of mowed grassland), Serio’s Grove Conservation Area (1.01 acres of mowed grassland), and Virginia Hammond Conservation Area (5.24 acres of mowed grassland) all contain grassland habitats that are used by numerous early successional species for nesting in the summer months and as a source of food and cover throughout the year. The annual mowing of these fields takes place between August 15th and September 15th of each year, which strategically avoids disruption to ground-nesting wildlife but occurs before the grass lays over in the fall. The program was officially launched with the Andover DPW in June of 2021.

Beyond protected areas that are actively managed for grassland habitat, early successional habitat is maintained in transmission line corridors, where utility companies periodically cut vegetation in the right-of-way. Although this practice creates early successional habitat, vegetation management may occur in early or mid-summer and can present a danger for ground-nesting species like Eastern box turtles. Clear communication with utility companies and support from the NHESP can help address potential conflicts that can arise in transmission line corridors and other utility rights-of-way.

Mowing should include removal of woody shrubs growing on the field edge to resist their natural expansion into the field. If necessary, a heavy mower should be used to clear back shrubs along field edges. Management should include removing any shrubs and trees growing along stone walls that divide adjacent fields to maximize the size of contiguous fields. Single trees standing in a field can be maintained if they offer significant aesthetic appeal, but generally should be removed to maximize size of the field and to eliminate refugia for woody invasive species.

How the mowing is done also influences wildlife. Mowing from the outside toward the center has the potential to trap small mammals, fledgling birds, reptiles, and amphibians in the center. Mowing from the middle and working outward allows more wildlife to have a chance to escape.



Regular mowing should prevent colonization by woody invasive species; although once established, invasive shrubs and vines can persist even in a mown field. Once woody species such as glossy buckthorn are established throughout a field, the most effective approach for their control is use of a broad-leaf herbicide which targets the shrubs but does not impact grasses.

Vines such as oriental bittersweet and black swallowwort can be pernicious grassland invaders. These species can be removed by hand and kept at bay with regular work parties dedicated to their removal. It is particularly important to control black swallowwort as soon as it is discovered since this species, related to milkweeds, spreads its wind-dispersed seeds far and wide, expanding in a field relatively quickly and reducing habitat quality for butterflies. In fact, the plant is toxic to some butterflies. If manual control is not successful, herbicides may be necessary.

Characteristics of each field and the intended management routine should be identified in a detailed ecological management plan for each property. Property stewards should meet annually to review condition of fields, identify threats that are not being addressed by the current management approach, and formulate adjustments to management to reduce those threats. **Efforts should be made to survey each field for breeding bird activity and use by butterflies, with volunteer efforts such as the annual Xerces Society butterfly count or the Massachusetts Butterfly Club as a model for success.**

Forest Management

The section on Management of Natural Areas in a Time of Changing Climate (page 11 – 13) recommended four strategies for forest management: Diversifying the forest's age structure and species composition, control of white-tailed deer densities, control invasive species and pests, and managing change.

Forests provide many ecological services including wildlife habitat, flood and erosion control, public health benefits, recreational opportunities, and carbon sequestration. Protecting our forests from development is a crucial first step to secure these natural benefits. In addition to forest protection, there are various ways to steward forests to retain or at times enhance their benefits to the community. This includes passive management, a mostly hands-off approach, and active management to create a particular habitat type or benefit a species of conservation need.

PASSIVE FOREST MANAGEMENT

A passive approach to forest management lets forests continue to mature. Allowing forests to naturally mature has inherent values, including:

- Encouraging old growth forests – one of the rarest habitats in Massachusetts. These forests have a unique multi-layered structure of vegetation and provide particularly high-quality habitat for some wildlife species. Old growth conditions can only develop with time, usually after 200–300 years.
- By sequestering carbon forest growth plays an important role in combatting climate change. Currently, carbon sequestration in our forests offsets about 14% of annual emissions in Massachusetts.
- As forest managers and scientists study the various benefits and implications of active forest management, it is important to have untouched sites for comparison.

ACTIVE FOREST MANAGEMENT

The thoughtful application of more active forest management practices can help restore habitat conditions found within young and old growth forests. Most of Andover was once cleared for agriculture or the wood was harvested for various purposes. As farmers moved west for better land forests began to regrow about 80–120 years ago and are now considered “middle-aged.” This means we have very little young forests (0-20 years) or old growth forests (200+ years).

Young forests occur in relatively open conditions and are dominated by dense growth of shrubs and sapling trees. This type of habitat used to occur naturally due to large-scale disturbances such as beaver activity and fires. These disturbances are now less frequent and are controlled to protect human lives and resources. Selectively removing generalist white pine stands from small areas of the forest to create patches of young forest is an effective way to recreate this type of early successional habitat for wildlife species that depend on such area, including several warblers and white-throated sparrows.

Middle-aged forests often have a less complex structure than **old growth forests** and provide poorer habitat for some species. Habitat management can be used to mimic the unique features of old growth forest, and bolster wildlife species of conservation concern. This may include the creation of standing deadwood, or snags, for cavity nesting wildlife species by girdling lower-value trees.

CLIMATE SMART FORESTRY (CSF)

Forests in Massachusetts are already affected by climate change—more extreme weather events damage trees, and the warmer climate makes forests vulnerable to invasive pests. CSF practices promote healthy forests and support carbon sequestration under changing conditions, allowing forests to be part of the climate change solution. For more information see

<https://www.massaudubon.org/our-conservation-work/ecological-management/habitat-management/climate-smart-forestry> .

FORESTERS FOR THE BIRDS PROGRAM

Mass Audubon has partnered with the Department of Conservation and Recreation and the Mass Woodlands Institute to bring the Foresters for the Birds program to Massachusetts. The program provides technical assistance for landowners to manage their forests for bird habitat. Carefully planned and sustainable forestry practices can create young forest habitat and enhance the structure within our maturing forests. For more information see <https://www.massaudubon.org/our-conservation-work/wildlife-research-conservation/bird-conservation-monitoring/forest-birds> . Note that towns and non-profits are not eligible for any financial incentives offered to private landowners for the Forestry for

the Birds Program. Still using a forester trained in this program can be beneficial to towns wishing to develop forestry plans.

FOREST MANAGEMENT – WORK IN PROGRESS

In 2013, three forest stewardship plans were prepared for Bald Hill – Wood Hill Conservation Area, Fish Brook North Conservation Area, and Virginia Hammond Conservation Area by licensed forester Gary Gouldrup. These plans outlined specific forest management recommendations based on the specific ecology of the wooded areas within these reservations to improve forest health, create wildlife habitat, and increase forest resiliency. The recommendations of these plans have yet to be implemented, so in the summer of 2021, efforts were resumed to implement the outlined forest management recommendations.

DEER MANAGEMENT – WORK IN PROGRESS

As a direct result of the removal of predators from the food chain, white-tailed deer have rapidly increased in abundance throughout the state of Massachusetts. These large deer populations have significant ramifications for Andover’s natural resources; heavy deer browse prevents the regeneration of trees and vegetation in the understory and shrub layer of forests, affecting the natural processes of forest ecology. Deer overabundance also causes a reduction in wildflowers, diminishes water quality, increases motor vehicle accidents, and increases in Lyme disease infections.

In response to this issue, the Andover archery hunting program was implemented in 2010. AVIS has since joined the program to expand the acreage in Andover available to hunters. Currently, non-resident hunters are chosen by a lottery, which is capped at 40 individuals. All hunters must pass a shooting test before their admittance into the program. Furthermore, all participating hunters must follow the laws outlined by MassWildlife and are only permitted to hunt by bow and arrow.

Wetlands, Stream, and Water Body Protection/Improvement

Andover’s watershed resources play an important role in the community: draining storm run-off, purifying ground water, harboring wildlife, and providing aesthetically pleasing places to visit. Protection of these aquatic resources, and the functions they perform, is a fundamental objective of the Conservation Commission. Therefore, all land management will comply with current local, state, and federal rules and regulations, including

- Wetland Protection Code administered by the Andover Conservation Commission
- Wetlands Protection Act administered by the Massachusetts Department of Environmental Protection
- Federal Clean Water Act administered by the Environmental Protection Agency

Any regulated activities considered within jurisdictional areas on conservation land will be fully reviewed by the Conservation Commission through the normal processes laid out in the Wetlands Protection Act and the Andover Code. Current and future management activities will strive to minimize real and potential impacts to wetland resources. Projects on conservation properties will serve as showcases for low-impact land use regarding wetlands and buffer areas.

Restoration and improvement of wetland habitats should focus on building connectivity and increasing flood-storage capacity. Connectivity for aquatic wildlife can be increased by ensuring that any wetland and stream crossings incorporate culverts or bridges of adequate size and design to ensure that wildlife can move through the passage unhindered. Stream culverts must ensure that water does not move through the passage at high speed, lead to a drop at the downstream end, or scour the riverbank below the crossing. Staff and commissioners should engage with Andover Engineering and DPW to review opportunities for improving culverts and other stream crossings to ensure that they are adequately sized for wildlife passage and in-stream habitat. Any work being performed in or near a wetland or floodplain must avoid any reduction in flood storage capacity. The northeast is predicted to receive more frequent intense storms in coming decades as one result of climate change. Storm water storage is one of the most valuable ecosystem services already performed by wetlands and thus will become even more important in the future.



Areas of Special Concern

Areas of special concern include those areas recognized by the state as ecologically significant and exemplary natural features within the town that may not have statewide importance but still hold great conservation value in the local landscape. Areas of special concern include:

- Rare species habitat identified by the Massachusetts Natural Heritage & Endangered Species Program (NHESP) in the most current Natural Heritage Atlas.
- Core Habitat and Critical Natural Landscapes identified by NHESP in their BioMap2 project (see section on page 6 and Appendix A).
- Locations of exemplary local natural features that might be identified in site-specific management plans.
- Areas where it is impractical to provide environmentally sustainable human access.

If at any time the recreational use of a conservation property has the potential to conflict with these ecological values, the natural resources should take precedence and recreational use of an area may be limited.

Invasive Species Management

Invasive species pose one of the greatest threats to the biodiversity, natural landscapes, agricultural interests, recreational activities, and scenic beauty of conservation properties. Since European colonization, humans have been intentionally and accidentally introducing non-native species to New England from around the world. Because introduced species did not evolve in their new environment, they often lack predators or competitors for resources, and are not affected by native invertebrates or pathogens that help to keep populations balanced. As a result, many introduced species rapidly spread and can overwhelm an area, causing substantial harm to native ecosystems. Therefore, non-native species are considered “invasive” when their introduction causes, or is likely to cause, economic or environmental harm or harm to human health (National Invasive Species Information Center, 2021). By

threatening specialized native habitats and the unique species assemblages they support, invasive species can contribute to a phenomenon known as “biotic homogenization”⁹.

The Massachusetts Invasive Plant Advisory Group (MIPAG) defines invasive plants as “non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to these systems.” Many organisms develop specialized associations with plants, so the invasion of non-native species can cause adverse effects that radiate throughout the food web. In addition to reducing biodiversity, invasive plants can alter soil chemistry, affect biogeochemical cycles, clog waterways, impact water quality, and degrade wildlife habitat. Some invasive plants alter habitats in ways that encourage pest species, such as ticks and mosquitoes, and potentially increase the transmission of certain diseases to humans¹⁰. According to MIPAG, 66 plant species are considered invasive or likely invasive in Massachusetts, with many others considered a potential threat. Unfortunately, globalization makes it increasingly difficult to prevent the spread of additional non-native species to the area.

Essex County has the second highest total number of invasive species reports of all Massachusetts counties (based on the University of Georgia Early Detection and Distribution Mapping System [EDDMapS] invasive species status report by state). The reality of this statistic is reflected in the severe non-native plant invasions that are widespread across Andover conservation land. Invasive plant species commonly found in Andover include Oriental bittersweet, glossy buckthorn, winged euonymus (burning bush), non-native bush honeysuckles, multiflora rose, Japanese knotweed, Japanese barberry, tree of heaven, Norway maple, autumn olive, purple loosestrife, and garlic mustard.

Massachusetts Invasive Plant Advisory Group Principles

The Massachusetts Invasive Plant Advisory Group advocates the following as guidelines for addressing invasive plant species¹¹.

1. The first principle of invasive plant management is to manage for specific outcomes. Thereafter, a meaningful strategy of invasives management must first define what natural or cultural values should have priority for protection from established or incipient invasion to ensure their

⁹ Olden J.D., Poff, N.L., Douglas, M.R., Douglas, M.E., & Fausch, K.D. (2004). *Ecological and evolutionary consequences of biotic homogenization*. Trends in Ecology and Evolution. 19(1):18-24.

¹⁰ Stone, C.M., Witt, A.B.R., Walsh, G.C, Foster, W.A., & Murphy S.T. (2018). *Would the control of invasive alien plants reduce malaria transmission? A review*. Parasites and Vectors. 11, 76. <https://doi.org/10.1186/s13071-018-2644-8>. and

Williams, S.C., Linske, M.A., & Ward, J.S. (2017). Long-term effects of *Berberis thunbergii* (Ranunculales:Berberidaceae) management on *Ixodes scapularis* (Acari:Ixodidae) abundance and *Borrelia burgdorferi* (Spirachaetales: Spirochaetaceae) prevalence in Connecticut, USA. Environmental Entomology. 46(6):1329-1338. <https://doi.org/10.1093/ee/nvx146>

¹¹ Massachusetts Invasive Plant Advisory Group (MIPAG). (2012, December). Guidance for the Effective Management of Invasive Plants: Version 2. Retrieved from <https://www.lexingtonma.gov/sites/g/files/vyhlf7101/f/uploads/guidanceinvplantmgmtmipag.pdf>

conservation. This mirrors the colloquial “save the best, leave the rest” philosophy that is often cited.

