Listening to the Landscape

Managing the Barber Reservation

Sherborn, Massachusetts

Prepared for the

Sherborn Conservation Commission

&

Land Management Task Force

Emily Davis & Brandon Tennis

Spring 2014

The Conway School

Project overview

The Barber Reservation is a 196-acre town-owned reservation in Sherborn, Massachusetts. The property is currently managed by Sherborn's Conservation Commission with the assistance of numerous volunteers and other town and regional entities, all primarily coordinated and guided by the Land Management Task Force (LMTF). The reservation is part of a larger area of conserved land, as it abuts other open spaces, which together comprise over 300 acres of public land and natural habitat.

The Barber Reservation has three main, and sometimes competing, user groups. Four utilities (an industrial railway, a natural gas pipeline, an oil pipeline, and an electricity transmission lines) use the site for their infrastructure corridors. Sherborn's residents use the site for recreation, such as horseback riding, dog-walking, mountain biking, trail running, and cross-country skiing. Finally, this site is also used by Sherborn's wildlife, as it provides a variety of habitat types within a relatively small area.

Some of the needs of these three distinct user groups are in accord with one another. For example, public access and certain types of recreation are promoted by open fields that provide attractive views across the landscape, which at the same time may support rare nesting bird habitat. However, there may also be conflicts and tensions among the users, such as when equestrians and their horses move through those open fields, potentially disturbing the nesting birds, or degrading their declining habitat. Since the utility companies' maintenance regimes and requirements for their easements on the property are strict and cannot be changed easily, the largest compromises are made by wildlife and user groups.

The Conservation Commission seeks a management plan that will help determine the best future use of Barber, given its current ecological conditions and accounting for the needs of the different user groups of this forest reservation. This management plan identifies the important ecosystem services provided by the property, and gives recommendations on how those ecological services can be improved, while also accommodating the need for passive recreation and periodic disturbance by utility companies.

A vision informs this management

Ultimately, a vision determines the approach for the management plan by clarifying what the Barber Reservation will be managed for. Wildlife, people, and utility companies share the reservation and this management plan seeks to support the requirements and goals of each of the user groups of the Barber Reservation.

Site analyses of the Barber Reservation (see Sheets 2-9) show that the reservation can, as it already does, serve these three user groups. But generally, there are compromises to the goals or needs of some of these users. Sherborn's LMTF's guiding principles attempt to balance the compromises asked of this rural landscape.

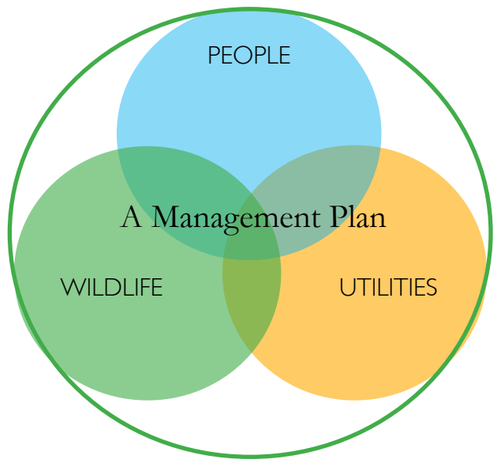

FIGURE 1.1: This management plan incorporates the requirements and goals of each of the user groups of the Barber Reservation.

The Guiding Principles

The Sherborn Land Management Task Force has developed a list of management goals and guiding principles that aim to direct management efforts of the town's open spaces. This management plan proposes a site design and management recommendations for the Barber Reservation based upon these goals and guidelines. In order of priority, and in its entirety, this project's guiding principles are to:

1. Promote biodiversity.
- Control invasive species
- Provide a carrying capacity level of habitats for native plants and wildlife
- Promote vigorous forests with varied species and age classes
- Monitor and protect sensitive and declining populations and habitats
- Avoid fragmentation or reduction in size of distinct or state-recognized habitat

2. Build, store and protect natural resources to preserve ecosystem services.
- Protect quality and quantity of ground and surface waters
- Maintain and improve stormwater attenuation and flood control capabilities
- Consider ways to harvest and use natural products to support the local community when compatible with other goals

3. Promote public use, education and engagement.
- Maintain and enhance passive recreation opportunities
- Recognize the value of public lands for scientific and cultural enrichment
- Invite Sherborn residents to use their forests and reservations

4. Promote corridors and linkages between open spaces through Sherborn, with adjoining towns and at the regional level.
- Prioritize new trail establishment and trail improvement projects which promote linkages
- Continue improvement of connecting regional trails

5. Protect Sherborn's rural character.
- Preserve and enhance vistas from roads and trails
- Preserve and document stone walls, fields and other features of historic or cultural significance
- Consider appropriate agricultural use of public lands

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PROJECT SUMMARY & VISION

Can ecological health be achieved on a highly used site?

Contrasting landscape elements

Within the boundaries of the Barber Reservation are areas of mixed hardwood uplands, wet forests, hayfields, wetlands, a beaver pond, and several potential vernal pools. All these habitat types occur in a relatively small area (196 acres), and therefore contribute valuable biodiversity to the area.

However, transmission lines run north-south on a land easement across the reservation, a railroad track and switch-yard run parallel to the transmission lines, and a buried gas pipeline cuts both of these corridors perpendicularly. As a result of these features, the landscape is fragmented. These utility corridors require regular maintenance, thus resulting in periodic impacts on the landscape around them.

Though the utility infrastructure is fixed on the landscape, some features on Barber are dynamic and changing. For example, a beaver pond in the center of the property is quickly growing in size, and some local residents are concerned about its expansion into the surrounding forest and on trails. Likewise, the forest edge is enlarging into the network of hayfields, thus diminishing their productivity and habitat value.

History of use and vegetation patterns

The Barber Reservation is the historic location of an old agricultural homestead, and the current hayfields are the obvious relics of the property's past use. The old homestead area sits in the southeast corner of the site, and continues to serve as the main access point and center of activity. Around this area, old stone walls and building foundations can be found, along with a standing old barn near the parking area. Immediately surrounding the homestead, the forest is composed of early- to mid-successional vegetation with a dominance of black cherry. Most of the invasive plant species on the reservation (multiflora rose, Asiatic bittersweet, and black locust) can be found in this area, as regular site disturbance over the years created conditions conducive to invasive species growth and spread. The Conservation Commission and the Land Management Task Force have concerns about the spread of these species farther into the site's interior landscape if left unchecked.

In other forested areas of the site are stands of upland and wet forest. The upland forests are a mix of oaks and other hardwoods, with a few stands of white pine monocultures. Within many of these forest stands is evidence of previous clear-cutting of the property (seen in old stumps and invasive species composition), to create hayfields. Over time, the forest grew along stone walls and in between fields, and now is the matrix that connects the other landscape features.

