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Principles and Policies for Management of Lexington Conservation Land



Prepared for the

Lexington Conservation Commission

by

Mass Audubon's Ecological Extension Service

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Introduction

Lexington has over 1,300 acres of conservation land under the purview of the Conservation Commission and cared for by Conservation Division and Department of Public Works staff as well as a strong volunteer group, the Lexington Conservation Stewards. 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 Lexington. In response to this need, the Conservation Commission and Conservation Stewards have created this guide to serve as a thoughtful, comprehensive, long-term set of land management principles and policies.

This document aims to provide overarching best practices, principles and strategies for land management that can be applied to the type of conservation land found in Lexington – relatively small parcels in a suburban setting with high edge ratio and high passive recreation usage. This document is informed by existing land management documents and input from the Conservation Commissioners, Conservation Division staff, and Conservation Stewards. It will serve as a reference point for land management plans written subsequently for each of Lexington’s conservation areas.

The Conservation Commission has ultimate decision-making authority over management activities on Lexington conservation lands. Conservation Division staff members are responsible for interpreting and implementing decisions of the Conservation Commission. Land Steward volunteers will coordinate all activity with Conservation Division staff.

General Character and Landscape Context of Conservation Land in Lexington

Since the 1960’s, Lexington has protected more than 1,300 acres of conservation land in perpetuity and placed it in the care of the Conservation Commission. This conservation land covers over twelve percent of the town, an impressive figure for a community so close to Boston. More than twenty-five conservation areas across town – spanning forests, fields, and wetlands – have trail networks that provide access for visitors seeking to explore local open spaces. Lexington’s conservation areas range from large swaths of land connected to other open space, such as the 161-acre Dunback Meadow, to small parcels tucked away in neighborhoods, such as the 6-acre Liberty Heights property.

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 Lexington 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.

Lexington lies at the boundary of the urban-suburban interface, between the more dense development of Arlington, Winchester, Belmont, and Waltham and the less developed outer suburbs. Conservation parcels are generally modestly-sized, and even the larger properties are characterized by a high ratio of edge to area, meaning that *core area*, or the area little-impacted by surrounding development, is generally small. As a result, the wildlife of Lexington’s conservation lands are generally species that do well in suburban settings, common species that have adapted well to a human-shaped landscape. Despite this proximity to human development, the natural areas of Lexington do provide important stopover habitat for a variety of migratory bird species.

The current (13th) edition of the Massachusetts Natural Heritage Atlas includes no Priority Habitat for Rare Species or Estimated Habitat of Rare Wildlife in Lexington. The Heritage Program's *BioMap2* report lists the area around the eastern end of the Minuteman National Historical Park as Core Habitat for the presence of a Species of Special Concern and an uncommon natural community. Core Habitats identify specific areas necessary to promote the long-term persistence of rare species, other Species of Conservation Concern, exemplary natural communities, and intact ecosystems. The Conservation Commission owns several small parcels off of Hayward Avenue that fall within this Core Habitat area. These parcels are currently not prepared for public use but could be part of a connection to Minute Man National Historical Park. Any access improvements should include a high level of sensitivity to the uncommon natural resources.

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

As posted on its website, the purpose of the Conservation Commission is to “promote and protect natural resources; to protect watersheds, waterways, and wetlands; to acquire and manage open land for passive recreation and natural habitat; and to provide corridors for wildlife.”

This passage from the 2013 edition of the Lexington Conservation Steward's *Trail Guide to Lexington's Conservation Land* lays out the primary values of conservation land for renewal, health, and experience; protection of ecosystem services; and preservation of community character:

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, known as ecosystem services. These services include flood protection, nutrient cycling, and the purification of air and water. And because all of Lexington was once farmland, forest, or wetland, conservation land helps to preserve the historic and cultural character of our town.

In keeping with these values, the Commission, staff, and volunteers manage Lexington's conservation properties for:

- passive recreation and education programs;
- protection of habitat for plants and animals;
- provision of ecosystem services such as flood protection, nutrient cycling, and purification of air and water;
- open space connectivity for both wildlife and trail users; and
- preservation of community character including scenic views and historic features.

While conservation lands will be managed collectively so that these community priorities are accommodated within Lexington, not every use is appropriate for every property. Intended uses and management priorities for individual properties will be articulated in property management plans.

Given that the Conservation Commission desires to maximize public enjoyment of town conservation land through passive recreation while protecting the important natural, cultural, and historic resources of the land, the following general principles will be used to consider management of the properties.