2. Next, the invasive species that poses the greatest threat to natural resources should be identified for targeted removal. This requires an inventory and possibly a map of the area(s) in question. When budget allows, expertise from outside groups may be helpful or necessary. When applicable, wetlands, state-listed species, or Priority or Estimated habitats should be noted and factored into all decision making to ensure minimal or no damage is inflicted.
3. After identifying the target invasive species, research should be conducted to determine the best management method – options include mechanical/manual (hand pulling), chemical (herbicide application), prescribed fire, and even biological control (i.e., the use of pests like beetles or weevils). Table 3 outlines season-specific management strategies that are recommended for common invasive plant species.
4. A realistic management goal should then be developed based on the extent of the invasion and other threats in the area. Goals may include eradication, suppression, or containment.
5. Available resources should then be evaluated relative to the selected goal to establish a timeline and ensure adequate resources are available to see the project to fruition. If inadequate resources are available, the goals may need to be reevaluated.
6. Once these details have been established, it is time to implement the selected management strategy. Smallest or satellite infestations should be treated first, while working towards larger or core infestations.
7. The final step is monitoring and documenting outcomes to determine the success of the project. This may include photographs of the management area, written descriptions, or a specific scientific protocol.
8. For all succeeding projects, the relative successes and failures of past invasive species management efforts should serve to inform and improve future invasive species management efforts. This embodies the spirit of adaptive management – a structured, iterative process of decision making in the face of uncertainty.

[Invasive Species Management Methods](#)

There are many ways to deal with this threat, including initial prevention, early detection, and control through manual removal (i.e., pulling, digging, cutting) mechanical treatment (i.e., mowing, smothering with black plastic), or use of biological control agents (i.e., species-specific predators, pathogens, or parasites), pesticide application, grazing, and fire. Invasive species are difficult to eradicate and without multiple seasons of dedicated management, and infestations will rebound despite one’s best efforts. Prioritization of targeted management is essential to successfully managing an area for invasive species.

Invasive species control efforts can be divided into two categories: species-based and location-based. The species-based approach will focus on individual species no matter where they occur on conservation properties. The five elements of the species-based approach are:

- Preventing invasion by new species,
- Early detection of new invasions,
- Eliminating or effectively controlling species with recent or limited presence,
- Limiting the spread of highly noxious invaders,
- Directing effort at species which are particularly susceptible to control.

Location based efforts focus efforts on all invasive species within specific areas of the conservation property. The three elements are:

- Protecting sensitive habitats,
- Establishing invasives-free zones,
- Restricting the spread and reducing the extent of heavily invaded zones.

For areas that are particularly sensitive habitat, contain species of concern, or hold high aesthetic value, location-based methods, which prioritize certain areas and take a systematic approach to large infestations, will direct control efforts.

The approaches will overlap at times and when taken together will define a comprehensive approach to reducing the presence of invasives across the conservation properties.

Management of invasives species should follow an adaptive approach – a continuous process that allows for flexibility in management based on the inclusion of the most recent management options. As new information becomes available on plant biology and treatment methods, it will be incorporated into future management decisions. An adaptive approach will also allow property managers to learn from the efficacy of current treatment methods and adjust future management actions.

SPECIES-BASED EFFORTS

PREVENT SPREAD OF EXISTING INVASIVES AND INTRODUCTION OF NEW INVASIONS

The primary element of a proactive prevention plan is limiting the introduction of new invasive species to individual conservation properties. The spread of existing invasives will be reduced by limiting soil disturbance and implementing restoration when soils are disturbed, by washing equipment that has been used in heavily invaded areas before moving to an un-invaded area, and by implementing practices to reduce likelihood of seed spread by individuals working on invasives control projects. Soil disturbance from plowing, tree removal, trail building, etc., should be limited and all disturbed soil should be covered with leaf litter at minimum with larger disturbed areas restored using a fast-growing native seed mix. All equipment used for maintenance operations in heavily invaded areas should be cleaned (e.g., with a leaf blower) before moving to non-invaded areas; and staff and volunteers should take special care to pat down, wipe, and/or rinse clothes and shoes after working with invasive plants.

EARLY DETECTION/RAPID RESPONSE

Any comprehensive invasive species control program must also include early detection (ED) of new invaders and rapid response (RR) to eliminate new invasions before they become well-established. ED efforts will be directed at the list of early detection species identified by the Massachusetts Invasive Plants Advisory Group (MIPAG). MIPAG's current ED list is presented in Table 1, and updates can be found on the MIPAG website: <http://www.massnrc.org/mipag/>. Land Stewards should be trained to identify the ED species which are not yet well-known in this part of the state, such as Japanese stiltgrass and mile-a-minute vine. The Conservation Commission, Conservation Division staff, and volunteer stewards should be prepared to collaborate on planning and implementing the rapid response element to eliminate new invasions as quickly as possible.

Once an infestation reaches a certain point, the only remaining management option becomes localized control (e.g., to protect species of conservation concern). However, if caught at an early stage it is feasible to eliminate invasions at low effort and cost.

LIMIT SPREAD OF HIGHLY NOXIOUS INVADERS

Special attention should be paid to particularly aggressive invaders, such as those species with wind-dispersed seeds, aggressive root suckering, allelopathic characteristics, rapid growth, and high resistance to control. Species in this category are shown in Table 2.

CONTROL SPECIES WITH RECENT OR LIMITED PRESENCE

Early invasions are much more easily eradicated than well-established stands of any species. Removing young woody plants before they reach a fruiting size prevents further spread, and it is critical to remove aggressively rooting species before they establish a dense underground network. Vining species are more easily removed before they tangle with native shrubs and trees.

CONTROL RELATIVELY EASILY MANAGED SPECIES

Japanese barberry and garlic mustard are examples of species that can be controlled with dedicated manual effort. Such species should be the focus of eradication efforts before they spread.

Table 1. Early Detection (ED) invasive plants as identified by the Massachusetts Invasive Plant Advisory Group (MIPAG).

Common name(s)	Species	Comments
Flowering Rush	<i>Butomus umbellatus</i>	Aquatic perennial herb
Brazilian waterweed	<i>Egeria densa</i>	Submerged aquatic
Tall mannagrass, Reed mannagrass	<i>Glyceria maxima</i>	Perennial grass
Giant Hogweed	<i>Heracleum mantegazzianum</i>	Biennial or short-lived perennial herb
Hydrilla	<i>Hydrilla verticillata</i>	Submerged aquatic
Parrotfeather	<i>Myriophyllum aquaticum</i>	Submerged aquatic
Yellow floating heart	<i>Nymphoides peltata</i>	Floating-leaved perennial aquatic herb
Mile-a-minute	<i>Persicaria perfoliate</i> , <i>Polygonum perfoliatum</i>	Once established this species spreads rapidly; annual herbaceous vine
Kudzu	<i>Pueraria montana ssp. lobata</i>	Woody vine
Tansy ragwort, Stinking willie, Stinking Billy	<i>Senecio jacobaea</i>	injurious to livestock; biennial herb
Pale swallowwort	<i>Cynanchum rossicum</i>	Kills Monarch Butterfly caterpillars; Perennial herbaceous vine
Tall pepperweed, Broadleaved pepperweed	<i>Lepidium latifolium</i>	Perennial herb
Japanese stiltgrass	<i>Microstegium vimineum</i>	Annual grass

Table 2. Particularly aggressive invasive species. (See excel file “andover_invasives.xls.)

Black swallowwort	<i>Cynanchum louiseae</i>
Common reed	<i>Phragmites australis</i>
Garlic mustard	<i>Alliaria petiolata</i>
Japanese knotweed	<i>Fallopia japonica</i>
Japanese stiltgrass	<i>Microstegium vimineum</i>
Purple loosestrife*	<i>Lythrum salicaria</i>
Tree of heaven	<i>Ailanthus altissima</i>
Water chestnut	<i>Trapa natans</i>
Oriental bittersweet	<i>Celastrus orbiculatus</i>
Common buckthorn	<i>Rhamnus cathartica</i>
Glossy buckthorn	<i>Frangula alnus</i>

* Now less of a problem because of prevalence of biocontrol beetles

PROTECT AND RESTORE RARE SPECIES HABITAT AND UNCOMMON OR EXEMPLARY NATURAL COMMUNITIES

Invasives control should be a priority at any sites within the town’s conservation properties that support state listed species or other species of conservation concern. Invasive control activities that occur near these populations will be conducted in a manner that does not have a negative effect on these populations.

INVASIVES FREE ZONES

Larger parcels of conservation land will typically have some sections that do not contain invasive plant species. These resilient parcels should be identified and monitored on an annual basis in the late summer to determine if these areas have remained pristine or if new invasions have started to become established. If a new infestation is found, efforts should be made to eradicate those plants and keep the “clean” areas “clean”.

LIMIT EXPANSION OF HEAVILY INVADED AREAS

An area that is completely covered in invasive species or has several species of invasive plants growing in the same location should be contained to prevent further spread of the infestation. This can be done by identifying the boundary of the heavily invaded area(s) and creating a treatment area buffer zone (e.g., 50 feet around the perimeter of infestation) for targeting management efforts. This allows stewards to prevent the encroachment of invasives in cleaner areas without getting overwhelmed or tackling a project that exceeds available resources.

If highly noxious species are present in the densely invaded area extra measures may need to be taken to truly prevent the further spread of the infestation. Some options include increasing the treatment area to a 100-foot buffer zone or hiring outside contractors to treat the infestation chemically.

However, many invasive species have berries with seeds that are eaten by birds and excreted far from the source, so for these fruiting species, a buffer will not be effective.

Treatment Methods

Different invasive species respond to different management techniques, several of which are summarized here and detailed in Appendix C. Manual control, pulling plants by hand or with light tools

such as loppers or weed wrenches, may be effective for small infestations and where volunteer capacity permits repeated effort. Large infestations and certain problematic species will require more intensive management, often involving the use of herbicides. Herbicides can only be applied by an individual duly licensed by the Department of Agricultural Resources. Because licensure requires liability insurance coverage, it is more likely that herbicide will be applied by a contracted professional or town employees than by volunteers. Property-specific management plans should identify infestations and recommended approaches for control. The Conservation Commission, Conservation Division staff, and stewards should plan and budget for involvement of professionals as necessary. Table 3 provides information on species that can be managed at various times of year.

DISPOSAL OF REMOVED INVASIVES

Invasive plants that have been hand pulled or cut can be piled on site to decompose or bagged and brought to an area for invasive plant containment. The site(s) used to dump invasives should be monitored to ensure that invasive plants are not establishing themselves from the materials deposited there. Staff and volunteers should take extreme care to avoid spreading seed or other material from which plants can resprout, (e.g., Japanese knotweed can sprout from any stray plant part).

Restoration

Many of our invasive species are adapted to pioneer disturbed soils. For this reason, all control efforts and general site work that results in exposed mineral soil should incorporate restoration with fast-growing native species. Small patches of exposed soil, for example from root wrenching a shrub, should be tamped down by foot and covered with leaf litter sourced on-site. Non-forested sites such as fields, should be seeded with a native grass mix including annual rye (*Lolium perenne*) which can provide a quick cover to open soils, prevent erosion, and allow non-invasives time to self-germinate. While annual rye is not a native it will only last one year giving time for more desirable species to germinate.



RECORD-KEEPING

All invasive plant species management actions should be documented with a field datasheet and records kept in a central file. Information collected should include the location, date, species targeted, phenology of plant (vegetative, flowering, fruiting), type of management used (manual, mechanical, chemical), the size of the infestation and an estimate of what percent of the area was managed (See Appendix C for a sample field sheet). Recording these data allow conservation staff to track the progress of management efforts, adapt tactics in future years if needed, and have a sense of the expanse of targeted invasive species.

Table 3: Season-specific Management for Commonly Found Invasive Plant Species.

Common Name	Spring	Summer	Fall
Autumn Olive	manual		chemical
Black swallowwort		chemical/manual	
Burning Bush	manual		chemical
Bush honeysuckle	manual	chemical	
Common reed			chemical
Garlic mustard	chemical/manual		
Glossy Buckthorn	manual		chemical
Japanese Barberry	manual		chemical
Japanese knotweed		chemical	
Japanese stiltgrass		chemical/manual	chemical
Multiflora rose	manual	chemical	
Oriental Bittersweet	manual		chemical
Purple loosestrife		biological	
Spotted knapweed		chemical/manual	
Tree-of-Heaven	manual		chemical
Water chestnut		manual	

Invasive Insects

Like invasive plants, non-native insects and pathogens can pose a significant threat to native tree species and forest ecosystems due to the lack of coevolved natural predators and the reduced resistance of host plants to invasion. Once introduced, invasive insects and pathogens can quickly spread and degrade water quality, forest health, and wildlife habitat. The impacts of invasive insects and pathogens can be exacerbated by factors such as climate change and weather events, adding additional complexity to the management of these invasions.

The leading invasive insects that are present in Andover’s ecosystems include the following species:

1. Emerald Ash Borer (*Agrilus planipennis*) – commonly called “EAB”
2. Gypsy Moth (*Lymantria dispar*)
3. Hemlock Woolly Adelgid (*Adelges tsugae*)

The emerald ash borer was first detected in Massachusetts in 2012 and was reported in Andover in 2013¹². These wood-boring beetles feed on the inner bark of ash trees, which disrupts the tree’s ability to transport nutrients and water. This species has damaged hundreds of millions of ash trees across the United States, therein affecting the habitat of the many organisms that have specialized associations with ash trees¹³. Three species of wasps have been introduced in Massachusetts for biocontrol

¹² Simisky, T. & Forman Orth, J. (2020, September). Emerald Ash Borer. Retrieved from <https://ag.umass.edu/landscape/fact-sheets/emerald-ash-borer>

¹³ Wagner, D.L. & Todd, K.J. (2016). New ecological assessment for the emerald ash borer. A cautionary tale about unvetted host-plant literature. *American Entomologist*. 62(1): 26-35.

(Massachusetts Department of Conservation & Recreation, n.d.-a), but the success of these introductions is yet to be determined.

The gypsy moth was introduced to Massachusetts in 1869 and has been a persistent problem since¹⁴. During its life stage as a caterpillar, this species can cause extensive defoliation of numerous deciduous trees and some conifers. These defoliation events occur cyclically and are currently passively managed by state agencies. Fortunately, gypsy moth outbreaks may be prevented or controlled, at least in part, by an introduced soil-borne fungus (*Entomophaga maimaiga*), and by the nucleopolyhedrosis virus. Both require ample moisture early in the season to proliferate¹⁵, so these agents may be ineffective in controlling gypsy moths during years with unusually dry springs and summers¹⁶.