A small gravel parking lot off Western Avenue is the main access point into the reservation. This parking area is inconspicuous from the road, and lacks proper trail signs or environmental information. As was expressed in multiple community meetings, many residents and users of the Barber Reservation feel that the entrance experience should be improved.

Near the gravel parking lot is an old stone foundation and a historic barn, which are the only existing structures on the site. Down the trail from the homestead, a grove of white pines grow in a cluster around the location of a former tennis court. After the tennis court was removed, a dense patch of invasive buckthorn and bittersweet colonized this area, taking advantage of the disturbed soil conditions.

FIGURE 2.1: Existing conditions of the Barber Reservation.

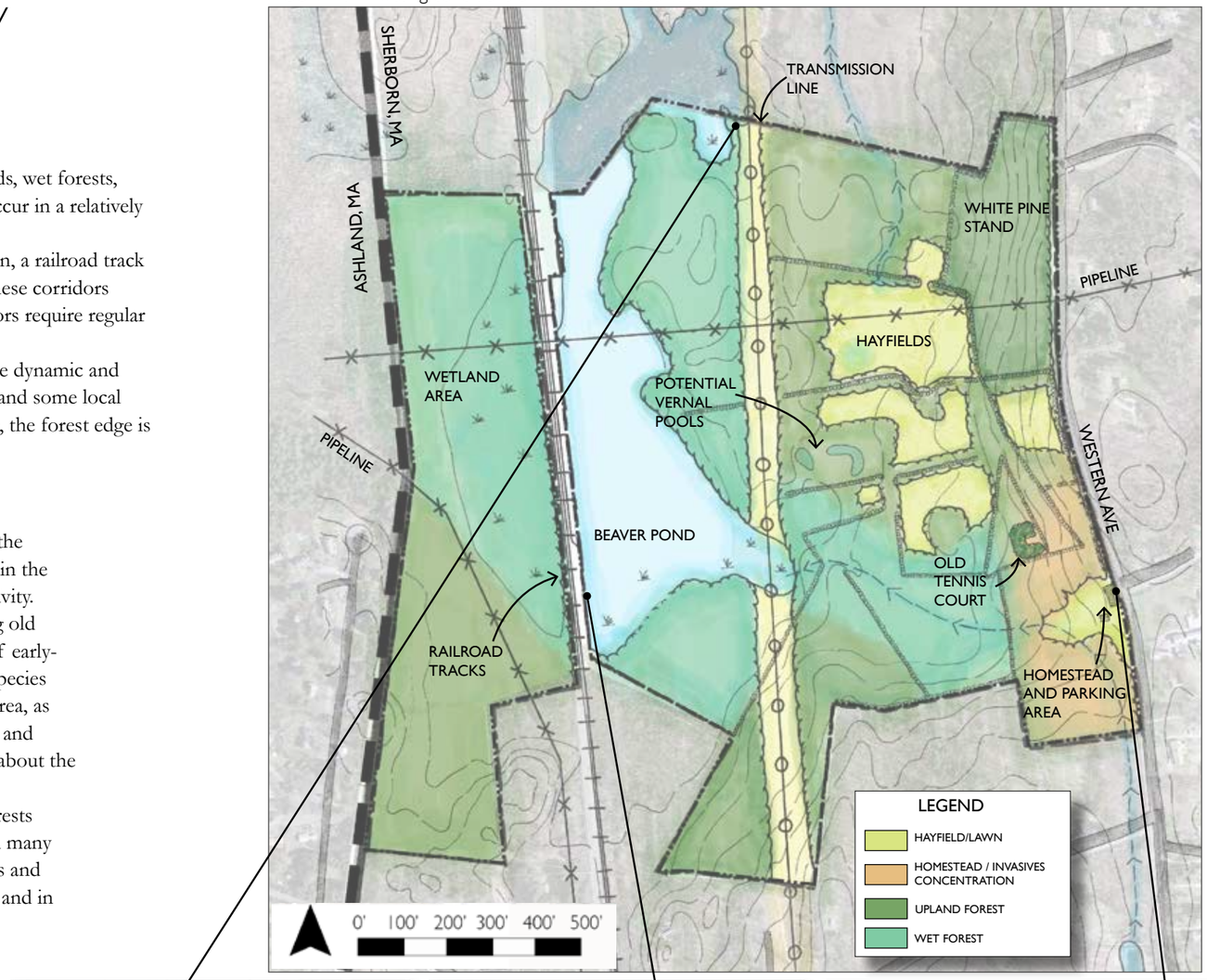

PHOTO 2.1: Large transmission lines are near these sensitive wetlands, which leads to concerns about the potential impact of utility maintenance regimes on the water quality.

PHOTO 2.2: Beavers have taken advantage of the large dam created by the railroad bed to expand their habitat. The beaver pond directly abuts this section of the railroad corridor.

PHOTO 2.3: The view of the parking area off Western Avenue and looking to the south. The center of activity and historically significant, the parking area has the potential to be more attractive.

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EXISTING CONDITIONS

The Barber Reservation serves the region with significant social and ecological services.

Regional significance

Sherborn is a town composed mainly of open spaces and permeable surfaces. This is unique for the largely developed and urbanized area, which is on the outskirts of Boston's greater metropolitan area. The cities of Boston, Worcester, and Providence are all within an hour's drive of Sherborn, and the town of Framingham sits just two miles north of the Barber Reservation. These denser, more developed areas surrounding Sherborn may benefit from its open spaces, either from the regional-scale ecosystem functions it provides or its recreation opportunities.

That the Barber Reservation is near the population center of Framingham has implications for its management plan, since management strategies are partly determined by current and expected public use and access. For example, a management plan that emphasizes trail improvement and maintenance of public infrastructure could make the reservation more available to nearby disadvantaged neighborhoods by prioritizing access and recreation.

As part of a larger system of open spaces in the area (see Figure 4.1), the Barber Reservation provides the region with ecosystem services, such as improving water quality and quantity, improving air quality, and providing habitat for wildlife. Also, the diversity of habitat types provided by the reservation (wetlands, upland forests, vernal pools, and early successional habitats) contributes to the natural heritage of the area.