- 1) Public access to town-owned conservation lands for passive recreational uses will be encouraged where it would not be detrimental to protection of the property's natural, historic, and cultural resources.

- 2) Approved public uses will be expressed through Conservation Commissions rules and regulations for conservation lands, property-specific regulations, use-specific regulations, and on-site signage.
- 3) Alterations to conservation land necessary to accommodate public access, such as vegetation management, trail building, and installation of appropriately-sized parking lots, bridges and boardwalks, will be considered favorably as long as they are:
 - a) determined to be necessary to accommodate public access;
 - b) demonstrated to be the best option for achieving public access; and
 - c) demonstrated to have minimal impact on known natural, cultural, or historic resources.
- 4) Visitor safety will be a top priority in planning and implementing property management, public access improvement projects, and land use regulations.
- 5) The Commission, staff, and volunteers will strive to maximize the natural resource values of each conservation parcel. Specifically, they will manage properties to:
 - a) protect habitat for rare and sensitive species;
 - b) enhance habitat for nesting and migrating birds;
 - c) protect uncommon and exemplary natural communities and maximize habitat value for dependent species;
 - d) maintain and extend wildlife corridors across conservation land;
 - e) maintain ecosystem services such as pollination, natural flood control, groundwater recharge, carbon sequestration, and food production; and
 - f) control invasive species.
- 6) Cultural and historic resources will be recognized, celebrated, and protected on conservation lands to the extent practicable. Specifically:
 - a) all identified historic resources will be protected from disturbance;
 - b) where appropriate, conservation land will accommodate agricultural uses traditional to the site or as identified as a community need (such as community gardens); and
 - c) sites will be managed to maintain traditional landscapes and vistas, especially those that contribute to community character.

Permitted and Prohibited Uses

A wide range of passive recreation activities are permitted on Lexington conservation properties including, but not limited to: walking, jogging, mountain biking, cross-country skiing, snowshoeing, nature observation, photography, education programs, and picnicking. Off-leash dog walking is permitted on almost all properties. Camping is permitted at Willards Woods.

As expressed in the Conservation Commission's rules and regulations for conservation lands, without permission of the Conservation Commission, it is forbidden to:

- Be in or on conservation land between the hours of 1/2 hour after sunset and 1/2 hour before sunrise.
- Commit any disorderly action, or disturb the peace, or conduct oneself in such manner as to interfere with the rightful enjoyment of the public upon these grounds.
- Hunt, trap or shoot.
- Remove, cut or damage any flowers, plants, shrubs, trees or rocks.
- Operate a motor vehicle (the term "motor vehicle" includes, without limiting the generality of the same, any car, truck, bus, motorcycle, motorbike or snowmobile) on conservation lands.
- Make a fire except in designated fireplaces with permission of the Fire Department.

- Discard litter except in designated receptacles or post, paint, affix or display any sign, notice, placard or advertising device.
- Dump materials of any kind.
- Build any structures.
- Dam any stream.
- Park a motor vehicle except in designated parking areas.
- Possess, be in control of, or be responsible for more than 2 dogs per person.
- Possess, be in control of, or be responsible for any dog or dogs unless carrying a waste bag for each dog and properly disposing of each dog's waste. Waste may be disposed of by placing the bagged waste in a designated trash or waste receptacle in the conservation land or by removing the waste from the conservation land for disposal.
- Possess, be in control of, or be responsible for any dog or dogs unless carrying a leash for each dog.
- Possess, be in control of, or be responsible for any dog or dogs unless such dog(s) are under immediate restraint and control of a responsible person (hereafter "the guardian"), either by leash, or by sight and voice command. Sight and voice command means that dog(s):
 - are within the guardian's sight at all times;
 - come to the guardian immediately when called;
 - stay at the guardian's command;
 - do not charge or chase any person, dog or wildlife, nor engage in any aggressive behavior;
 - do not cause damage to any conservation land, or any land used to gain access to conservation land.
- On Saturdays and Sundays, to possess, be in control of, or be responsible for any dog or dogs in or on the conservation land known as "Willard's Woods," unless such dog(s) are controlled by leash.
- Possess, be in control of, or be responsible for any dog or dogs in marked "On-Leash" zones at the entryways to the conservation land known as "Willard's Woods," unless such dog(s) are controlled by leash.