The hemlock woolly adelgid was introduced to Massachusetts in 1988 and has since caused significant damage to the state's native eastern hemlock trees. This insect feeds on sap from the twigs of the host plant and can be easily seen with the naked eye as small, white, woolly clusters on the underside of hemlock needles. Trees growing in suboptimal habitats (e.g., in drought-prone or compacted soils) may die within 3 to 5 years of infestation, while trees growing under favorable conditions may tolerate the adelgid for 7-10 years before showing signs of decline¹⁷. The significant damage to hemlock trees in turn affects the many organisms that rely on these trees for cover and food¹⁸, including several bird species that are considered hemlock specialists¹⁹. Two beetle species have been released in Massachusetts for biocontrol of hemlock woolly adelgid (*Sasajiscymnus tsugae* and *Laricobius nigrinus*) but they have not yet been successfully established²⁰.

¹⁴ Massachusetts Department of Conservation & Recreation. (n.d.-b). *Lymantria dispar* (gypsy moth) in Massachusetts. Retrieved from <https://www.mass.gov/guides/lymantria-dispar-gypsy-moth-in-massachusetts#:~:text=The%20Lymantria%20dispar%20has%20been,in%20the%20caterpillar%20life%20stage>.

¹⁵ Childs, R. (Revised by Simisky, T.). (2016). Gypsy Moth (*Lymantria dispar*). Retrieved from https://ag.umass.edu/sites/ag.umass.edu/files/pdf%2Cdoc%2Cppt/final_gypsy_moth_fact_sheet_1_column.pdf

¹⁶ Harrington S. (2017, September 26). A very hungry caterpillar is killing trees in New England. Retrieved from <https://yaleclimateconnections.org/2017/09/a-very-hungry-caterpillar-is-killing-trees-in-new-england/>

¹⁷ Childs, R. (Revised by Simisky, T.). (n.d.). Hemlock Woolly Adelgid. Retrieved from <https://ag.umass.edu/print/9557>.

¹⁸ Quimby, J.W., Salom, S.M., Tigner, T.C., & Reardon, R.C. (1995). Value and importance of hemlock ecosystems in the eastern United States. *Environmental Science*.

¹⁹ Toenies, M.J., Miller, D.A.W., Marshall, M.R., & Stauffer, G.E.. (2018). Shifts in vegetation and avian community structure following the decline of a foundational forest species, the eastern hemlock. *The Condor*. 120(3):489-506. <https://doi.org/10.1650/CONDOR-17-204.1>.

²⁰ Massachusetts Department of Conservation & Recreation. (n.d.-b). Current Forest Health Threats. Retrieved from <https://www.mass.gov/service-details/current-forest-health-threats>

Recent reports of Asian longhorned beetles (*Anoplophora glabripennis*) and spotted lanternflies (*Lycorma delicatula*) in Massachusetts present possible future issues with these damaging invasive insects as well.

Other Invasive Organisms

Andover is affected by other invasive macroorganisms, such as the Asian carp (*Cyprinus carpio*), Asian jumping worm (*Amyntas agrestis*), European starling (*Sturnus vulgaris*), and the house sparrow (*Passer domesticus*). Despite their larger size, these species are similarly difficult to manage and cause serious disruptions to Andover's native organisms. There are very few options for control available to land managers, but invasive birds can be deterred by using specific nesting boxes or choosing birdseed preferred by native species.

Although invisible to the naked eye, pathogens are an important category of invasive species. Invasive pathogens are those pathogenic microorganisms such as bacteria, fungi and viruses that spread to new habitats and pose the risk of disease to native plants and/or animals²¹. Invasive pathogens may produce disease in a single species or a closely related group for species, such as the lethal fungal pathogen that causes Dutch elm disease in American elms and other elm trees²². Pathogens of high concern that are current affecting forests in Massachusetts include the following:

- White pine needle disease, caused by four fungal pathogens: *Lecanosticta acicola*, *Septorioides strobi*, *Bifusella linearis* and *Lophophacidium dooksii*
- Beech bark disease, caused by *Xylococcus betulae* and the beech scale insect, *Cryptococcus fagisuga*.

Wildlife Enhancement/Management Recommendations

There are several actions that land managers can take to enhance the quality of wildlife habitat within a conservation area. In addition to benefiting native species populations, improved habitat can help make conservation areas a more interesting destination for visitors interested in wildlife observation.

Brush piles

Strategically place piles of brush in the forested areas or at the edges of the fields can be assembled to provide resting/escape cover and den sites for wildlife. Brush piles are used for cover by Eastern cottontails and other small mammals. Songbirds may use brush piles for perch sites, especially if the piles are located near feeding or nest sites. If brush piles are adjacent to a water source, amphibians and reptiles may use them for breeding, feeding, or resting. See <https://extension.psu.edu/management-practices-for-enhancing-wildlife-habitat> for more information on steps for enhancing wildlife habitat.

Snags

Leaving dead or partially dead standing trees provides several important benefits to a variety of wildlife. Snags support cavities for nesting and resting, perches for hunting and displaying, and an abundant

²¹ USGS Leetown Science Center. (n.d.). Invasive Pathogens. Retrieved from <https://www.usgs.gov/science/science-topics/invasive-pathogens>

²² Ibid

supply of food for insect eaters. There are numerous species of birds and mammals that use snags at some point in their life cycles, such as pileated woodpeckers and barred owls. The best method to provide snags for wildlife is to retain existing snags in places where they will not create a dangerous situation for people using the nearby area. Snags can also be created by girdling low quality trees, such as white pines in a generalist stand.

Nest boxes

Nest boxes, platforms, and other types of nesting structures provide nest sites for wildlife in areas where natural nest sites (particularly cavities) are absent or available only in low numbers. They are also used to attract wildlife to specific areas even when nest sites are not limited. Nest boxes can be used to provide nest sites for birds such as bluebirds, tree swallows, wrens, and wood ducks. Nest boxes also provide nest sites for mammals like squirrels and bats. Platforms and other structures are used to provide nest sites for species like the ospreys, eastern phoebe, barn swallow, and some waterfowl. Special colonial nest boxes can be erected for purple martins. Bat boxes can also be erected along the field edges. See Mass Audubon's website

<https://www.massaudubon.org/learn/nature-wildlife/birds/birdhouses> for instruction on building and placing nest boxes.

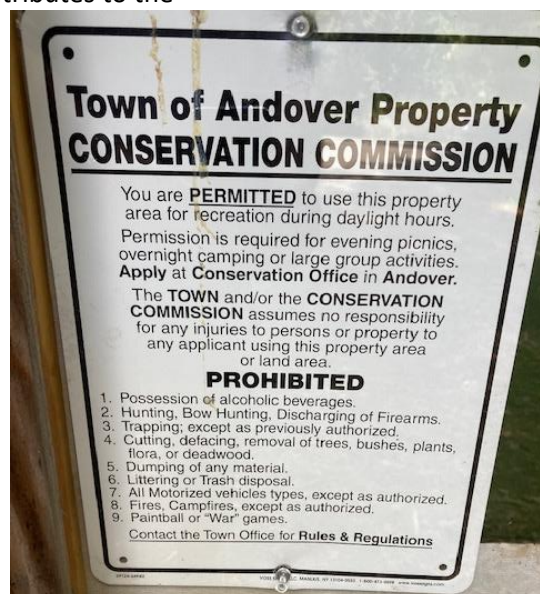
Nest boxes that are put out in a field can be monitored by volunteers, and the results shared with the Cornell Lab of Ornithology.

Pollinator Plantings

Pollinator-friendly plantings support numerous kinds of native bees, as well as honeybees, butterflies, hummingbirds, and other pollinators. Planting a diverse mix of flowering plants that provides a sequence of blooms from early spring to late fall will have the most impact. Even a small patch of the right native flowers can help, as this contributes to the larger landscape mosaic in which the pollinators live and search for food. For a list of plants and guidelines for planting see



PURPLE MARTIN HOUSE



https://extension.unh.edu/resources/files/Resource005973_Rep8387.pdf and for a plant list that supports native declining pollinators, visit the MCA Native Pollinator Task Force at <https://www.svtweb.org/mca-native-pollinator-task-force> .

Prevention and Remediation of Human Impacts

As a densely settled suburban town, Andover's conservation land is highly impacted by both allowable and prohibited human uses. Having a cadre of volunteer stewards who look after conservation areas is a great help for the Conservation Commission.

Prohibited and Illegal Use

Once established, illegal and prohibited uses of conservation properties can be very difficult to discontinue. ATVs, paintball, forts and firepits are examples of prohibited activities that should be 'nipped in the bud'. Individuals will often engage in these types of prohibited uses on a whim; however, if there is no sign of a reaction, such as closing informal access points, posting signage, engaging neighbors, or cleaning up litter, the use may continue and intensify.

Stewards should regularly inspect each property including areas off trail with an eye for unpermitted uses. Such use should be reported immediately to Conservation Division staff, no matter how minor. Staff and stewards should then develop an appropriate response focused on:

- Repair of impacts, including cleaning litter, removing structures, etc., which demonstrates that the site is being cared for.
- Education about permitted uses through temporary signage at secondary or informal entrances.
- Outreach to these users, e.g., through letters to neighbors or information distributed in local media or through the school system.

More problematic illegal and offensive uses such as drinking parties, drug use, and casual assignations should lead to involvement of Andover police and a specific plan to add patrols until the activities are driven out.

Dumping/Pollution

Once discovered dumped materials should be cleaned up as soon as possible. Delayed cleanup gives the impression that a property is not well-monitored and well-cared for, which is discouraging to visitors and invites further misuse. Stewards should monitor parking areas and all road frontage of conservation parcels at least monthly and immediately inform staff of new dumping. Each report should include a photograph, some indication of location, and an assessment of what materials have been dumped. Small piles of innocuous materials such as paper or household trash should be removed as soon as possible by the steward. Removal of larger piles or anything including potentially hazardous material should be coordinated by staff with DPW or another appropriate partner. Locations experiencing repeated dumping should be posted with signs reading "No Dumping Including Yard Waste". If dumping continues, it will be reported to Andover police with a request for more frequent patrol of the site.

Encroachment

While vandalism and dumping in commonly used areas of conservation land is easily detected, encroachment along the boundaries is more difficult to monitor, yet critically important. Common forms of encroachment include dumping yard waste across a boundary, extending a lawn into

conservation land, and clearing vegetation across the boundary. Other cases may involve fence building, placement of a shed or swing-set, or intensive landscaping extending onto conservation land. Failure to identify, pursue, and resolve encroachments reduces the value of conservation land and may jeopardize the ability to obtain an appropriate resolution. Accordingly, the Commission will take timely action to resolve encroachments in the defense of lands entrusted in their care. Resolution should take place as soon as practical, and encroachments should be treated consistently.

Different levels of encroachment will likely require different responses. A critical step is mutual agreement with the offending neighbor that an encroachment has occurred. Potential outcomes include passive restoration where nature restores the disturbance; active restoration; remediation of conservation land elsewhere within the town; or monetary compensation.

Boundary Maintenance

Clearly marking boundaries and maintaining open communication with abutters will help to minimize the risk of encroachment. Small, weather-resistant markers, such as plastic markers nailed to trees, should be placed along boundary lines at regular intervals – especially those boundaries adjacent to residential development. Boundaries should be inspected a minimum of once per year, and an annual report with a summary of any encroachments, including documentary photographs and maps, should be prepared, and kept on file by conservation staff.

Travel off Official Trails

Travel off official trails will be discouraged by clearly stating on all signs and kiosks that visitors should remain on trails. In those areas where un-official trails become apparent, large sticks and branches will be placed on the trail to indicate that travel is not allowed. Where needed, “*Trail Closed*” or “*Ecological Restoration Area. Do Not Enter*” signs will be posted.

Property stewards should endeavor to understand use of each site for geocaching or other informal activities that specifically involve leaving official trails. Stewards should engage these user groups to understand the use and make a recommendation to staff regarding potential impacts of off-trail use. If any such use is determined to be having a specific impact on a known resource, action should be taken in cooperation with the specific user group to minimize impact, or if deemed necessary, to alter or discontinue this use.

Off-leash Dogs and Pet Waste

Andover’s conservation lands are popular destinations for birders, nature lovers, walkers, dog-walkers, and visitors seeking a quiet escape. For the most part these activities are in harmony with a conservation area’s role as a wildlife refuge. However, one distinct exception is dogs being walked off-leash. Off-leash dogs are a particular threat for ground-nesting birds and other wildlife, where dogs can fatally disrupt these nests without the owner’s knowledge. Off-leash dogs are also at greater risk of defecating in the woods unseen, which poses a significant threat to the health of Andover’s drinking water and wildlife habitat.

Andover’s By-Laws require dogs outside the premises of the owner to be held firmly on a leash no greater than six feet in length by a person who shall have control of such a dog except at the Town Dog Park where dogs can be “under the direct and immediate supervision of a responsible adult”.

Unrestrained dogs may be taken by police or the canine control officer and impounded in an animal

shelter. Not all visitors observe this regulation and person power for enforcement is limited. Most people will obey the regulation if they have enough information to understand the harm that their pets may cause – education is the key.

Several elements of a program to encourage keeping dogs on leash are recommended:

1. Install interpretive signs on the precarious state of ground nesting wildlife and the adverse impacts of loose dogs at the informational kiosk and trailheads.
2. Signs can also mention how other visitors may fear of off-leash dogs or have an unfriendly dog that may not wish to be approached by another animal.
3. Recruit volunteer docents during busy weekends to educate visitors about the site's wildlife and remind them of the importance of keeping their pets on-leash.
4. Consider a volunteer program like the "Bark Ranger" initiative that began in Weston with the Sudbury Valley Trustees.

Signs can also be posted at popular dog walking spots to encourage owners to clean up after their pets. The Dogs of Andover website includes the following:

"Dog waste left on the ground is more than smelly and unsightly....it pollutes our water and poses a health risk for pets and people, especially children! During rainfall, pet waste left on lawns, trails, and sidewalks washes into storm drains where it ends up flowing, untreated, directly into streams and local water bodies. Pet waste carries bacteria (twice as much as human waste), viruses, and parasites that threaten the health of humans and wildlife. Decaying pet waste consumes oxygen and sometimes releases ammonia. Low oxygen levels and ammonia can damage the health of fish and other aquatic life.

Unlike wildlife, who consume resources and nutrients from the same ecosystem they're a part of, dogs eat pet food rich in nutrients to provide them with a complete and healthy diet. Those pet foods lead to excess nutrients like nitrogen and phosphorus in the environment when dog poop isn't picked up. A buildup of those nutrients can create unstable conditions in many ecosystems.