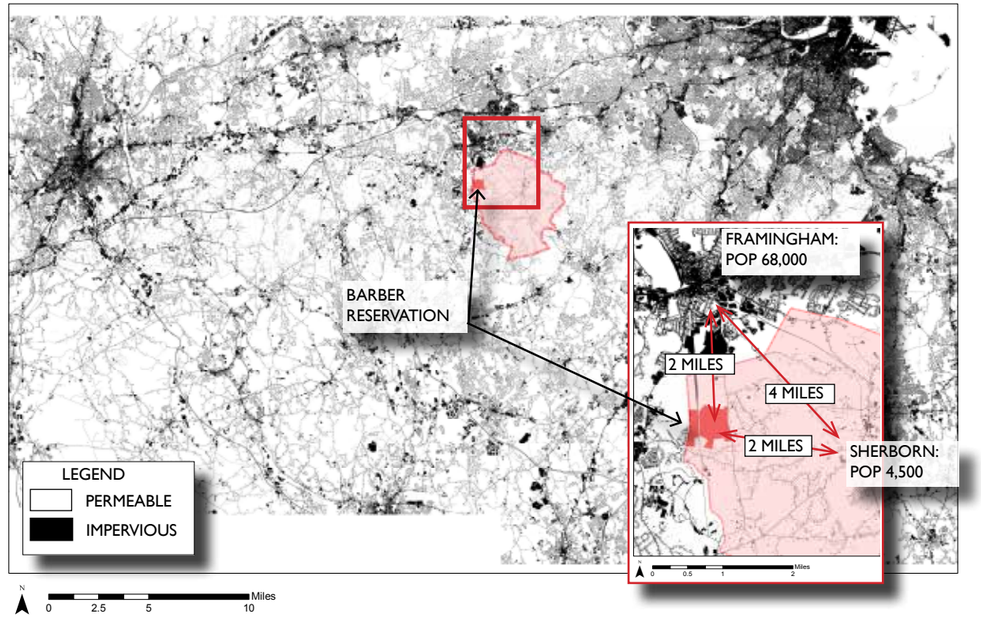

FIGURE 3.1: The Barber Reservation is equidistant to both Sherborn center and Framingham, but has been conceived of as primarily serving the residents of Sherborn. However, Framingham's much larger population benefits from Barber's ecological services and may place recreational demand on it.

Proximity to environmental justice populations

Environmental justice populations are community groups identified to be disproportionately vulnerable to the effects of environmental degradation, such as industrial waste contamination or polluted waterways. These communities usually lack strong political representation or the financial means to fund environmental programs in their neighborhoods. Programs across the country and in the Commonwealth have been developed to improve the ecological health and social well-being of these communities through access to healthy open spaces.

The Town of Sherborn celebrates its rural character, which contributes to the residents' strong sense of place and pride in the town. Through this abundance of open spaces, Sherborn also promotes environmental justice in the region. Sherborn has an existing hydrological connection to Framingham, which has environmental justice populations, as it provides valuable flood control by slowing the flow of water and increasing water infiltration into local aquifers (see Sheet 5). Barber's proximity to environmental justice populations in Framingham means that it can also be a meaningful and valuable place of recreation and education for these residents.

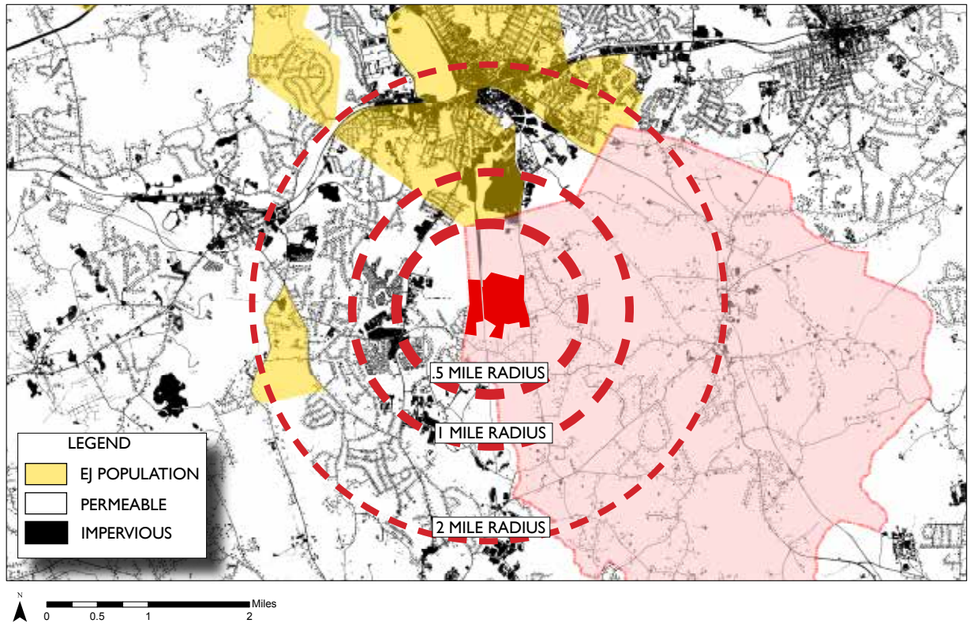

FIGURE 3.2: There are extensive environmental justice populations within two miles of the Barber Reservation, as shown by the environmental justice population blocks from the 2010 US census.

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SITE CONTEXT
SOCIAL ELEMENTS

Sherborn serves the region with valuable ecosystem services and conservation-focused open spaces.

Emphasis on conservation and agriculture

Sherborn is largely rural in character, in contrast to the developed cities around it, but it is not unique in its open space acreage except that, while there are abundant cultural, historic, and recreation-based open spaces near Boston, Sherborn's open spaces are largely designated for agriculture or conservation. This suggests that while Sherborn has been successful in conserving open space for its ecological functions or as working landscapes, it has the potential for integrating people into the land around them in culturally significant ways, such as with parks or wildlife viewing.

Sherborn also has extensive open space used for agriculture than any other municipality around it. As has been stated by Sherborn residents in community meetings, this may imply that town's agrarian history and legacy is important to the residents, and continuing that pattern of land use may be a source of civic identity.