Conservation Commissioners and Conservation Stewards have identified specific uses as being most appropriate and of greatest interest at specific properties. These uses are presented in Appendix A.

Best Practices for Addressing Primary Land Management Issues

Habitat Conservation/Preservation

Meadow Management

The Town annually mows the vegetation at some areas of its conservation areas in order to maintain open meadows. Conservation land with mown areas include Parker Meadow, Cotton Farm and Upper Vine Brook, Juniper Hill, Paint Mine and Hennessey Field, Poor Farm, West Farm, Daisy Wilson's Meadow, Idylwilde, Willard's Woods, and Shaker Glen. In addition, agricultural practices keep other fields open on Town-owned land (Chiesa Farm and Waltham Street Farm). Meadows are mown to maintain this habitat type, to retain historic vistas, and to offer variety in the user's open space experience. Existing fields and meadows will continue to be managed as such unless a site specific management plan recommends otherwise.

Meadows range from grass-dominated, frequently mown hayfields to infrequently mown, wildflower-dominated meadows. Each type provides habitat for a different suite of species based on plant composition, meadow 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 meadows 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. Meadows as small as 10 acres will host breeding bobolinks and should be managed for bird habitat. While smaller meadows provide supplemental habitat for birds, they will generally be managed for plant and invertebrate habitat, and cultural and aesthetic values.

Challenges to meadow management include succession, encroachment, impacts to wildlife, and invasive species. In the absence of some form of disturbance, most New England meadows 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 meadow 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 meadow. The goal of management is to plan the disturbance in a way that minimizes impacts to meadow-dependent species.

The most common forms of disturbance are mowing, grazing, and burning. Since burning is logistically complex and expensive, meadow management on Lexington conservation land will generally be limited to grazing and mowing. Grazing can be an appropriate method for meadow 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 meadow 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 preferred meadow 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. While most of the fields on Lexington conservation land are not large enough to attract grassland nesting birds, anything over 10 acres should be managed to accommodate bobolink, which will use a grassy field this small. **Thus, any fields over 10 acres should be mown in early August so that they remain grass-dominated. Fields smaller than 10 acres can be mown in September or October to provide nectaring plants for invertebrates.**

- 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 the 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 – Grassland nesting birds prefer a field with less thatch close to the ground. Larger fields managed as grassland habitat should be hayed, with material removed after mowing. Smaller wildflower meadows managed for invertebrate habitat can be mown with clippings left in place.

Mowing should include removal of woody shrubs growing on the meadow edge to resist their natural expansion into the field. If necessary, a heavy mower should be used to clear back shrubs on field edges. Management should include removing shrubs and trees growing along stone walls that divide adjacent meadows to maximize the size of contiguous meadow. Single trees standing in a meadow 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 to become established.

Regular disturbance should prevent colonization by woody invasive species, although once they are 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 meadow 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. If manual control is not successful, herbicides may be necessary.

Characteristics of each field and the intended management routine should be identified in the 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, perhaps by using volunteer effort such as the annual Xerces Society butterfly count or members of the Massachusetts Butterfly Club.**

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. There are many ways to deal with this threat including initial prevention, early detection, and control through manual removal, mechanical treatment, pesticide application, biological control, grazing and fire. Invasive species are difficult to eradicate and without multiple seasons of dedicated management, 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 will 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.

The approaches will overlap at times and 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. 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 the very least, with larger areas restored with 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 will 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 Commission, staff, and stewards should be prepared to collaborate on planning and implementing the rapid response element to eliminate new invasions as quickly as possible.

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

Flowering rush	<i>Butomus umbellatus</i>
Brazilian waterweed	<i>Egeria densa</i>
Giant hogweed	<i>Heracleum mantegazzianum</i>
Yellow floating heart	<i>Nymphoides peltata</i>
Kudzu	<i>Pueraria montana ssp. lobata</i>
Water chestnut	<i>Trapa natans</i>
Pale swallowwort	<i>Cynanchum rossicum</i>
Tall pepperweed	<i>Lepidium latifolium</i>
Japanese stiltgrass	<i>Microstegium vimineum</i>

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.

Table 2. Particularly aggressive invasive species.

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>

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.

Location-based Efforts

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.

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. 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 conservation stewards to prevent encroachment of invasives in cleaner areas without getting overwhelmed or tackling a project that is too big for the available resources.

If highly noxious species are present in the densely invaded area, extra measures may need to be taken to really prevent 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.