Please be sure to not only pick up after your dog but also dispose of the waste in a receptacle. If no receptacle is available, please be prepared to bring the waste back home to dispose of in your trash. Never throw dog poop bags down a storm drain.

Scooping the poop is not only the right thing to do, in Andover, it's also the law!

A culture of picking up dog waste often evolves based on the behaviors of others: when a dog owner sees others picking up, s/he will adopt this as standard behavior; when a dog owner observes uncollected dog waste, s/he often assumes that this is the local practice and follows suit. Stewards should work to identify local, dog-owning 'ambassadors' who would be willing to speak with other dog walkers about the importance of picking up their dog's waste. In addition, stewards should endeavor to clean up uncollected dog waste on a regular basis to avoid giving the impression that it is ok to leave behind a dog's waste.

Passive Recreational Uses

A vital role of the Commission is to provide all citizens with ample opportunity to engage in a wide range of passive recreational uses. At the same time, the Commission is obligated to protect the natural resources found within its lands. Therefore, the Commission may restrict the use of certain properties, either partially or in entirety, to help ensure that natural resources are not impacted and to enhance visitor enjoyment. Furthermore, the Commission recognizes that some properties contain inherent limitations, such as extensive wetlands, steep terrain, or lack of adequate parking, and thus certain activities and uses may not be suitable at all properties.

Trails

Trails are one of the most important means of gaining support for conservation by providing access to a site. A well-designed, comfortable, and safe trail facilitates enjoyment of an area and protects the conservation values of the site, while a poorly designed and maintained trail can be a barrier, making return visits and support less likely. The existing trail network is an integral part of Andover's recreational open space, providing citizens with a means for exploring and enjoying the town's conservation lands. Trail networks will utilize appropriate existing trails and add trails as necessary to create loop walks of varying distance and character. Trails will also link conservation properties with other conservation land, open space, and greenway corridors. Trails will be located to minimize redundancy and enhance the visitor experience by not exceeding the capacity of the conservation property to accommodate trails. To the greatest extent possible, all trails will be located outside of sensitive natural resource areas, such as habitat for rare wildlife, wetlands, steep slopes, or soils that are too wet or prone to erosion. Appropriate mitigating measures will be taken when this goal is not attainable, such as installation of boardwalks or bog bridges.

The number of or total length of trails in a property or part of a property may be reduced or limited to enhance the visitor experience or for reasons including, but not limited to: redundancy; presence of rare or vulnerable resources; lack of external access points; the capacity of the property to sustain trails; property deed, conservation restriction, or conservation easement restrictions that preclude human access; or the impracticality of relocating trails or building structures to mitigate erosion, wetland damage, or other resource damage. Redundant trails or trails that are causing damage to natural resources will be closed or rerouted. Closed trails and trail sections will be blocked with brush or, if use continues, with a small sign indicating that the trail is closed.

The Commission and staff will work with volunteer stewards to systematically monitor trails and maintain an updated inventory of trail conditions as part of the annual property inspection process. Volunteer stewards will identify priority trail maintenance issues such as boardwalk repairs, trail erosion, and trail obstructions. Monitoring will also be used to catalogue areas where improvements such as benches and signs would enhance the visitor's experience. Volunteer stewards will also monitor for adequate signage, including trail blazes/medallions, directional arrows, route connectors, and points of interest.

Easements and road frontage granting access to conservation land should be identified as soon as practical, for example, clearly marked with one or more signs identifying the easement or frontage as conservation land access.

Staff will maintain spatial data on the location of trails on conservation land. Trail location data will be available for display and analysis in a geographic information system (GIS).

Sustainable Trail Design

Climate change is significantly impacting trails due to more intense and frequent weather events. Northeastern U.S. saw a 55% increase in the amount of rain or snow falling in the heaviest 1% of storms between 1958 and 2016. Some climate models project that monthly precipitation between December and April will increase 1 inch by the end of this century. Both the Appalachian Mountain Club and the Long Trail Club have noted the impacts on trails of extreme weather events. Trail managers have noted more erosion, more frequent blowdowns, and more wet trail areas that stay wet longer. These factors can all have a big impact on the visitor experience and on maintenance. Some of the trails on Andover's conservation land do not meet standards of sustainability, which can impair a pleasant visitor experience.

The US Forest Service defines a sustainable trail as one that will

- withstand the impacts of normal use and natural elements,
- cause negligible soil loss,
- encourage users to stay on trail,
- not adversely affect area's natural or cultural resources, and
- require minimal maintenance.

An assessment of the trails on Andover conservation land is recommended. Trail assessments provide a detailed segment-by-segment evaluation of tread conditions that can be used for planning and budgeting purposes. They provide detailed information of each segment of trail which is useful in developing trail restoration plans as well as seeking funds for the restoration of trails. They can help managers see the larger picture so sound restoration or maintenance priorities can be developed. Like buildings, trails should be viewed as assets which depreciate and thus need periodic refurbishment or structural upgrading. Larger structures on trails such as bridges, boardwalks, observation platforms, and any other elevated structures will deteriorate over time and need regular inspection to ensure that they are sound. Comprehensive trail assessments are usually done every 5 to 10 years to evaluate conditions.

A trail assessment would evaluate the existing trail network, section by section. Problem areas would be identified and alternatives for solving those problems would be presented and discussed. Based on that discussion each solution would be described in detail (i.e., width, linear feet of boardwalk, materials, permitting requirements, and costs, etc.). Design, construction, and maintenance of the trail network shall be guided by the standards and guidelines in *Trail Solutions: IMBA's Guide to Building Sweet Singletrack*²³ and the *U.S. Forest Service Trail Construction and Maintenance Notebook*. The particulars of trail design will vary across the Andover conservation properties based on site conditions

²³ For an on-line version of much of the same information see <http://www.crgov.com/DocumentCenter/View/1430/Sustainable-Trail-Development-Guidelines-PDF?bidId=>

and use. Nevertheless, the Commission, staff, and volunteers will pursue the following principles in trail design.

Trail width – Trails will be 4-6 feet wide in areas of heavy use and close to parking areas so that pedestrians can walk side by side or pass and so that cyclists can safely pass on multi-use trails. Lesser used trails and those further from parking areas will be 2-4 feet wide to minimize impacts to natural resources and to encourage a closer experience with nature, with the expectation that some width expansion is inevitable with use. Woods roads and other double-track trails should be maintained at their existing width to accommodate the full suite of uses and to maintain their historic character. Vegetation should be regularly clipped back to 2 feet beyond the tread width and up to a height of 8 feet to accommodate winter use so that it does not grow into the trail. Selected trails through rapidly encroaching vegetation may need to be trimmed wider. Trails intended for cross-country skiing should be trimmed up to 12 feet to prevent snow-burdened limbs from bending onto the trail corridor.

Trail surface – Trails will normally retain a natural soil surface except where boardwalks cross wetlands or where trails are designed to meet accessibility standards. Trails through meadows will be maintained with periodic mowing and need not be cleared down to mineral soil. In rare circumstances where the existing substrate cannot be made into a sustainable surface, supplemental surfacing material may be used. Accessible trails will meet standards set by the *U.S. Forest Accessibility Guidelines Service*²⁴.

Signage Design Standards

The Commission will develop standardized signage for properties. Signage should have a consistent look at all conservation properties and include, at minimum:

- Roadside sign – A highly visible sign identifying the property by name and as an Andover conservation property. Signs should be located close to the road, be oriented perpendicular to the road, include very little text, and be designed with contrasting text and background to enhance legibility from a passing car.
- Boundary markers – All conservation land exterior boundaries should be indicated in the field with small plastic markers, ideally custom ordered with text identifying the land as owned by the Andover Conservation Commission.
- Trail signs – Blazes or weather-resistant markers mounted to trees that correspond to colored trails on publicly available maps.

Parking areas at more heavily used properties should have a weatherproof structure such as a capped wooden kiosk or metal or composite sign including the site name, ownership, a trail map, and a list of approved uses. Such a kiosk could include a plexiglass- or Lexan-covered bulletin board or a chalk board for recording wildlife sightings, but materials must be regularly updated. Information boards should include a reminder to check for ticks in all seasons. Volunteer efforts to build kiosks and other signage will be encouraged; however, volunteers will work closely with volunteer stewards and staff to ensure that the design of any structures is consistent with other trailheads in town.

²⁴ https://www.americantrails.org/images/documents/FSTAG_2013-Update_190413_201340.pdf

Entryway Design and Maintenance

A well-designed and maintained entryway sets the tone of the use and care of a conservation area. A hidden driveway and parking lot, confusing parking, outdated or faded signage, and litter give the impression of neglect and questionable safety. A clearly visible entrance will provide; well-marked, level, and logical parking that is visible from the road; informative signage; and appearance of frequent maintenance draw in a wide variety of users and immediately set the tone of respectful enjoyment of the property. Most of Andover's conservation areas have little or no parking so ways to improve access and parking should be considered.

Entryways will be visited on a regular basis by volunteer stewards and monitored for dumping and other litter, damage to signage and other infrastructure, condition of the parking lot, and parking lot capacity and use. Stewards will make note of potential incipient issues and hazards such as potholes, erosion, and dead tree limbs. Stewards will collect any small litter and report to Conservation Division staff when larger piles of dumped materials and other issues requiring immediate attention are discovered.

Where appropriate, entryways will provide adequate parking for typical visitor use. Stewards will monitor parking and update Conservation staff if parking capacity is inadequate, as indicated by cars parked informally at times of heavy use.

Connectivity Between Conservation Areas

Connecting open spaces benefits both people and wildlife providing habitat connectivity through the less developed parts of our landscape and potentially creating an extended trail network. The Conservation Commission will refer to goals and priorities identified in the Andover Open Space and Recreation Plan when considering acquisition of new conservation parcels. The Conservation Commission will continue to work closely with groups like Andover Trails and the Bay State Trail to develop and extend the Andover trail system and other town-wide trail connections.

User Conflicts

If conflicts between user groups arise, the Commission and staff will make reasonable efforts to engage the involved parties and reach a resolution that accommodates the users while adhering to Commission principles and policies.

Safety/Education

Emergency Vehicle Access

The Commission strives to provide a safe experience for all its visitors, yet visitors must assume a certain degree of risk when visiting conservation properties. Risks inherent in use of conservation land include, but are not limited to, uneven ground, falling tree limbs, wildlife encounters, and limited emergency vehicle access in certain parts of the properties. Conservation properties will be managed to offer access for emergency vehicles if such access has existed in the past, such as along a woods road, but the properties will generally not be managed to create new roads to permit more extensive emergency vehicle access.

To facilitate emergency response, the Commission will schedule annual meetings with the Andover Fire and Police Departments to discuss emergency vehicle access issues, including protocols for accessing any properties that are gated.

The Commission will also work with the town to periodically maintain existing fire roads, as determined necessary, such as clearing brush, or improvement of surfaces and drainage. Fire roads will be kept gated and locked to discourage unintended use.

Accessibility

The Commission aims to provide passive recreational opportunities for users of all physical abilities where feasible. The Commission, staff, and volunteers will follow the standards laid out in the *U.S. Forest Service Accessibility Guidelines*²⁵.

The Commission and Conservation staff are also working to improve recreational amenities for individuals with disabilities, such as updated trailhead signage that incorporates accessible design, and accessible boat and kayak launches. Future opportunities for accessible paths and accessible community garden design are also currently being explored.

Outreach and Education

The Conservation Commission may coordinate with others to offer annual walks and educational activities to engage the citizens of Andover about the natural resources contained within conservation land and the many benefits they provide the town, including passive recreation, mitigation of climate change, wildlife habitat, and a variety of ecosystem services. The Commission will use outlets such as their trail guide and web site and will foster connections with other groups within the town, such as the Andover Trail Committee, Eagle Scouts, the Andover Recreation Department, and local schools to reach a broader audience of the citizenry than is currently engaged.

Complying with Applicable Laws, Regulations, and Guidelines

When planning management activities, care should be taken to make sure all projects are carried out in accordance with applicable laws and regulations. Activities on Andover conservation land that may be regulated under local, state, and federal laws are listed in the table below. Projects involving more than one type of activity must comply with laws/rules for all applicable activities.

²⁵ <https://www.fs.usda.gov/sites/default/files/FSTAG-2013-Update.pdf>

Table 4 Activities regulated under local, state, and federal laws, regulations, and rules

Activities	Applicable Laws/Regulations/Rules
Any activity or workplace condition that could result in a potentially unsafe situation for a Town employee	1. Massachusetts General Law Chapter 149, Section 6-1/2 (requires public sector employers to comply with OSHA standards)
Work within a state- or town-protected wetland resource area or buffer zone	2. Town of Andover Wetlands Protection Bylaw 3. Massachusetts Wetlands Protection Act and associated regulations (310 CMR 10.00)
Work within an area mapped as Estimated Habitat for Rare Wildlife and/or Priority Habitat for Rare Species	Massachusetts Endangered Species Act and associated regulations (321 CMR 10.00)
Work involving the application of pesticides	Massachusetts Pesticide Control Act and associated regulations (333 CMR)
Archery deer hunting	1. Massachusetts General Law Chapter 131 2. Town of Andover Deer Hunting Permit and other requirements listed on the Town of Andover’s website (https://andoverma.gov/157/Deer-Hunting-Information) 3. Regulations listed in MassWildlife’s Massachusetts Fishing & Hunting Guide (https://www.mass.gov/doc/2021-massachusetts-fishing-and-hunting-guide/download)
Projects to create walkways, trails, sites, etc. that are accessible to people with disabilities	1. Americans with Disabilities Act (28 CFR part 35) 2. Americans with Disabilities Act Accessibility guidelines (36 CRF part 1191, appendices B and D)
Timber harvesting/Forest cutting	Massachusetts Forest Cutting Practices Act (Massachusetts General Law Chapter 132)
Projects involving the construction of any structure in, over or under any navigable water of the United States ²⁶ , the excavation or dredging from or depositing of material in such waters, or other work affecting the course, location, condition, or capacity of such waters	3. Section 10 of the Rivers and Harbors Act of 1899 (33 CFR 322) 4. Section 404 of the Clean Water Act (33 CFR 323) 5. 401 Water Quality Certification (314 CMR 9.00); Section 401 of the Clean Water Act (33 U.S.C. 1251; 33 USC 1341)
Projects involving the discharge of dredged or fill material and discharges associated with excavation into waters of the U.S. ²⁷	6. Massachusetts General Law Chapter 91 (Waterways) (310 CMR 9.00)
Certain projects requiring a federal license or permit that involve the discharge of dredge or fill material, dredging, and dredged material disposal activities, or discharge of a pollutant into waters of the U.S. within Massachusetts	
Certain projects involving the placement, construction, alteration, demolition or removal of structures, addition of fill, dredging, and certain other activities in tidelands, Great Ponds, and navigable non-tidal rivers and streams. ²⁸	

²⁶ The entire section of the Merrimack River within Massachusetts is a navigable water (USACE 2012).