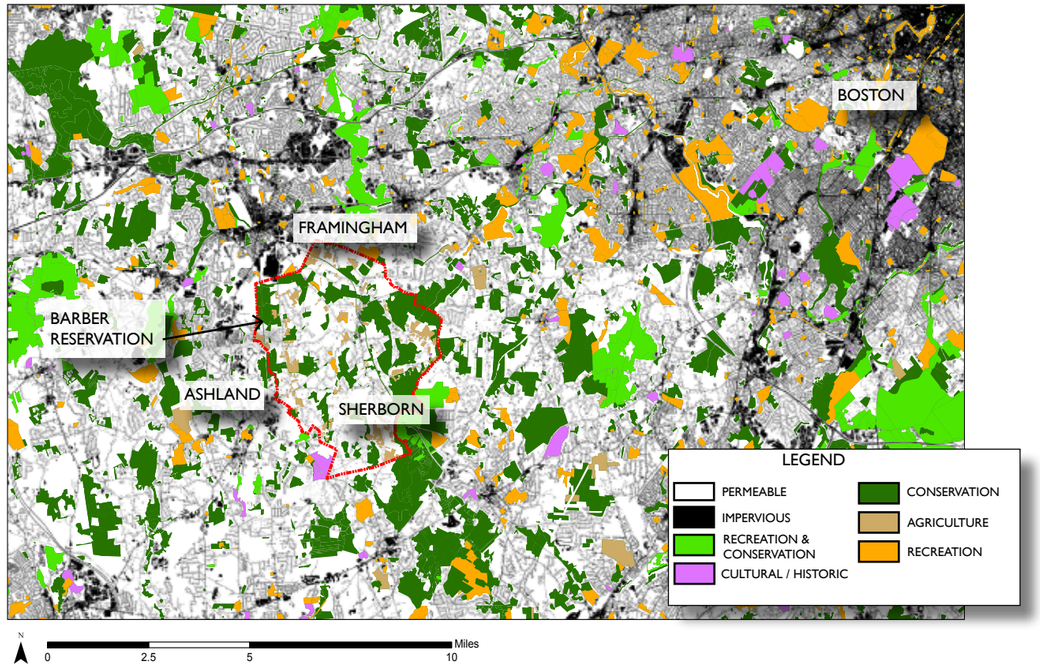

FIGURE 4.1: Sherborn's open spaces primarily serve the town's agricultural and conservation needs. In contrast, the use of open space for recreation is more prevalent outside of the town.

Barber's role in regional water systems

The watersheds of both the Charles and Concord Rivers are in Sherborn, and are divided in town by low hillocks. The Barber Reservation is well within the upper reaches of the Concord watershed, which actively drains water northward toward Framingham and away from the town of Sherborn. This drainage pattern and flow undoubtedly affects Framingham, but management of this water resource determines whether the effects are positive or negative.

The Barber Reservation shares a watershed and natural resources more closely associated with Framingham, in spite of its location within Sherborn's town boundaries. Sherborn, therefore, is responsible for managing Barber, at least in part, with regards to the large urban population downstream. Currently, there are no formal management guidelines or strategies for water on the Barber Reservation. However, developing sound water management guidelines for the Barber Reservation may help the system better catch and store water on site, therefore recharging ground water aquifers as well as mitigating flood effects in severe or prolonged storms.

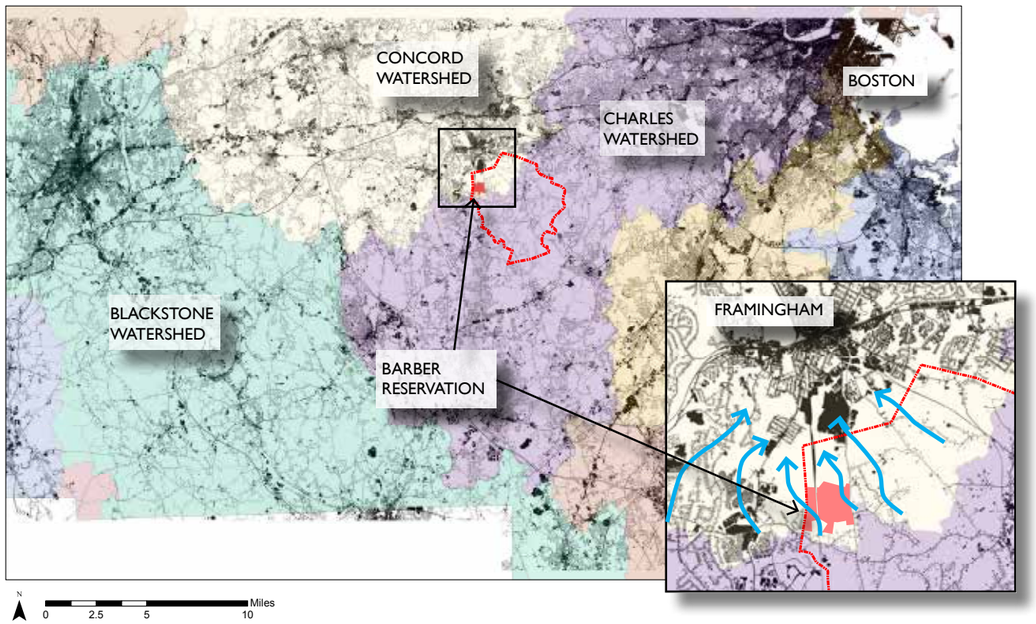

FIGURE 4.2: Lying at the headwaters of the Concord River, the Barber Reservation drains into the larger urbanized area of Framingham. Therefore, it may provide important ecosystem services such as storm water retention, filtering, and aquifer recharge that affect many people in the region.

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SITE CONTEXT
ECOLOGICAL FUNCTION

The Barber Reservation is primarily a wet site, and is part of a larger wetland system.

Historic wetland connection

The upland hillocks of the Barber Reservation drain water into its lowlands. These lowlands with poorly draining soils, hold and slowly infiltrate the water into the ground.

As people developed the landscape, however, aspects of the built environment disrupted this drainage pattern (see Figure 5.1), including the CSX railroad embankment (currently acting as a dam). Prior to the construction of the railroad dike, the reservation drained into a larger wetland complex that lies just northwest of the Barber Reservation in the neighboring town of Ashland.

Built in 1848 and upgraded in the 1920s, the railroad primarily served a General Motors factory (just one mile north of the reservation) for many years until the factory closed. Nonetheless, the railroad continues to sever the reservation's connection to the larger wetland complex.

Figure 5.1 shows how the built railroad continues to alter the drainage pattern by causing water to pool and then drain to the north into a much smaller wetland complex. The altered drainage pattern may result in the larger wetland to the northwest becoming smaller and the wetlands to the northeast of the railroad becoming larger. This could result in a loss of ecological integrity if wetland plant and animal species are unable to move between the wetlands.

BEFORE RAILROAD EMBANKMENT:

AFTER RAILROAD EMBANKMENT:

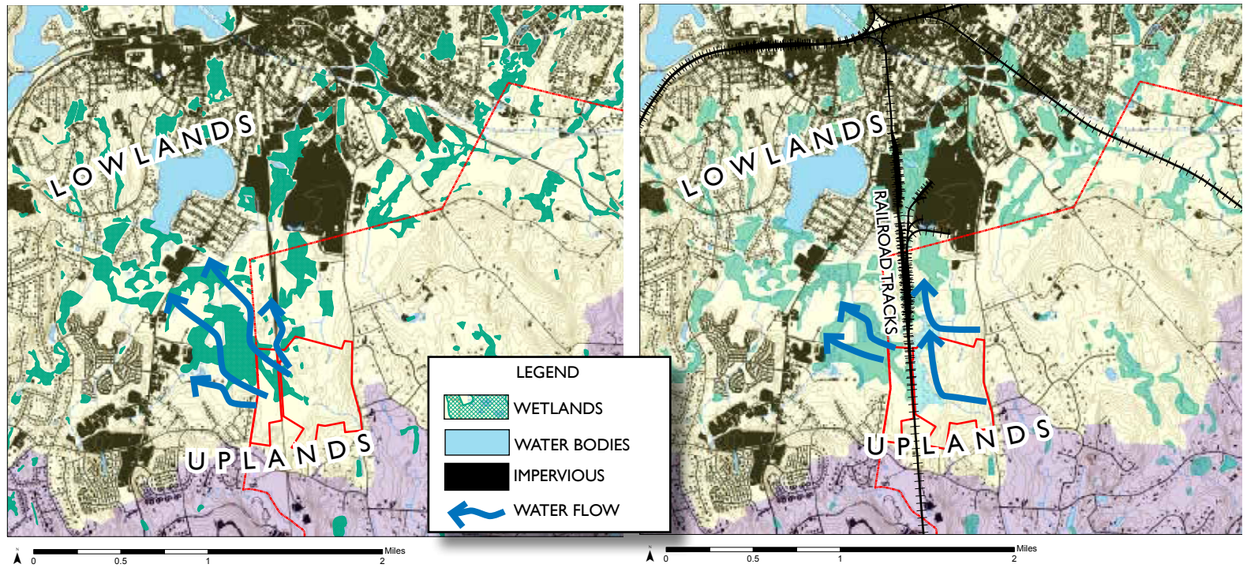

FIGURE 5.1: After the construction of the industrial railroad corridor, and then later the beaver dams, the flow of water has changed on the Barber Reservation. Barber used to drain to the northwest, but now the water is held in a beaver pond and flows to the north.

Drainage and soil types reflect and perpetuate wet conditions

The wet conditions in the lowlands of the Barber Reservation are partly a result of poorly draining soils and the patterns of water movement across the site. The areas of well-drained uplands served the historic homestead as agricultural fields. Well-draining soils can percolate water quickly but only if the water is able to be slowed, captured, and infiltrated. More commonly across the site, the reservation's low-lying areas capture the runoff and the poorly-draining soils slowly percolate and filter the water into the groundwater and aquifers. This ecosystem service cleans water and may also function as flood control in regards to an increase in precipitation due to climate change.

In part because of the landform and soil types, the pattern of water drainage on the site is not uniform. Water moves in many directions, and collects in several low-lying basins. This pattern is further perpetuated by the construction of the utility corridors, which are generally topographically elevated such as with the CSX railroad.

When managing Barber, strategies are useful that allow continued infiltration of water into the regional aquifers, and that accept that wet conditions and pooling will occur.

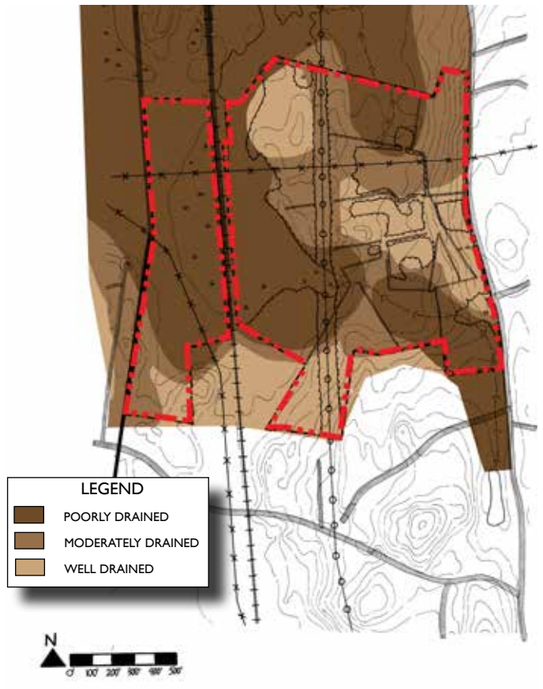

FIGURE 5.2: Soil types by drainage. The predominantly poorly drained conditions result in pooling.

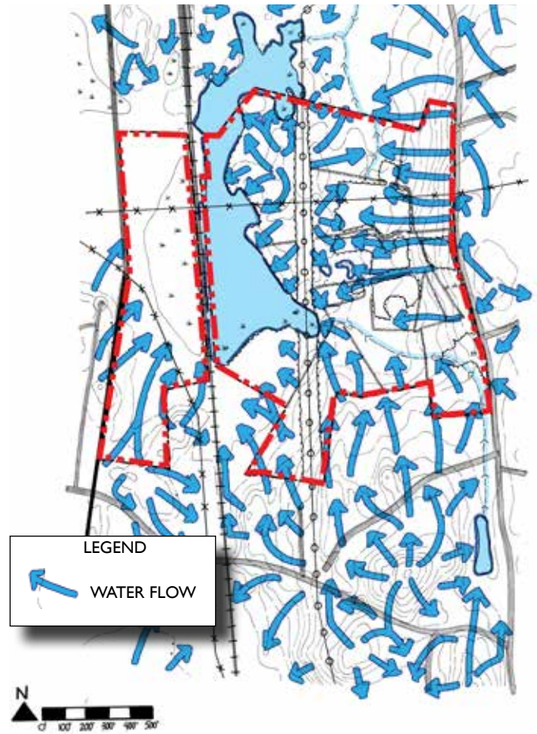

FIGURE 5.3: Water drainage patterns are not uniform, contributing to pooling in many areas.

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SITE ANALYSIS
WETLAND SYSTEMS

The Barber Reservation has abundant beaver habitat, and beaver activity should be accepted and planned for.

Beaver activity in Barber

The Barber Reservation is part of a larger beaver habitat area within a regional wetland complex. This larger wetland complex has active beaver populations, and it is possible that beavers present on the Barber Reservation now have migrated from one of these populations.

Beaver removal in the Commonwealth is often difficult to execute, as a result of extensive permitting processes and legal restrictions. Additionally, any beaver removal practices on the site would likely be ineffective, since many more beavers live off site in the rest of the wetland complex, and can readily move back into the Barber Reservation. A more productive approach to beaver management on the site would be to allow the beavers space to complete their life cycle, celebrate the diverse ecosystems they create, and enjoy the many ecological functions they provide (see Figure 6.1), which could ultimately benefit the human communities in the area.

Because of the topography of the site and its neighboring parcels, it is unlikely that beaver ponds would flood the homes on higher ground just to the south of Barber. Therefore, property damage should not be a strong concern for these residents. However, beaver pond migration may happen in some low-lying areas just to the north of the Barber Reservation, in an area known as the Humphrey's Conservation Area.

Although no property damage is anticipated if such a expansion occurred, there may be implications for land management in the lowland area. Figure 6.2 shows the extent of a "dynamic landscape buffer," delineated by outlining the topographic low-lying area. This is the area that can collect water, has small channelized woodland streams, and contains beaver habitat and therefore may be prone to flooding or changing hydrological conditions. In regards to a management plan, it would be best to minimize any possible impact, disturbance, or infrastructure in this area, so as to prevent property damage. This buffer also takes into account that beaver habitat is dynamic in nature, as shown in Figure 6.1. Currently, the central area of Barber is a beaver pond. But with time, if and when beavers leave the area, a beaver meadow will form here, changing the landscape and creating new ecological conditions.