Treatment Methods

Different invasive species respond to different management techniques, several of which are summarized here and detailed in Appendix B. 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, while volunteers could obtain this license, it is more likely that herbicide will be applied by a contracted professional. Property-specific management plans should identify infestations and recommended approaches for control. The Commission, 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.

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	

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, e.g. from root wrenching a shrub, should be tamped down by foot and covered with leaf litter from on-site. Non-forested sites such as meadows, should be seeded with a grass mix including annual rye (*Lolium perenne*) which can provide a quick cover to open soils and allow non-invasives time to self-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 progress in management efforts, adapt tactics in future years if needed, and have a sense of the expanse of targeted invasive species.

Wetlands, Stream, and Water Body Protection/Improvement

Lexington'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 Lexington 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 Lexington 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 of wetland habitat 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 Lexington 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 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 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.
- Locations of exemplary local natural features 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 will take precedence and recreational use of an area may be limited.

Prevention and Remediation of Human Impacts

Dumping/Pollution

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 users 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 should be reported to Lexington police with a request for more frequent patrol of the site.

Prohibited and Illegal Use

Once established, illegal and prohibited uses of conservation properties can be very difficult to discontinue. ATVs, paintball, forts and fire pits are examples of 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 staff, no matter how minor. Staff and stewards should 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 as to 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 Lexington police and a specific plan to add patrols until the activities are driven out.

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 should 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 neighboring landowner 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 of Official Trails

Travel off of official trails will be discouraged by clearly stating on all signs and kiosks that visitors should remain on trails. In those areas where unofficial 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 geo-caching 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.

Dog Waste

Signs will be posted at popular dog walking spots to encourage owners to clean up after their pets. Signs should include information about impacts to wildlife and water quality and the safety of visitors as well as other pets. 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. With this in mind, 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 acceptable to leave your dog’s waste.

Trash Bins

If trash receptacles are made available, they must be emptied on a regular basis. An overflowing trash can leads to further litter and leaves the impression that the property is not well cared for.

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 temporarily or in whole, to help ensure that natural resources are not impacted and also to enhance visitor enjoyment of the properties. Furthermore, the Commission recognizes that some properties contain inherent limitations, such as extensive wetlands, steep terrain, or lack of adequate parking, and certain activities and uses may not be suitable at all properties.

Trails

The existing trail network is an integral part of Lexington'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, raised planks, or water bars.

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 conservation 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 boardwalks 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, directional arrows, route connectors, and points of interest.

Easements and road frontage granting access to conservation land should be identified as soon as practical, e.g. 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).

Trail Design

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* and the *U.S. Forest Service Trail*

Construction and Maintenance Notebook. The particulars of trail design will vary across the Lexington conservation properties based on site conditions 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. 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 and so that vegetation does not grow into the trail. Selected trails through rapidly encroaching vegetation may need to be trimmed wider or more frequently depending on local conditions.

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 weekly 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. Boardwalks will follow specifications developed by the Conservation Stewards and kept on file by the Conservation Stewardship Program Coordinator. Accessible trails will meet standards set by the *U.S. Forest Service Accessibility Guidelines*.

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 a Lexington 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 Lexington Conservation Commission.
- Trail signs – blazes or weather-resistant markers mounted to trees that correspond to colored trails on publicly available maps.

Parking lots at more heavily used properties should also 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 staff and volunteer stewards will review the design and installation of structures and assist if necessary to ensure that they are consistent with other trailheads in town.

Entryway Design & 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; 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.

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 staff larger piles of dumped materials and other issues requiring immediate attention.

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 by creating an extended trail network and providing habitat connectivity through the less developed parts of our landscape. The Conservation Commission will refer to goals and priorities identified in the Lexington Open Space and Recreation Plan when considering acquisition of new conservation parcels. The Conservation Commission will continue to work closely with the Greenways Corridor Committee (GCC) to develop and extend the *ACROSS* Lexington trail system and other town-wide trail connections.

Scenic Vistas

Scenic vistas into conservation land from abutting roads will be managed to promote maintenance of community character and aesthetic enjoyment of the property by passers-by to the extent that such maintenance does not detract from natural resource values. Maintaining these vistas may require the periodic removal of brush, saplings and trees. Scenic vistas within properties that provide vantage points of landscape views, such as those from hill tops or pond shores, may also be maintained by the periodic removal of vegetation. Any vegetation clearing for vista maintenance must be reviewed during the Spring work plan meeting and approved by Conservation staff.