²⁷ Waters of the United States include (a) navigable waters of the United States (b) wetlands (c) tributaries to navigable waters of the United States, including adjacent wetlands and lakes and ponds (d) interstate waters and their tributaries, including adjacent wetlands, and (e) all other waters of the United States not identified above, such as isolated wetlands, intermittent streams, and other waters that are not part of a tributary system to interstate waters or to navigable waters of the United States, where the use, degradation or destruction of these waters could affect interstate or foreign commerce (USACE 2012).

²⁸ Navigable non-tidal rivers and streams relevant to Andover include (1) the non-tidal portion of the Merrimack River and (2) any non-tidal river or stream on which public funds have been expended for stream clearance,

Activities	Applicable Laws/Regulations/Rules
Prescribed fire ²⁹	<ol style="list-style-type: none"> 1. Massachusetts Comprehensive Fire Safety Code (527 CMR 1.00) 7. Massachusetts Department of Environmental Protection Air Pollution Control Regulations for Open Burning (310 CMR 7.07)
Survey, excavation, or construction activities on municipal lands potentially affecting archeological, paleontological, or historical sites or objects	<ol style="list-style-type: none"> 1. State Register Review (Massachusetts General Law Chapter 9, Section 27C) 2. Massachusetts Unmarked Burial Law (Massachusetts General Law Chapter 38 Section 6) 3. Massachusetts Environmental Policy Act (301 CMR 11.00: if destruction of a listed archaeological site) 18. Section 106 of the National Preservation Act of 1966 (16 USC 470 et seq)

channel improvement, or any form of flood control or prevention work, either upstream or downstream within the river basin, except for any portion of any such river or stream which is not normally navigable during any season, by any vessel including canoe, kayak, raft, or rowboat (MADEP 2021).

²⁹ Assuming impacted area is below Massachusetts Environmental Policy Act (MEPA) thresholds

Andover Conservation Land Spotlights

The Andover Conservation Commission is proud to have conserved over 2,000 acres of land in Andover, but many of the sites are small (32 are less than 5 acres). The Conservation Commission website lists and provides a description of many of the larger sites (<https://andoverma.gov/932/Reservations>), which are particularly valued for their contiguous protected acreage. Moving forward, these larger conservation areas would benefit from a more detailed stewardship or ecological management plan (EMP) particularly those that provide habitat for species of conservation concern, it would be ideal for the Town of Andover to collaborate with AVIS on management plans for properties with adjacent to ownerships.

The following spotlights provide a brief description of two of Andover's particularly ecologically significant sites which would benefit from a formal management plan in the future.

Lightning Tree Conservation Area

The 25-acre Lightning Tree Conservation Area was conveyed to the Andover Conservation Commission in 2015 by the developer of a solar energy array that was built nearby. It got its name from a large white pine tree that is fabled to have been struck by lightning and burned, before falling to the ground along the banks of the Shawsheen River.

Description

While not large in area, Lightning Tree Conservation Area is characterized by sandy soils, resulting in a unique sandplain vegetation community that supports several state-listed plant and insect species. The Lightning Tree Conservation Area is contiguous with two abutting properties that are owned and maintained by AVIS. When combined with Lightning Tree, these conservation areas – known as Sanborn North and Sanborn South – permanently preserves approximately 40 acres of riverfront along the southern banks of the Shawsheen River all located in BioMap2 Core Habitat 2503 (See Appendix A – BioMap2 Summary). The site is also contiguous with a powerline corridor that is maintained as grassland and shrubland by the utility company and connects the conservation land to other open spaces along the corridor. Meg's Trail – named in honor and memory of Meg Batcheller, a beloved Town of Andover employee and resident – traverses all three properties along the banks of the Shawsheen River.

This diverse site also includes a certified vernal pool (on AVIS land); riverfront emergent wetlands; open



NEW JERSEY TEA ENCLOSURE

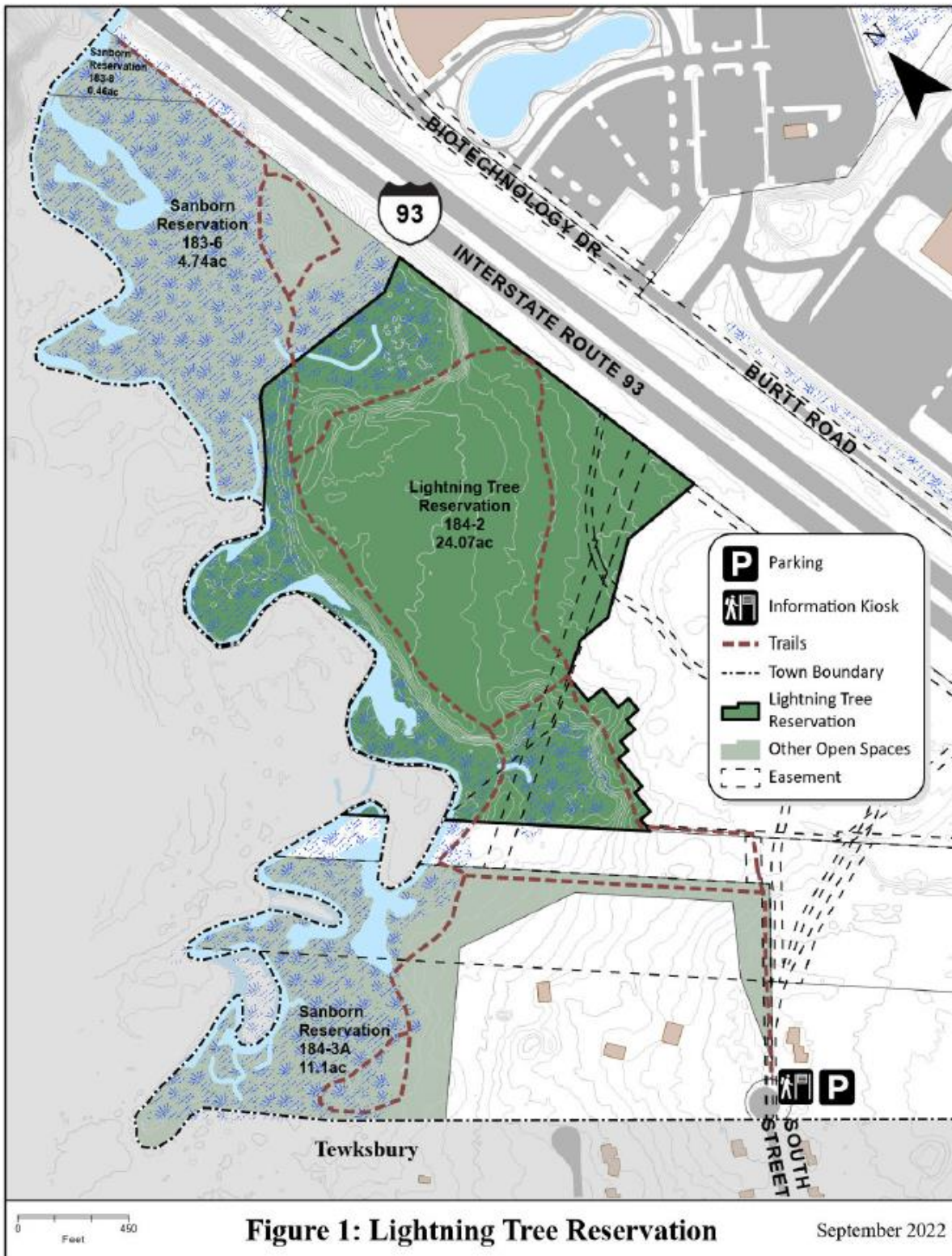


Figure 1: Lightning Tree Reservation

September 2022

water, forested wetlands; coniferous forest; deciduous forest; and grasslands. It also contains some beautiful waterfront vistas, viewing benches from several scenic locations along the Shawsheen River, and a well-marked trail network.

Parking and Public Access

While the Lightning Tree Conservation Area is in Andover, parking for the property is located at 1320 South Street in Tewksbury, MA in is available in a clearly marked lot.

Management

This unique sandplain habitat and the rare species associated with it are dependent on disturbance – fire historically in the form of wildfire. Thus, prescribed fire is a management tool that could be used on site to help create, restore, and maintain the diversity of habitats found in Lightning Tree.

Three species of plants that thrive in this sandy, fire-influenced habitat are necessary food sources for Frosted Elfin (a State listed Special Concern butterfly whose caterpillars eat wild indigo and lupin) and the New Jersey Tea Inchworm (a State listed Endangered moth whose inchworm eats New Jersey Tea). To help protect this food source, there are several deer exclosures on site that protect New Jersey Tea plants from deer browse. In the future the efforts to manage this unique habitat are worthy of interpretation, such as educational plaques or guided walks.

Glossy and common buckthorn are invasive species that are found throughout the site and threaten to outcompete the more desirable native species. There is evidence of the property's dedicated volunteers attempt to control the buckthorn (e. g., by using manual control and Buckthorn Baggies to prevent stump sprouting), but it is still rampant. Pulling small plants by hand or by weed wrench is recommended, while cutting stems and using Buckthorn Baggies will often be effective for plants that are too large to pull.

This entire site (including both the Town land and AVIS land) is of high ecological importance due to the unique habitat it supports and for the presence of state listed species. Therefore, only recreational uses compatible with the protection of these rare resources should be allowed. A comprehensive Ecological Management Plan for the entire area is recommended as is exploring the possibility of using a prescribed burn to improve the habitat.

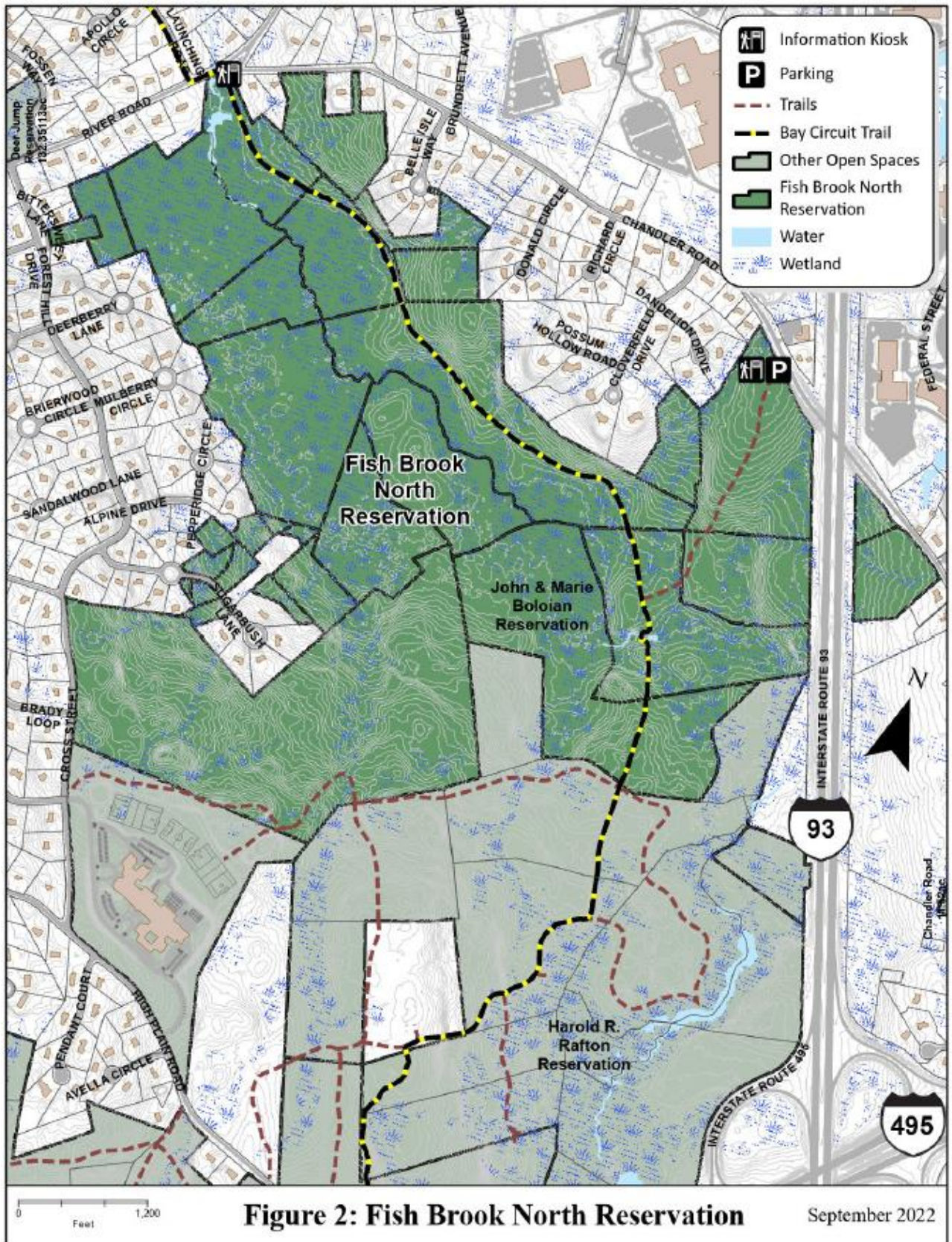
Fish Brook North Conservation Area

Fish Brook North Conservation Area is one of Andover's largest conservation areas, spanning 299 acres with 2.1 miles of trails. The Fish Brook Watershed contributes to Andover's public water supply, so the protection of this natural area helps to maintain the quality of Andover's drinking water.

The Bay Circuit Trail runs through Fish Brook North and connects to the John and Marie Boloian Conservation Area, AVIS's Harold Rafton Reservation, and the Virginia Hammond/Bald Hill Conservation Area. All together these contiguous protected properties total more than 680 acres.