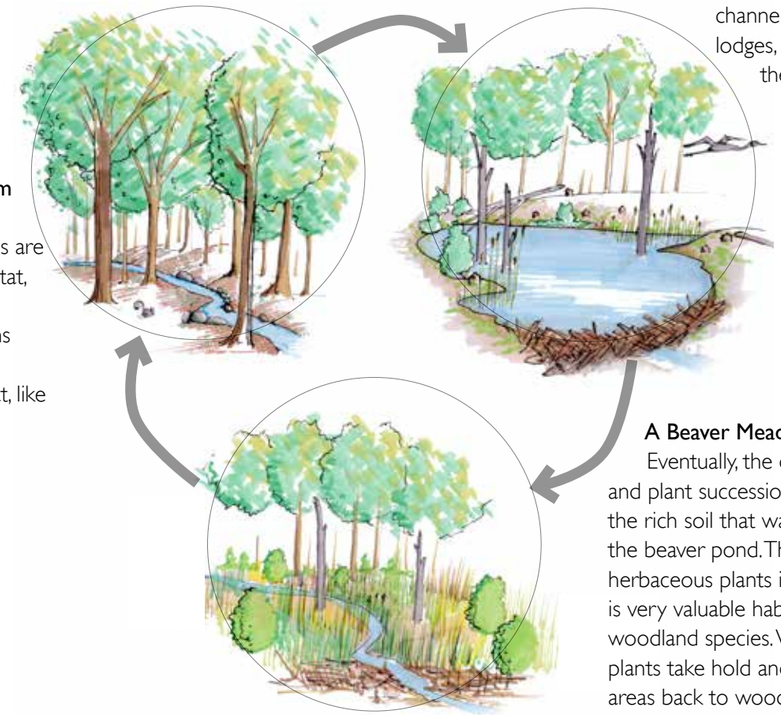
Wetland systems are dynamic and changing

For the railroad to run across the Barber Reservation, an embankment was built to lift the tracks above the wetland. The embankment essentially became a dam in the wetland. In the Barber Reservation, the railroad dike did not just stop water from draining to the west, it also likely raised the already high water table to above-ground exposure. It is possible that what is now a beaver pond first began as a seep in a wooded area as the water table rose to new heights.

With a railroad embankment already serving as a successful dam across the wetland, beavers had to do relatively little to dam water flowing through the embankment culverts, and then dam the resulting peripheral flows. The result has been an expanding pond behind a rising water table.

An active wetland landscape is dynamic and ever changing. All low-lying areas in and around the Barber Reservation are susceptible to beaver activity and, subsequently, inundation. However, the dynamic landscape buffer does not solely correlate to beaver activity. Large or prolonged storms can raise the water table, as can a dramatic landscape disturbance (such as clear-cutting or poor agricultural practices) above these low areas. Therefore, low areas may change as a result of several different factors or variables, and it is best to designate them as no-build or low-impact sites to alleviate any more conflict between man-made and natural landscape features and thus prioritizing habitat health and ecosystem functioning.

Figure 6.1:
Beaver Habitat Cycle



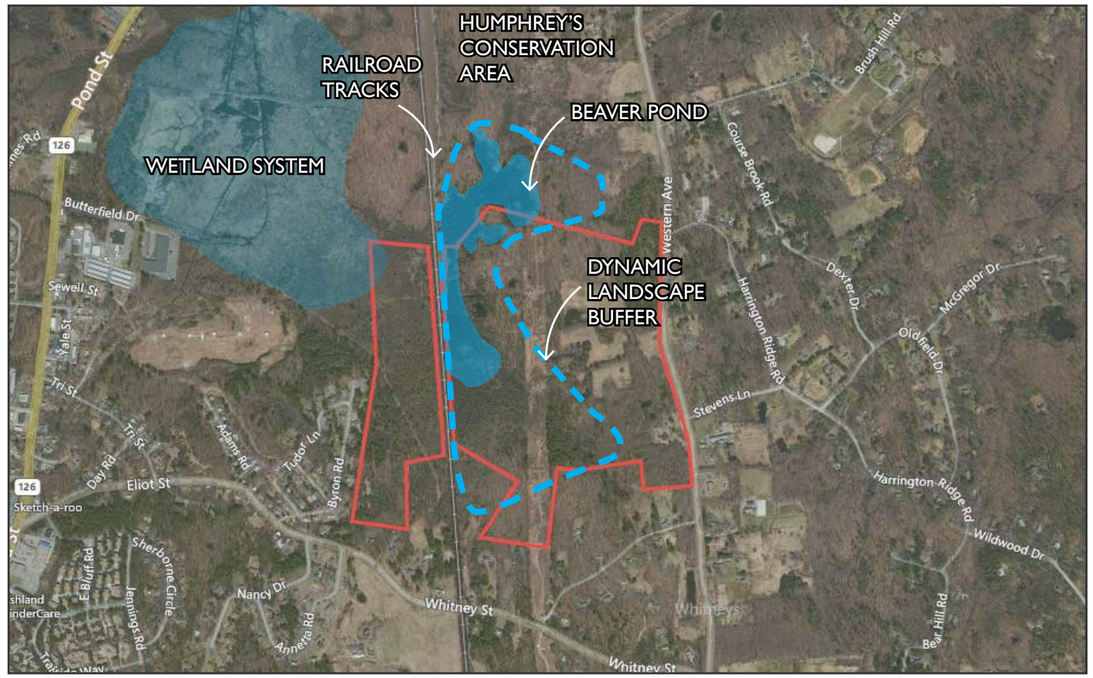


FIGURE 6.2: The blue dashed line shows the dynamic landscape buffer for the Barber Reservation, which includes much of the low-lying area of the property, as well as the area which has been separated from the larger wetland system to the west.

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SITE ANALYSIS
BEAVER ACTIVITY

Utility corridors converge on the Barber Reservation, and their maintenance must be integrated into the site's larger management plan.

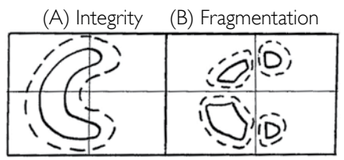

FIGURE 7.1: Schematic drawing showing the concept of (A) core integrity in spite of utility corridors with careful management and (B) fragmentation due to poor management of utility corridors.

Corridor characteristics

An array of utility corridors converge on the Barber Reservation, including a railroad track and switch-yard, transmission lines, a gas pipeline, and an oil pipeline. These intensively maintained corridors criss-cross the landscape in a grid pattern. These corridors can be devastating to or supportive of wildlife depending on the species and on the utility company's maintenance practices. However, natural landscape features that stay intact across utility corridors provide greater ecological integrity, as can be seen in Figure 7.1.