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 of 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 the fact that not every part of every conservation property will be accessible to emergency vehicles. 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 Lexington 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 Department of Public Works 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.

Handicap Accessibility

The Commission aims to provide passive recreational opportunities for users of all physical abilities. The Commission, staff, and volunteers will identify opportunities for creating accessible trails according to the standards laid out in the *U.S. Forest Service Accessibility Guidelines*.

Outreach and Education

The Conservation Commission will coordinate with Citizens for Lexington Conservation and the Conservation Stewards to offer annual walks and educational activities to engage the citizens of Lexington about the natural resources contained within conservation land and the many benefits they provide the town, including passive recreation, wildlife habitat, and ecosystem services. The Commission will use outlets such as their trail guide and web site, and foster connections with other groups within the town, such as scouts, the recreation department, and schools to reach a broader audience of the citizenry than is currently engaged.

Other Safety Concerns

Informational kiosks will include signs regarding health issues such as ticks and mosquitoes. Volunteer stewards will place temporary flagging and signage where a Poison ivy, bee or wasp nest is found close to a trail. Staff and volunteers will aim to keep trails cleared of downed trees and poison ivy encroaching on edges. All safety concerns identified by stewards should be noted and logged with the Conservation Commission.

Prioritizing Management Actions

Management activities will be prioritized according to the following considerations.

- Safety issues – any actions related to the safety of visitors will be given highest priority in terms of Commission decision-making, staff and volunteer resources, field work scheduling, and funding. A conservation property or a portion of a property or trail may be closed until a specific safety issue is remedied.
- Natural resources – as the number one purpose of the commission is to “promote and protect natural resources”, natural resource management activities will be the highest ongoing priority. In practice this means: any proposed improvements for recreational or other use must not impact natural resource values; staff and volunteer effort will be directed to addressing natural resource management needs, as appropriate; natural resource management plans will be completed for each conservation property; and the Commission and staff will seek funding, as appropriate, to address natural resource management needs.
- Cultural resources – elements of the conservation properties that embody the cultural heritage of Lexington will be protected and managed to the extent they do not interfere with visitor safety or natural resources.
- Recreational access – Improvements and maintenance activities for all approved recreational uses will be reviewed, planned, funded, and implemented, to the extent possible, as long as they do not interfere with the above management priorities.

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 (boardwalk, invasive control, etc)	X			
Annual Work Plan Review Meeting with Staff and Stewards	X			
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, sign posts, etc.)		X	X	X
Mowing for Manicured Areas			X	
Mowing for Grassland Fields			mid-late August	
Mowing for Wild Flower Meadows				late Sep- Oct
Boundary monitoring for encroachments, signage, etc.	X			X
Year-in-review meeting with Staff and Stewards	X			

Regulations that May Affect Management Decisions

All conservation land management activities must be in compliance with all local, state, and federal laws, bylaws, codes, rules, and regulations as well as property-specific easements or terms. These include, but may not be limited to:

- Federal
 - Clean Water Act (Section 404)
- State
 - Massachusetts Wetlands Protection Act
 - Massachusetts Pesticide Control Act
 - Article 97
 - Forest Cutting Practices Act
- Town
 - Lexington Wetlands Code
 - Lexington Tree Bylaw
- Property-specific
 - Conservation Restriction
 - Donor's letter of intent
 - Other easements

Appendix A – Recreational Use Appropriateness Matrix

Table A-1. Diverse recreational uses identified by Mass Audubon were ranked by their appropriateness at various Lexington conservation properties. Uses were rated by the Conservation Commission, staff, and volunteer stewards most familiar with each site.

Site	Most Appropriate	Appropriate	Least Appropriate
Brown Homestead	Accessible trails Dog walk (on/off) Hike Nature Study Picnic	Agriculture Bike Education	Camp Garden Horseback ride
Chiesa Farm	Dog walk (on/off) Education Hike Nature Study XC ski & snowshoe	Horseback ride Picnic	Accessible trails Agriculture Garden
Cranberry Hill	Bike Dog walk (on/off) Hike Nature Study XC ski & snowshoe		
Daisy Wilson Meadow	Bike Dog walk (on-leash) Education Hike Horseback ride Nature Study XC ski & snowshoe	Accessible trails Dog walk (off-leash) Garden Picnic	
Dunback Meadow	Bike Dog walk (on/off leash) Garden Hike Nature Study	Picnic	Accessible trails
Hayden Woods	Accessible trails Agriculture Bike Garden XC ski & snowshoe	Hike Picnic	Nature study