Description

The property's trails wind through extensive wetlands (including shallow marsh, deep marsh, and shrub swamp), forested wetlands, evergreen forests (predominantly white pine), deciduous forest (including maple, birch, oak, hickory, and sassafras). Wildlife thrives in these protected areas, with numerous sightings of beavers, deer, foxes, kingfishers, great blue herons, and much more. Fish Brook



includes one Priority Habitat (#2002 and Estimated Habitat #1284) and one certified vernal pool, while the contiguous John & Marie Boloian Conservation Area includes two certified vernal pools.

Parking and Public Access

This property is open to the public for non-motorized recreation such as hiking, trail running, leashed dog walking, skiing, and birdwatching. Street parking is available at the junction of River Road and Chandler Road where there is a trailhead and entrance kiosk. There is also a parking area, trailhead, and entrance kiosk on Chandler Road for the John and Marie Boloian Conservation Area.



Management

Current and past management have consisted primarily of trail clearing and trimming, with some hand-pulling of invasive species in the edge habitat. There are a number of brush piles along the trail from the River Road entrance, which may offer some cover and habitat value for wildlife. Bog bridges constructed by Boy Scout troops cross some wet areas along the trail, but climate change and associated intense storms have expanded some of these wet areas, so some of the bog bridges need extending. Where feasible, certain sections of the trail could also be relocated to drier upland terrain to avoid further erosion in resource areas.

Buckthorn, Japanese barberry, Oriental bittersweet, and garlic mustard were some of the invasive species noted along the trail. Pulling small plants by hand or by weed wrench is recommended, while cutting stems and using Buckthorn Baggies will often be effective for buckthorn plants that are too large to pull.

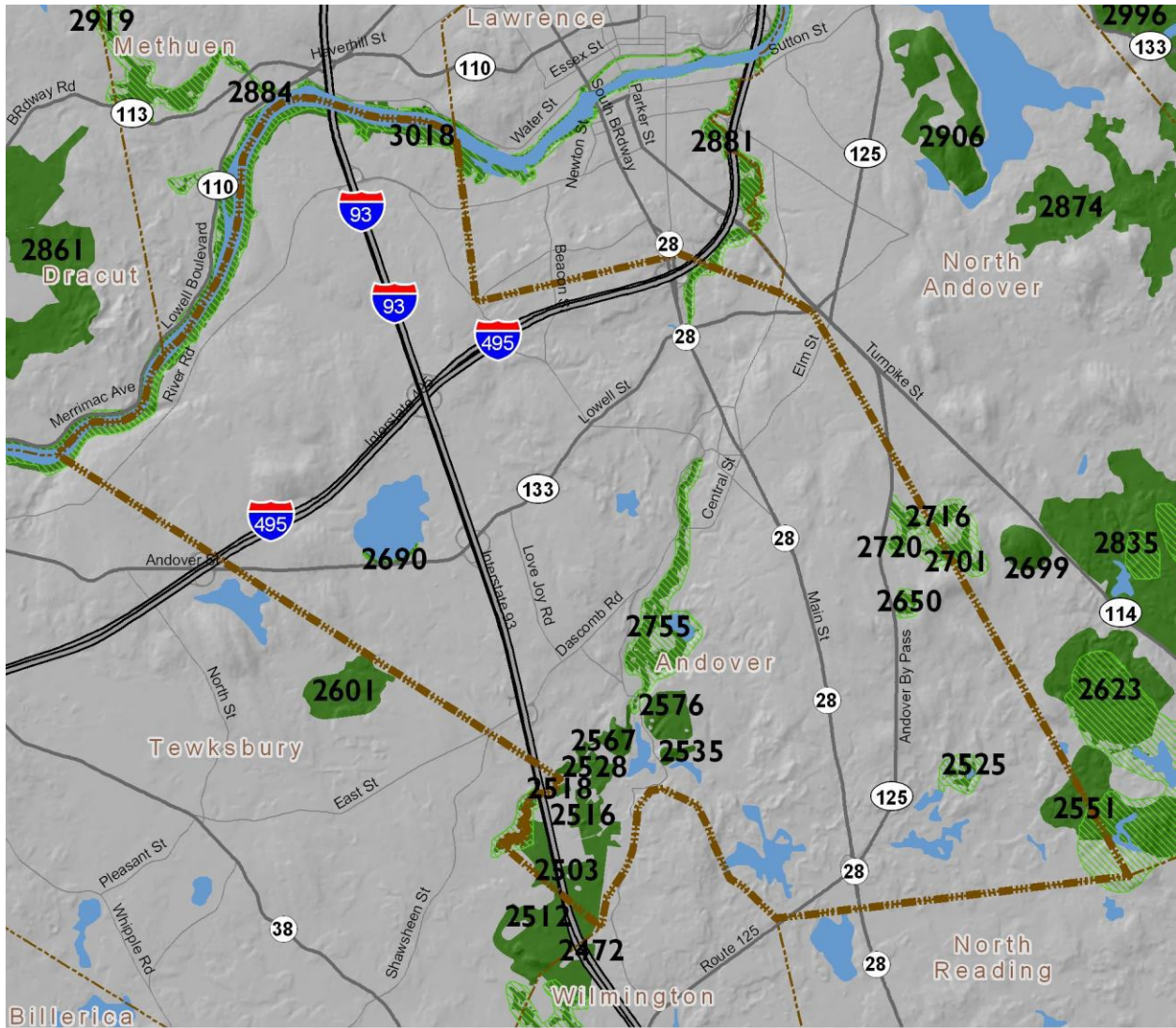
The contribution of Fish Brook North to the contiguous swath of 680-protected acres is significant due to its size and diversity of habitats the property helps support. A comprehensive Ecological Management Plan for the entire area including adjacent AVIS properties is recommended.

Recommended Schedule of Annual Maintenance Activities

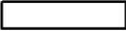
	Winter Dec- Feb	Spring Mar- May	Summer Jun - Aug	Fall Sep- Nov
Monthly Property Visits	X	X	X	X
Permitting (trails, boardwalks, invasive control, etc. in wetlands and buffer areas)	X			
Annual Work Plan Review Meeting with Staff and Stewards	X			

	Winter Dec- Feb	Spring Mar- May	Summer Jun - Aug	Fall Sep- Nov
Safety Meeting with Staff, Stewards, Police and Fire Dept.		X		
Trail Walk/Clean Up (downed limbs, drainage issues, signage needs, plow damage)		X		
Invasive Plant Management	X		X	X
Building Projects (kiosks, signposts, trails, boardwalks, etc.)		X	X	X
Mowing for Manicured Areas			X	
Mowing for Grassland Fields		March	mid-late August	X
Mowing for Wildflower Fields		March		late Sep- Oct
Boundary monitoring for encroachments, signage, etc.	X			X
Year-in-review meeting with Staff and Stewards	X			

Appendix A – BioMap2 Summary



- BioMap2 Core Habitat
- BioMap2 Critical Natural Landscape

1 Mile




Elements of BioMap2 Cores

This section lists all elements of BioMap2 Cores that fall *entirely or partially* within Andover. Not all the elements listed here may occur within the bounds of Andover.

E= Endangered, T= Threatened, SC= Special Concern, S1= Critically Imperiled communities, typically 5 or fewer documented sites or very few remaining acres in the state, S2= Imperiled communities, typically 6-20 sites or few remaining acres in the state, S3= Vulnerable communities, typically have 21-100 sites or limited acreage across the state, SWAP= State Wildlife Action Plan

Core 2503 – Shawsheen River

Species of Conservation Concern

New Jersey Tea Inchworm	<i>Apodrepanulatrix liberaria</i>	E
Sandplain Euchlaena	<i>Euchlaena madusaria</i>	SC
Twilight Moth	<i>Lycia rachelae</i>	E
Frosted Elfin	<i>Callophrys irus</i>	E

Core 2512 – Shawsheen River

Aquatic Core

Wetland Core

Species of Conservation Concern

Triangle Floater	<i>Alasmidonta undulata</i>	SWAP
New Jersey Tea Inchworm	<i>Apodrepanulatrix liberaria</i>	E
Sandplain Euchlaena	<i>Euchlaena madusaria</i>	SC
Twilight Moth	<i>Lycia rachelae</i>	E
Frosted Elfin	<i>Callophrys irus</i>	SC

Core 2516 – Shawsheen River

Species of Conservation Concern

New Jersey Tea Inchworm	<i>Apodrepanulatrix liberaria</i>	E
Sandplain Euchlaena	<i>Euchlaena madusaria</i>	SC
Twilight Moth	<i>Lycia rachelae</i>	E
Frosted Elfin	<i>Callophrys irus</i>	SC

Core 2518 – Shawsheen River

Species of Conservation Concern

New Jersey Tea Inchworm	<i>Apodrepanulatrix liberaria</i>	E
Sandplain Euchlaena	<i>Euchlaena madusaria</i>	SC
Twilight Moth	<i>Lycia rachelae</i>	E
Frosted Elfin	<i>Callophrys irus</i>	SC

Core 2525

Wetland Core

Core 2528 – Shawsheen River

Species of Conservation Concern

New Jersey Tea Inchworm	<i>Apodrepanulatrix liberaria</i>	E
Sandplain Euchlaena	<i>Euchlaena madusaria</i>	SC
Twilight Moth	<i>Lycia rachelae</i>	E
Frosted Elfin	<i>Callophrys irus</i>	SC

Core 2535 – Shawsheen River

Species of Conservation Concern

Twilight Moth	<i>Lycia rachelae</i>	E
Frosted Elfin	<i>Callophrys irus</i>	SC
Core 2551 – Harold Parker State Forest		
Wetland Core		
Vernal Pool Core		
Core 2567 – Shawsheen River		
Species of Conservation Concern		
New Jersey Tea Inchworm	<i>Apodrepanulatrix liberaria</i>	E
Sandplain Euchlaena	<i>Euchlaena madusaria</i>	SC
Twilight Moth	<i>Lycia rachelae</i>	E
Frosted Elfin	<i>Callophrys irus</i>	SC
Core 2576 – Shawsheen River		
Species of Conservation Concern		
Twilight Moth	<i>Lycia rachelae</i>	E
Frosted Elfin	<i>Callophrys irus</i>	SC
Core 2650 – Ward Reservation		
Priority & Exemplary Natural Communities		
Level Bog		S3
Core 2690 – Harold Parker State Forest		
Aquatic Core		
Species of Conservation Concern		
American Waterwort	<i>Elatine americana</i>	E
Core 2701 – Ward Reservation		
Wetland Core		
Core 2716 – Ward Reservation		
Wetland Core		
Core 2720 – Ward Reservation		
Wetland Core		
Core 2755 – Shawsheen River		
Aquatic Core		
Core 2881 – Shawsheen River		
Aquatic Core		
Core 3018A – Merrimack River		
Aquatic Core		
Wetland Core		
Priority & Exemplary Natural Communities		
Estuarine intertidal: freshwater tidal marsh		
Estuarine intertidal: salt marsh		
Small-river floodplain forest		
Species of Conservation Concern		
American Waterwort	<i>Elatine americana</i>	E
Eaton's Beggar-ticks	<i>Bidens eatonii</i>	E
Engelmann's Umbrella-sedge	<i>Cyperus engelmannii</i>	T
Estuary Arrowhead	<i>Sagittaria montevidensis ssp.</i>	E

Parker's Pipewort	<i>Eriocaulon parkeri</i>	E
Seabeach Dock	<i>Rumex pallidus</i>	T
Vasey's Pondweed	<i>Potamogeton vaseyi</i>	E
New England Siltsnail	<i>Floridobia winkleyi</i>	SC
Arrow Clubtail	<i>Stylurus spiniceps</i>	SWAP
Cobra Clubtail	<i>Gomphus vastus</i>	SC
Coppery Emerald	<i>Somatochlora georgiana</i>	E
Riverine Clubtail	<i>Stylurus amnicola</i>	E
Umber Shadowdragon	<i>Neurocordulia obsoleta</i>	SC
Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	E
Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	E
Bald Eagle	<i>Haliaeetus leucocephalus</i>	T

Core Habitat Summaries

Cores that do not include Conservation Commission lands are not included.

Core 2503 – Shawsheen River

A 149-acre Core Habitat featuring Species of Conservation Concern.

New Jersey Tea Inchworms, geometrid moths, inhabit xeric, open areas on sandy or rocky soil with abundant New Jersey Tea (*Ceanothus americanus*), the exclusive larval host.

Sandplain Euchlaena moths inhabit heathlands and other disturbance-dependent habitats. The primary larval host plants are heaths such as lowbush blueberry (*Vaccinium* spp.).

The habitat for the Twilight Moth is poorly understood and probably somewhat variable; in Massachusetts it inhabits pitch pine/scrub oak barrens. Larval host plants are undocumented in Massachusetts; elsewhere the Twilight Moth feeds on various woody plants, especially poplars and willows (Salicaceae), cherries and apples (Rosaceae), and birches and alders (Betulaceae).

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports.

Core 2512 – Shawsheen River

A 480-acre Core Habitat featuring Wetland Core, Aquatic Core, and Species of Conservation Concern.

Wetland Cores are the least disturbed wetlands in the state within undeveloped landscapes—those with intact buffers and little fragmentation or other stressors associated with development. These wetlands are most likely to support critical wetland functions (i.e., natural hydrologic conditions, diverse plant and animal habitats, etc.) and are most likely to maintain these functions into the future.

The 110-acre Wetland Core is among the largest 20% of Wetland Cores statewide and in this ecoregion.

Aquatic Cores are intact river corridors within which important physical and ecological processes of the river or stream occur. They delineate integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern.

Triangle Floaters are freshwater mussels commonly found in low-gradient river reaches with sand and gravel substrates and low to moderate water velocities, although they are found in a wide range of substrate and flow conditions.

New Jersey Tea Inchworms, geometrid moths, inhabit xeric, open areas on sandy or rocky soil with abundant New Jersey Tea (*Ceanothus americanus*), the exclusive larval host.

Sandplain Euchlaena moths inhabit heathlands and other disturbance-dependent habitats. The primary larval host plants are heaths such as lowbush blueberry (*Vaccinium* spp.).