Utility corridors fragment the landscape. By severing the interior of an ecosystem, such as a forest or meadow, a utility corridor can greatly reduce or even displace interior species such as woodpeckers and thrushes by exposing them to external forces such as light, wind, and temperature fluctuations that is different than their natural habitat.

Exposing the interior of an ecosystem can create edge, pockets, and microclimates that serve species such as deer, fox, and birds of prey. However, traditional utility corridor maintenance results in hard edges with very little transition from one eco-type to another. This important transition is known to as an *ecotone* and hard edges greatly reduce edge species that depend upon it.

The on-going conventional maintenance of utility corridors retards the natural succession of an evolving landscape and potentially provides habitat for plants and animals that rely on an ecosystem of early successional vegetation. This ecosystem has grown more rare in New England with a decreased frequency of natural disturbances such as wildfires and man-made disturbances such as agriculture. If managed purposefully, utility corridors can serve as an early successional habitat. In addition, while utility corridors are static, they move through a landscape and so can potentially connect landscape elements such as meadows, rock outcrops, and forested areas. Wildlife may use a utility corridor to move across the landscape, alleviating conflicts between people and wildlife.

The Natural Heritage and Endangered Species Program (NHESP) has identified rare species habitat just south of the Barber Reservation, shown in Figure 7.3. If similar rare species habitat conditions were to be present or established within the Barber Reservation, then it is possible, depending on specific species needs, that utility corridors that connect these habitats to the reservation could potentially serve as migration corridors and assist with the preservation of these rare species.

Integration for a successful management plan

Each utility already has an established maintenance plan with criteria standard to each industry and permissible by law. Thus, utilities that converge upon the Barber Reservation are not maintained primarily for ecological functioning.

To ensure or enhance ecological health, the negative impact of utility corridors that cross a conservation area (such as the Barber Reservation) need at least to be mitigated. In addition, where possible, utility corridors should serve an ecological function. A successful management plan should allow for the maintenance of utility corridors while increasing the ecological functioning of those corridors, on the reservation and in the region.

Rail-Trail potential

The town has already purchased two-and-a-half acres of the railroad corridor (south of the reservation just beneath Whitney Street) with plans to establish a rail-trail. Extending the rail-trail north into the Barber Reservation would create additional access, complete recreational loop trails, highlight the beaver pond with exceptional views, and re-purpose an industrial corridor as an animal-migration and human-recreation corridor. Extended even further north, the rail-trail can directly link environmental justice populations in Framingham to the reservation.

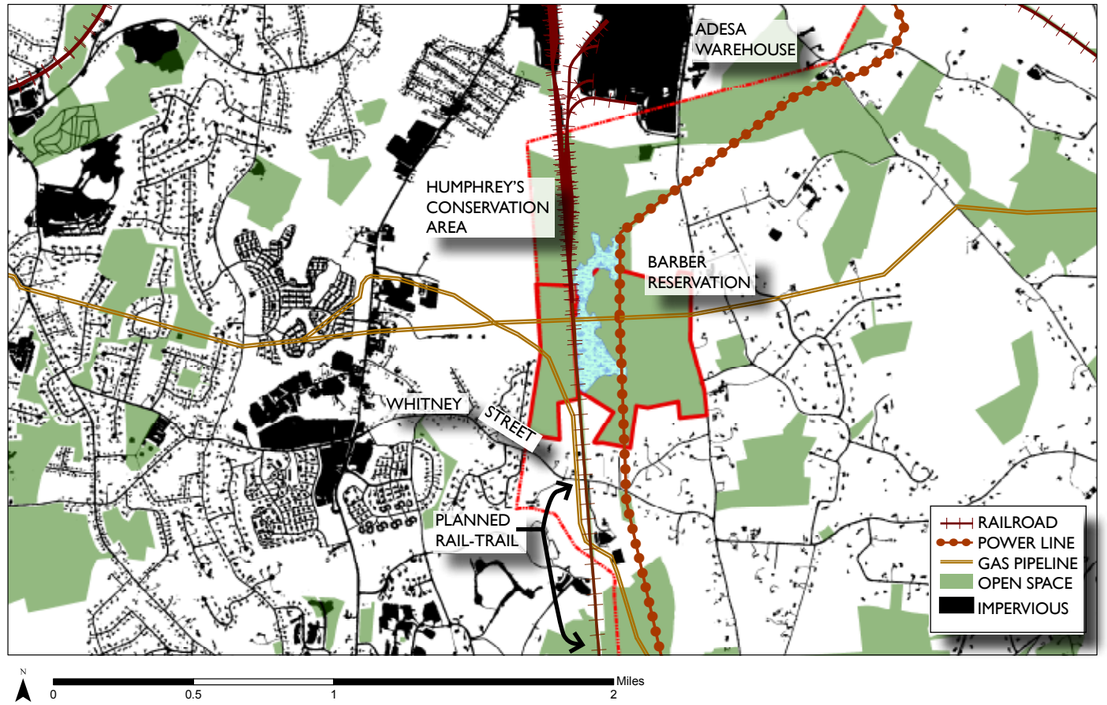

FIGURE 7.2: Regional utility corridors criss-cross the landscape and converge on the Barber Reservation. Because of their infrastructure, the landscape within the reservation is fragmented, and a tension exists between the maintenance of hard landscape features and dynamic natural patterns.