Site	Most Appropriate	Appropriate	Least Appropriate
Henessy Field	Accessible trails Bike Dog walk (on/off leash) Horseback ride Nature Study Picnic	Agriculture Camp Education Hike	Fire ring Fish
Idylwilde	Dog walk (on/off leash) Garden Hike XC ski & snowshoe	Accessible trails Nature study Picnic	
Joyce Miller's Meadow	Bike Dog walk (on-leash) Hike Nature Study	Dog walk (off-leash) Education Picnic	XC ski & snowshoe
Juniper Hill	Hike	Dog walk (on/off leash) Nature study XC ski & snowshoe	Accessible trails
Katahdin Woods	Accessible trails Bike Hike XC ski & snowshoe		
Liberty Heights	Accessible trails Dog walk (on/off leash) Hike Nature Study XC ski & snowshoe	Education Picnic	Bike
Lower Vine Brook-Leary Parcel	Accessible trails Dog walk (on/off leash) Hike Nature Study XC ski & snowshoe	Bike Education	Camp Fish Garden Picnic
Meagherville	Accessible trails Bike Hike Nature Study	Dog walk (on/off leash) Picnic Swim XC ski & snowshoe	Education Fish
North Street	Dog walk (on/off leash) Education Hike Nature Study	Bike Fish Picnic XC ski & snowshoe	Accessible trails

Site	Most Appropriate	Appropriate	Least Appropriate
Paint Mine	Accessible trails Bike Dog walk (on/off leash) Education Hike Nature Study Picnic	XC ski & snowshoe	
Parker Meadow	Accessible trails Dog walk (on/off leash) Education Hike Nature Study Picnic XC ski & snowshoe		Bike Fish Horseback ride
Poor Farm	Hike	Accessible trails Dog walk (on/off leash) Nature study Picnic XC ski & snowshoe	Camp
Shaker Glen	Dog walk (on/off leash) Education Hike Nature Study	XC ski & snowshoe	Accessible trails Camp Picnic
Simond's Brook	Dog walk (on/off leash) Hike XC ski & snowshoe	Accessible trails Bike Education Horseback ride Nature study Picnic	
Sutherland Woods¹			
Tophet Swamp	Accessible trails Bike Hike Nature Study	Dog walk (on/off leash) Education Picnic XC ski & snowshoe	
Turning Mill Pond	Education Hike Nature Study Picnic XC ski & snowshoe	Accessible trails Bike Camp Dog walk (on/off leash) Fish	

¹ No responses were received for the Sutherland Woods property.

Site	Most Appropriate	Appropriate	Least Appropriate
Upper Vine Brook-Cotton Farm	Agriculture Bike Dog walk (on/off leash) Education Hike Picnic XC ski & snowshoe	Accessible trails Garden Nature study	
West Farm	Dog walk (on/off leash) Education Hike Nature Study	Accessible trails Fish XC ski & snowshoe	Bike Camp Picnic
Whipple Hill	Camp Dog walk (on/off leash) Education Fire Fish Hike Picnic XC ski & snowshoe	Accessible trails Bike Horseback ride Nature study	
Willard's Woods	Bike Dog walk (on/off leash) Fire ring Fish Hike Nature Study Picnic XC ski & snowshoe	Accessible trails Agriculture Camp Education Garden Horseback Ride	
Wright Farm	Agriculture Bike Camp Dog walk (on/off leash) Fire ring Fish Garden Hike Nature Study		

Appendix B – Invasive Plant Management Options

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 due to the fact that 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 sap 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 ease 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 and shrubs best when done in the fall when sap 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 have to 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.	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.
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 data on seed banking.

Species	Biology	Control Recommendations		Monitoring Period
		Manual	Chemical	
Bush honeysuckles	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 as long as 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 of 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 Common reed 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 Common Reed 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.	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.
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.

Species	Biology	Control Recommendations		Monitoring Period
		Manual	Chemical	
Japanese knotweed	The majority of 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.
Multiflora rose	It flowers from April to June and fruits July- Dec. It reproduces by seed and vegetatively.	Hand-pulling small plants is 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.

Species	Biology	Control Recommendations		Monitoring Period
		Manual	Chemical	
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 or Triclopyr can be used.	5 years Seeds do not remain viable, but resprouts from roots.
Purple loosestrife	<i>Galerucella spp.</i> 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 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 C: 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