The habitat for the Twilight Moth is poorly understood and probably somewhat variable; in Massachusetts it inhabits pitch pine/scrub oak barrens. Larval host plants are undocumented in Massachusetts; elsewhere the Twilight Moth feeds on various woody plants, especially poplars and willows (Salicaceae), cherries and apples (Rosaceae), and birches and alders (Betulaceae).

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports.

Core 2516 – Shawsheen River

A 48-acre Core Habitat featuring Species of Conservation Concern.

New Jersey Tea Inchworms, geometrid moths, inhabit xeric, open areas on sandy or rocky soil with abundant New Jersey Tea (*Ceanothus americanus*), the exclusive larval host.

Sandplain Euchlaena moths inhabit heathlands and other disturbance-dependent habitats. The primary larval host plants are heaths such as lowbush blueberry (*Vaccinium* spp.).

The habitat for the Twilight Moth is poorly understood and probably somewhat variable; in Massachusetts it inhabits pitch pine/scrub oak barrens. Larval host plants are undocumented in Massachusetts; elsewhere the Twilight Moth feeds on various woody plants, especially poplars and willows (Salicaceae), cherries and apples (Rosaceae), and birches and alders (Betulaceae).

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports. Hentz's Redbelly Tiger Beetle inhabits rock outcrops and ridges with sparse vegetation; soil-filled fissures must be present for the larvae to construct their burrows. Some of the outcrops occupied by Hentz's Redbelly Tiger Beetles burn frequently, which may enhance habitat for both adults and larvae by clearing vegetation and opening the canopy.

Core 2518 – Shawsheen River

A 6-acre Core Habitat featuring Species of Conservation Concern.

New Jersey Tea Inchworms, geometrid moths, inhabit xeric, open areas on sandy or rocky soil with abundant New Jersey Tea (*Ceanothus americanus*), the exclusive larval host.

Sandplain *Euchlaena* moths inhabit heathlands and other disturbance-dependent habitats. The primary larval host plants are heaths such as lowbush blueberry (*Vaccinium* spp.).

The habitat for the Twilight Moth is poorly understood and probably somewhat variable; in Massachusetts it inhabits pitch pine/scrub oak barrens. Larval host plants are undocumented in Massachusetts; elsewhere the Twilight Moth feeds on various woody plants, especially poplars and willows (Salicaceae), cherries and apples (Rosaceae), and birches and alders (Betulaceae).

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports.

Core 2525

A 20-acre Core Habitat featuring Wetland Core.

Wetland Cores are the least disturbed wetlands in the state within undeveloped landscapes—those with intact buffers and little fragmentation or other stressors associated with development. These wetlands are most likely to support critical wetland functions (i.e., natural hydrologic conditions, diverse plant and animal habitats, etc.) and are most likely to maintain these functions into the future

Core 2528 – Shawsheen River

A 38-acre Core Habitat featuring Species of Conservation Concern.

New Jersey Tea Inchworms, geometrid moths, inhabit xeric, open areas on sandy or rocky soil with abundant New Jersey Tea (*Ceanothus americanus*), the exclusive larval host.

Sandplain *Euchlaena* moths inhabit heathlands and other disturbance-dependent habitats. The primary larval host plants are heaths such as lowbush blueberry (*Vaccinium* spp.).

The habitat for the Twilight Moth is poorly understood and probably somewhat variable; in Massachusetts it inhabits pitch pine/scrub oak barrens. Larval host plants are undocumented in Massachusetts; elsewhere the Twilight Moth feeds on various woody plants, especially poplars and willows (Salicaceae), cherries and apples (Rosaceae), and birches and alders (Betulaceae).

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports.Core.

Core 2535 – Shawsheen River

A 19-acre Core Habitat featuring Species of Conservation Concern.

The habitat for the Twilight Moth is poorly understood and probably somewhat variable; in Massachusetts it inhabits pitch pine/scrub oak barrens. Larval host plants are undocumented in Massachusetts; elsewhere the Twilight Moth feeds on various woody plants, especially poplars and willows (Salicaceae), cherries and apples (Rosaceae), and birches and alders (Betulaceae).

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens

and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports.

Core 2567

A 67-acre Core Habitat featuring Species of Conservation Concern.

New Jersey Tea Inchworms, geometrid moths, inhabit xeric, open areas on sandy or rocky soil with abundant New Jersey Tea (*Ceanothus americanus*), the exclusive larval host.

Sandplain *Euchlaena* moths inhabit heathlands and other disturbance-dependent habitats. The primary larval host plants are heaths such as lowbush blueberry (*Vaccinium* spp.).

The habitat for the Twilight Moth is poorly understood and probably somewhat variable; in Massachusetts it inhabits pitch pine/scrub oak barrens. Larval host plants are undocumented in Massachusetts; elsewhere the Twilight Moth feeds on various woody plants, especially poplars and willows (*Salicaceae*), cherries and apples (*Rosaceae*), and birches and alders (*Betulaceae*).

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports.

Core 2576 – Shawsheen River

A 90-acre Core Habitat featuring Species of Conservation Concern.

The habitat for the Twilight Moth is poorly understood and probably somewhat variable; in Massachusetts it inhabits pitch pine/scrub oak barrens. Larval host plants are undocumented in Massachusetts; elsewhere the Twilight Moth feeds on various woody plants, especially poplars and willows (*Salicaceae*), cherries and apples (*Rosaceae*), and birches and alders (*Betulaceae*).

The Frosted Elfin is a small lycaenid butterfly, inhabiting xeric and open, disturbance-dependent habitats on sandy (occasionally rocky) soil, including grassy openings in pitch pine/scrub oak barrens and similar anthropogenic habitats such as powerline cuts, railways, old sand/gravel pits, and airports.

Core 2755 – Shawsheen River

A 181-acre Core Habitat featuring Aquatic Core.

Aquatic Cores are intact river corridors within which important physical and ecological processes of the river or stream occur. They delineate integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern.

Core 2881 – Shawsheen River

A 131-acre Core Habitat featuring Aquatic Core.

Aquatic Cores are intact river corridors within which important physical and ecological processes of the river or stream occur. They delineate integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern.

Core 3018A – Merrimack River

A 6,298-acre section of a larger 35,194-acre Core Habitat featuring Wetland Core, Aquatic Core, Priority Natural Communities, and Species of Conservation Concern.

The mainstem of the Merrimack River, as it winds its way from the New Hampshire border in Tyngsborough to the tidal waters of its mouth, supports 19 rare and uncommon species. Bald Eagles have recently returned to nest along the river, while the federally Endangered Atlantic and Shortnose Sturgeons cruise the river's waters in small numbers. In West Newbury, a Freshwater Tidal Marsh - a very uncommon type of natural community - hosts six Endangered and Threatened plants, including the globally rare Eaton's Beggar-ticks and Parker's Pipewort.

The Freshwater Tidal Marsh community occurs along coastal rivers, upstream of brackish tidal marsh. Here the marshes are flooded by tidal action twice a day, but with fresh water. These structurally diverse marshes are globally rare. This example of Freshwater Tidal Marsh is relatively large and in good condition. It is the largest community of this type north of Boston.

The Salt Marsh community type is a graminoid-dominated, tidally flooded coastal community with several vegetative zones. Salt Marshes form in areas subject to oceanic tides, but sheltered from wave energy. At over 16,000 acres this example of Salt Marsh is the largest in New England. It is generally in good condition and largely under conservation ownership.

Small-River Floodplain Forests are silver maple/green ash forests occurring on alluvial soils of small rivers and streams. They occur on small tributaries of the Connecticut and Nashua Rivers and along some small rivers of eastern Massachusetts. This example of Small-River Floodplain Forest, though quite small, is an unusual variant of the community dominated by Green Ash. It is in relatively good condition and is well buffered by the surrounding landscape.

Wetlands Cores are the least disturbed wetlands in the state within undeveloped landscapes—those with intact buffers and little fragmentation or other stressors associated with development. These wetlands are most likely to support critical wetland functions (i.e., natural hydrologic conditions, diverse plant and animal habitats, etc.) and are most likely to maintain these functions into the future.

Aquatic Cores are intact river corridors within which important physical and ecological processes of the river or stream occur. They delineate integrated and functional ecosystems for fish species and other aquatic Species of Conservation Concern.

Appendix B – Massachusetts Endangered Species Act Species in Andover

Status: E = Endangered, T = Threatened, SC = Special Concern

Category	Common Name	Scientific Name	Status	Date Last Observed
Amphibian	Blue-spotted Salamander	<i>Ambystoma laterale</i>	SC	2012
Butterfly/Moth	Barrens Buckmoth	<i>Hemileuca maia</i>	SC	Historic
Butterfly/Moth	Frosted Elfin	<i>Callophrys irus</i>	SC	2020
Butterfly/Moth	New Jersey Tea Inchworm	<i>Apodrepanulatrix liberaria</i>	E	2008
Butterfly/Moth	Sandplain Euchlaena	<i>Euchlaena madusaria</i>	SC	2008
Butterfly/Moth	Slender Clearwing Sphinx	<i>Hemaris gracilis</i>	SC	2015
Butterfly/Moth	Twilight Moth	<i>Lycia rachelae</i>	E	2002
Dragonfly/Damselfly	Umber Shadowdragon	<i>Neurocordulia obsoleta</i>	SC	?
Mussel	Brook Floater	<i>Alasmidonta varicosa</i>	E	Historic
Mussel	Dwarf Wedgemussel	<i>Alasmidonta heterodon</i>	E	Historic
Mussel	Eastern Pondmussel	<i>Ligumia nasuta</i>	SC	Historic
Reptile	Eastern Box Turtle	<i>Terrapene carolina</i>	SC	2019
Reptile	Wood Turtle	<i>Glyptemys insculpta</i>	SC	2019
Vascular Plant	Adder's-tongue Fern	<i>Ophioglossum pusillum</i>	T	1902
Vascular Plant	American Bittersweet	<i>Celastrus scandens</i>	T	1874
Vascular Plant	American Waterwort	<i>Elatine americana</i>	E	2002
Vascular Plant	Dwarf Mistletoe	<i>Arceuthobium pusillum</i>	SC	1903
Vascular Plant	New England Blazing Star	<i>Liatris scariosa</i> var. <i>novaeangliae</i>	SC	2017
Vascular Plant	Pale Green Orchid	<i>Platanthera flava</i> var. <i>herbiola</i>	T	1903
Vascular Plant	Philadelphia Panic-grass	<i>Panicum philadelphicum</i> ssp. <i>philadelphicum</i>	SC	1885
Vascular Plant	Plymouth Gentian	<i>Sabatia kennedyana</i>	SC	2006
Vascular Plant	Purple Milkweed	<i>Asclepias purpurascens</i>	E	1878
Vascular Plant	Purple Needlegrass	<i>Aristida purpurascens</i>	T	1903
Vascular Plant	Reed Bentgrass	<i>Calamagrostis pickeringii</i>	E	1903
Vascular Plant	Resupinate Bladderwort	<i>Utricularia resupinata</i>	T	Historic
Vascular Plant	Slender Cottongrass	<i>Eriophorum gracile</i>	T	1958
Vascular Plant	Narrow False Oats	<i>Trisetum spicatum</i>	E	1904
Vascular Plant	Swamp Oats	<i>Sphenopholis pensylvanica</i>	T	1903

Appendix C – Invasive Plant Management Options

Many invasive species and relatively small infestations can be managed manually or mechanically (hand pulling, weed wrench, shovel, etc.), others are best managed with targeted, careful use of herbicides applied by a licensed herbicide applicator.

Foliar spray- This method is usually applied with a type of sprayer (backpack, mist blower, or tank). The percent of solution depends on the target species, the time of year, and type of sprayer. Glyphosate will target all species while Triclopyr will only target broadleaf plants and will have minimal impact if any on grasses.

Bloody glove- A more intensive method of herbicide application often used in place of foliar spray when impacts to non-target species is a concern. Herbicide is applied directly to leaves and stems of target species from a soaked cotton glove worn over a rubber glove.

Cut and paint- The stem of the plant is cut so a cross section is showing. The outer edge of the stem is then painted in herbicide; if the stem is hollow herbicide can be injected into the hollow stem. Triclopyr or Glyphosate can be used for treatment.

Girdling- This method used for trees involves making a shallow cut through the bark and outer cambium tissue; the plant is slowly killed due to the inability to transport water and nutrients up the trunk. Girdling is particularly effective for species that sprout aggressively from root suckers, particularly black locust, since it seems to bypass the signal to respond to a dead main stem by sprouting from root suckers. Care must be taken not to cut too deeply into the trunk as too deep a cut can sever all phloem tissue which transports nutrients down into the roots of the plant and is necessary to transport herbicide into the roots. If the phloem is all cut, downward transport will cease, and black locust will respond by sprouting aggressively from root suckers.

Basal bark- Herbicide is applied to the outer surface of the stem. Triclopyr is used because glyphosate will not penetrate the stem. There should not be any standing water present or moisture on the stem. The application can be made with a paint brush or backpack sprayer from the base of the stem to about 1 foot up the stem.

Recommended herbicides:

Triclopyr- Triclopyr is a selective herbicide that will affect broad leaf plants and will have minimal to no impact on monocots. This is since it stimulates cell growth elongation. Since monocots grow naturally by elongating their cells it will have little to no affect where since dicots grow laterally, they burst their cell walls and cause damage to the plant when they are stimulated for cell elongation. Since this herbicide can be mixed with water or oil it can be used for foliar sprays, cut and paint, or basal bark applications. It is recommended to use this herbicide when there is a dense native grass understory surrounding a target plant.

Glyphosate- Glyphosate is a broad-spectrum herbicide meaning it will kill most plants it is applied to. It is an amino acid inhibitor, so it inhibits the growth of plants. Foliar sprays should be applied while the plant is actively growing but cut and paint applications can be done during the fall/winter months. This herbicide can be used for foliar sprays and cut and paint applications. Since water is used as the base of the solution it cannot be used for basal bark treatments because water-based solutions will not

penetrate the bark layer. During cut and paint treatments the herbicide will need to be applied before the cambium layer seals for it to be effective.

Table B-1. General Management Options.

Method	Good for Volunteers?	Timing	General guidelines	Target Species
Cut and paint	Yes	Late August to November	Preferably done in the fall when woody plants are translocating energy towards roots. Can be done to all trees/ shrubs except black locust (signals root suckering). Preferred treatment for multiflora rose. If berries are present, take extra precaution to not spread seed. Best when left in local area and burned in brush pile. Good for volunteers working together with staff: have volunteers cut and haul brush while licensed applicator paints herbicide.	Common Reed (stem injection) Japanese knotweed (stem injection) Burning Bush Oriental bittersweet Multiflora rose (preferred) Bush Honeysuckle (fall) Glossy buckthorn Autumn olive
Hand pull	Yes	Spring and Summer	Great for herbaceous plants with taproot and shallow root system. Best for small infestations. All trees/ shrubs can be hand-pulled when in seedling stage. Garlic mustard should be hand-pulled when second year plants start sending up seed stalk and all plant parts should be bagged and kept out of the sun (seeds can still develop if sunlight is available).	Spotted knapweed Garlic mustard All seedlings for trees and shrubs

Method	Good for Volunteers?	Timing	General guidelines	Target Species
Mechanical (weed wrench/ shovel)	Yes	Spring through Fall, although better before seed set.	Great for small shrubs/ trees. Best when done in early spring when leaves start coming out but before berries develop. Shovels can be used to dig up herbaceous plants with fibrous root systems (black swallowwort) care needs to be taken to make sure all root system is dug up. Soil should be tamped down after removal or native species planted soon after disturbance to keep additional invasives from re- colonizing area.	Japanese knotweed Burning Bush Japanese barberry Black swallowwort Autumn olive Tree of heaven
Basal bark herbicide	No	August through October	This method is best when done in late summer mid fall (Aug- Oct) when flow is towards roots. Can be performed on all trees/ shrubs.	Burning Bush Autumn olive
Biological	Yes	Dependent on insect.	This method of treatment works well for purple loosestrife. It is the least disruptive method of treatment currently available. Usually agents are released in July/ August. The affect the biological agent will have on the environment should be taken into consideration and the relative easiness of other forms of treatment. Depending on infestation size this could be a good way to treat spotted knapweed.	Purple loosestrife (preferred) Spotted knapweed (needs research)

Method	Good for Volunteers?	Timing	General guidelines	Target Species
Foliar spray herbicide	No	When leaves are out.	For trees/ shrubs best when done in the fall when flow is towards roots. Can be done any time for herbaceous plants. When spraying the least amount of herbicide at the smallest effective percentage should be used. The surrounding habitat (wetland vs upland), nesting/ breeding animals, and whether it is a necessary treatment should be considered.	All species
Girdling	If certified in chainsaw safety	Fall	A chainsaw is used to create a ~2" wide cut all around the tree between knee and waist height taking care to remove only the outer layer of cambium, then the fresh cut is painted with herbicide.	Larger trees
Bloody glove	No	When leaves are out.	A rubber glove is worn on the hand with an absorbent cotton glove over it. The cotton glove is dipped in a glyphosate solution (strength depending on target species) then used to directly apply herbicide to leaves, stems, and inflorescences of target plants. Herbicide is absorbed directly into the plant via the stem and leaves, however, breaking the stem aids in more rapid absorption.	Small patches of common reed, seedlings, etc. particularly in wetlands where impacts to non-target species is a concern.

Table B-2. Species Specific Management Options.

Species	Biology	Control Recommendations		Monitoring Period
		Manual	Chemical	
Autumn Olive	Autumn Olive flowers in May-July (plants must be at least 3 years old to flower). Seeds are produced August – November and nuts usually ripen in September. Adults produce less seed in the shade than the sun. Autumn Olive reproduces primarily by seed.	Seedlings can be hand-pulled. Bigger plants can be removed with weed wrenches. Care should be taken to get entire root system. Plants re-sprout vigorously when cut without the use of herbicide. Resprouting may also be stopped by use of “Buckthorn Baggie”.	A foliar treatment with at 2% solution of Triclopyr or Glyphosate can be used when leaves are present. A 25% solution of Triclopyr or Glyphosate can be used for cut-and-paint. A 20% solution of Triclopyr is recommended for basal bark treatments.	3 years No information available on seed viability.
Black Swallowwort	Black swallowwort spreads vegetatively and by seed. It flowers in June-August. The seeds are released from August to October;	Plants can be dug up with a shovel. The entire root system would need to be removed and this method is very time consuming.	A 2% foliar spray of Glyphosate or Triclopyr is recommended before mid- July. Chemical treatment is recommended from May- June, this would be before the plants flower so there would not be a possibility of spreading seed.	6 years Seeds remain viable up to five years
Winged Euonymus (Burning Bush)	Burning Bush reproduces by seed and vegetatively.	Small plants can be hand pulled while a weed wrench will need to be used for larger plants. Care should be taken to remove entire root system.	A 2% foliar solution of glyphosate is recommended when leaves are present. A 20% solution of glyphosate or triclopyr is recommended for cut and paint and a 20% solution of triclopyr should be used for basal bark application.	5 years No information on seed banking,

Species	Biology	Control Recommendations		Monitoring Period
		Manual	Chemical	
Bush Honeysuckles (Tartarian and Morrow' s)	The berries are mildly poisonous if eaten.	small plants can be hand pulled or removed with a weed wrench. Care should be taken to remove all roots and not to spread berries.	Foliar spraying can be done if there are leaves present a 2% solution of triclopyr or glyphosate is recommended. A 25% solution for cut and paint treatments can be used, put the solution right into the hollow stem and around the stem edge. This is best during the fall when all the plant fluids are headed towards the root system.	3 years Few seeds viable for more than one year.
Common Reed	Common Reed reproduces by seed and vegetatively. Inflorescences develop in late June.	Plants can be cut. The shoots should be removed to prevent re sprouting.	A 2% solution of Glyphosate is recommended. Since Phragmites is an aquatic species, an aquatic safe herbicide must be used. The best results are when the herbicide is applied in the late summer or early fall when Phragmites is actively growing and in full bloom. Remove dead stems, if possible, by mowing or clipping.	2 years Seed viability is typically low, although it may vary year to year.
Garlic Mustard	Garlic mustard is a biennial plant and is allelopathic.	Basal rosettes and second year plants can be hand pulled. Plants should be pulled at base near ground to ensure that the root is removed.	A 2% glyphosate solution can be sprayed in April/ May before the basal rosettes go to seed and in September/ October when other plants are dormant.	6 years The seed bank is viable for 5 or more years.
Glossy Buckthorn	Reproduces by seed.	Seedlings can be hand-pulled and larger plants can be removed with a weed wrench. "Buckthorn Baggies" can be used to prevent resprouting.	Cut and paint with a 20% solution of glyphosate or 25% triclopyr. A 2% foliar spray can be used while there are leaves. Remove dead stems, if possible, by mowing or lopping.	7 years Seeds remain viable for 5-7 years.

Species	Biology	Control Recommendations		Monitoring Period
		Manual	Chemical	
Japanese Barberry	Japanese Barberry spreads by seeds and vegetatively. The seeds have a 90% germination rate.	Small plants can be removed by hand pulling or using a weed wrench.	A 2% foliar spray can be used when leaves are present (April). Both glyphosate or a triclopyr solution can be used. A 25% cut and paint solution of glyphosate or triclopyr can be used, it is most effective in the fall when sap flow is towards the root system.	2 years Do not persist in seed bank.
Japanese Knotweed	Most of the literature recommends spraying after flowering; this makes it harder for the plant to have enough reserves to re-sprout that year. When the plant is in flower (August) there are a lot of bees around this species; care should be taken to avoid spraying bees when present and if possible, efforts should be made to spray multiple times a year before flowering.	Due to its extensive root system hand pulling Japanese Knotweed is not recommended as an efficient form of control.	A 2% solution of Triclopyr or Glyphosate is recommended for foliar spraying and is recommended to be done soon after flowering. For cut and paint techniques a 25% solution of glyphosate or triclopyr is recommended.	4 years Seeds do not remain viable beyond one year, but rhizomes and other plant parts can sprout up to three years after treatment.
Japanese Stiltgrass	Japanese stiltgrass emerges in late August.	Small patches can be hand pulled and bagged. Be sure to remove entire root system.	A 2% glyphosate or triclopyr solution can be used for foliar spray in August/September.	7 years Seeds remain viable for 5-7 years.

Species	Biology	Control Recommendations		Monitoring Period
		Manual	Chemical	
Multiflora Rose	It flowers from April to June and fruits seeds July-Dec. It reproduces by seed and vegetatively.	Hand-pulling small plants are recommended as long as all the roots are removed. It is not recommended for established plants.	Foliar application is best when near flowering time. A 2% of triclopyr or glyphosate can be used. Cut and paint or basal bark applications can also be applied in the fall. A 25% solution of triclopyr or glyphosate is recommended for cut and paint and 20% of triclopyr can be used for basal bark treatments.	20 years Seeds of multiflora rose are viable for up to 20 years.
Oriental Bittersweet	The seeds are viable for several years but can sprout from roots and runners.	Seedlings are easy to hand-pull. Bigger vines can be removed by unwinding them from their host and using a weed wrench to uproot them. This can be done year-round, but use caution when berries are present.	You can foliar spray with a 2% solution of Glyphosate or Triclopyr. A 20% solution can be used for basal bark treatment. A 25% solution is recommended for cut and paint treatments, both Glyphosate and Triclopyr can be used.	5 years Seeds do not remain viable, but resprouts from roots.
Purple Loosestrife	Galerucella spp. beetles are recommended for bio control agents.	Plants can be removed by hand pulling. All roots should be removed.	An aquatic safe herbicide (Rodeo) should be used. A 2 % foliar spray is recommended in late August early September.	Ongoing Produces nearly inexhaustible seed bank. Bio-control will not eliminate plant.
Spotted Knapweed	Plants may contain carcinogenic compounds and skin irritation can also occur; gloves should be worn when handling	Plants can be hand pulled and bagged. Care should be taken to get entire root system and not to distribute seeds if present.	A 2% Glyphosate foliar spray can be used. Plants are most susceptible if sprayed in the late stages of flower buds (late June).	10 years Seeds can survive for 8 or more years.

Species	Biology	Control Recommendations		Monitoring Period
		Manual	Chemical	
Tree-of-Heaven	Tree-of-heaven flowers in May-June, and fruits starting in July. It reproduces by seed and vegetatively. Plants need to be 2 or 3 years old to produce viable seed. It re-sprouts vigorously when cut without herbicide.	Small plants can be removed by hand- pulling or using a weed wrench. Care should be taken to remove entire root system.	A 2% solution is recommended for foliar spray. Either Triclopyr or Glyphosate can be used. Triclopyr is recommended for cut and paint (30% solution) and basal bark (20% solution) treatments.	2 years Few seeds remain viable after one year.
Water Chestnut	Water chestnut emerges in June and sets seed in August	Small patches can be hand pulled in canoes and kayaks. Vegetation can be used as compost.	An aquatic specific herbicide would be used. Also required NPDES permits would have to be in place before control.	15 years Seeds remain viable for 12 or more years.

Appendix D: Invasive Species Treatment Record Datasheet

Invasive Species Treatment Record

Property:

Date:

Location:

UTM (WGS84/NAD83):

Weather (include 24 hours before and after for chemical treatment)

	Current	24 hours before	24 hours after
Temp.			
Wind speed/direction			
Cloud Cover			
Precipitation			

Method: Chemical Manual Mechanical Biological

Chemical

Chemical used: % Solution Used: Amount of solution used:

Amount of herbicide used: Mix date:

Adjuvants/Carriers etc.:

Method of Application:

Name of applicators:

Biological

Biological control agent: # Released: Stage:

Mechanical/ Manual

Equipment used:

Acres/number of plants treated:

% of infested area treated:

Growth stage of target:

Target Species:

Comments:

Date current treatment mapped w/ GPS:

Efficacy notes:

Date/type of last treatment:

ATTACH MAP OF TREATMENT AREA

or hand draw on back of this sheet

Appendix E – List of Conservation Commission Lands

Conservation Area Name	Acreage	Ecological Value
Fish Brook North	299.49	High
Bald Hill/Wood Hill	232.79	High
Fish Brook South	171.96	High
Foster's Island	127.459	High
Pustell	117.98	High
Doyle Link	91.1	High
Hearthstone	65.19	
Al Retelle	64.31	
Pheasant Ridge	59.37	
Somerset Drive	56	
Bellevue	51.32	
Foster's Pond	47.77	
Virginia Hammond	43.5	
Laconia Drive	42.43	
Iron Gate	42.21	
John & Marie Boloian	38	
Pole Hill	34.08	
Gray Road-Tucker Rd	33.11	
Belmont Park	30.49	
Carmel Woods	26.94	
Rolling Green	26.6	
Rattlesnake Hill	24.68	
Lightning Tree	24.07	
Jenkins Trail	23.61	
Fieldstone Meadows	22.14	
Spencer Court	20.48	
Serio's Grove	18.88	
Sunnyside Acres	17.62	
Mary French	16.32	
Sacred Heart	14.65	
Shawsheen Pines	14.6	
Tea Lot	13.81	
Greenwood	12.21	
Hussy's Pond	11.37	
Belknap	10.14	
Merrimack River	10.1	
Starwood Crossing	9.34	
Salem Street	9.28	
Bulfinch	8.51	

ITA Skug	8.4
Dug Pond	7.87
River Road West	7.79
Pulte Open Space	7.207
Larchmont Circle	6.26
Fleming	6.069
Elm Street	5.93
Hayward	5.8
Summer Street	5.01
Germano Way	4.44
Lincoln Street	4.31
Red Spring	4.28
Orchard Crossing	4.12
Wethersfield/Cameron Green	3.6
Charlotte Circle	3.27
River Road East	3.24
Lowell Street	3.09
High Street	3.01
Vine Street	2.86
Shawsheen Flats	2.74
Great Heron	2.64
Emma Road	2.24
Gregory Circle	2.23
Oriole Drive	1.75
Rocky Hill Road	1.61
South Main St	1.53
Old School House	1.48
Castle Park	1.09
Rock Island	1
Molly Road	0.88
Raytheon	0.88
Heffron ROW	0.86
Roger's Dell	0.77
Lupine Road	0.76
Apache Ave	0.75
Brechin	0.72
Linwood Street	0.72
Pettingell	0.66
Appletree Lane	0.63
Dufton Road	0.17
Shawsheen Road Strip Green	0.16
Chipped Tooth	0.09

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