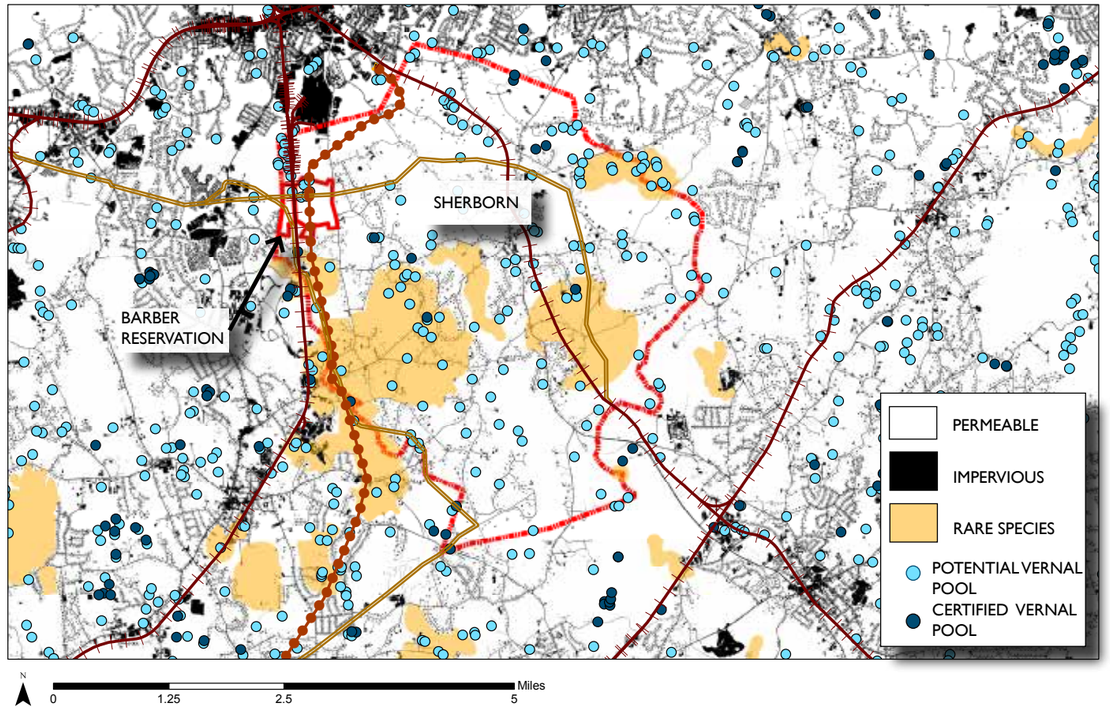

FIGURE 7.3: Areas of rare species habitat, as identified by the NHESP, are directly south of the Barber Reservation, and the utility corridors physically connect them to the reservation. If they don't adversely affect the rare species habitat, the utility lines may be a migration corridor for rare species.

The Barber Reservation has the potential to re-establish trail linkages in the region.

Accessing and traversing the landscape

Steep slopes represent only about one-tenth of the land area of the Barber Reservation, but limit pedestrian access to the site from Western Avenue (see Figure 8.1). The only formalized or official access onto the reservation is through a small parking lot off Western Avenue. Although the property has approximately 15,000-feet of frontage along this busy town road, the steep slopes on the eastern edge of the property prevent easy access. Also, the parking area is difficult to see when driving along Western Avenue, and hedgerows along the road boundary prevent any views into the open hayfields from the road. Many drivers pass the reservation, and increasing the views into the property or improving the curb appeal of the parking lot may help bring awareness to the property and its recreational opportunities.

On the reservation, a series of unmarked trails emanate from the homestead area. The most common trail taken by visitors is an unimproved utility road, cut into the hillside at a gentle slope and heads into the divided hayfields. This provides the easiest access into the interior of the site. Built well and able to provide multi-use access, this road serves as the main trail for all of the reservation's user groups.

In the hayfields the land falls away into lowland crests and depressions. Trails taper off into areas that are seasonally harvested, resulting in a diminished trail hierarchy and site disturbance from dispersed foot- and equestrian-traffic.

There are many trails in the Barber Reservation; most are unmarked and many are redundant. The trail system can be confusing to some visitors unfamiliar with the site, and also potentially leads to mis-use of trails by expanding corridor widths or rutting wet soils that are erosion-prone with saturated conditions.

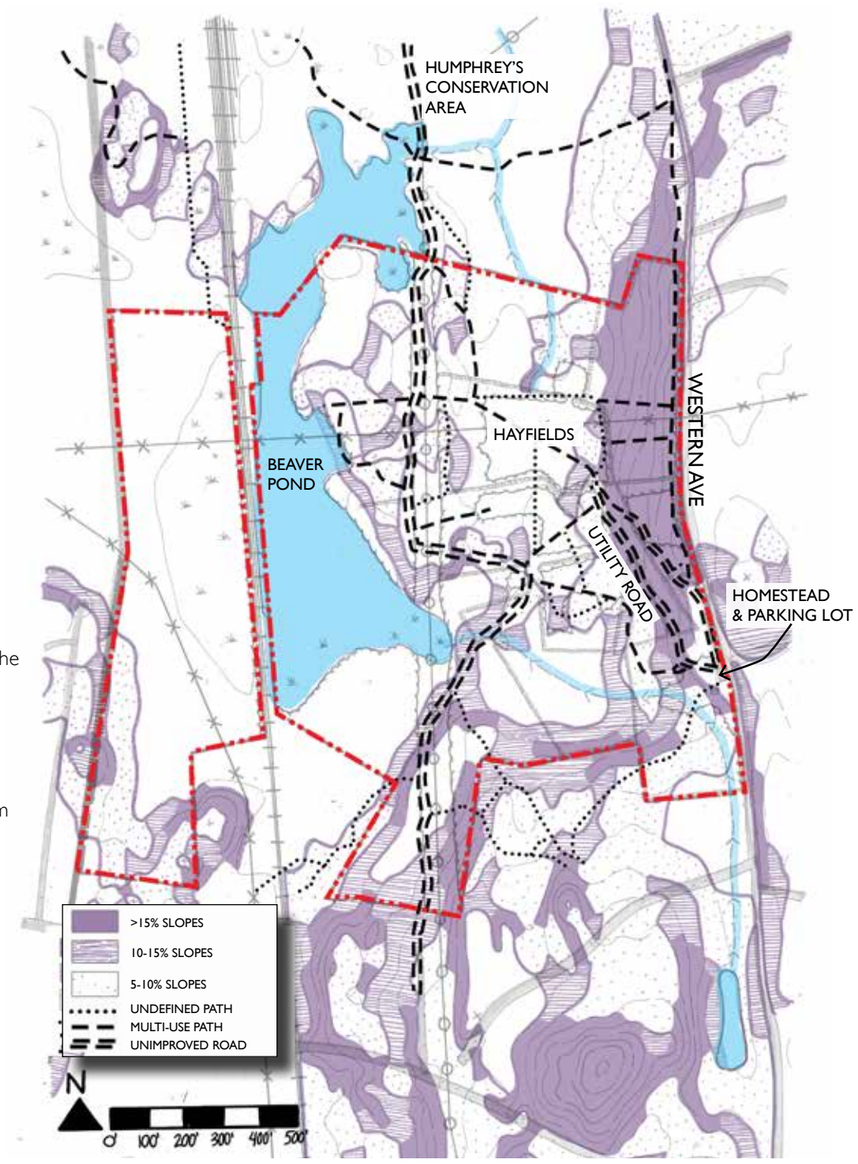

FIGURE 8.1: Trails on the Barber Reservation lack clear structure and hierarchy. The slopes on the site are generally gentle, except along the eastern edge of the property, including along Western Avenue. These steeper slopes restrict access from the current parking lot.

Bay Circuit Trail connections

The Bay Circuit Trail was originally routed through the Barber Reservation, but the combination of lowlands, a high water table, a railroad embankment, and an expanding beaver pond have conspired to reroute the trail numerous times. The Bay Circuit Trail is a 205-mile-long trail that circumscribes the landscape just outside of the greater Boston metropolitan area. It connects the Barber Reservation to the town's and region's open spaces (see Figure 8.2). The current route replaces the reservation's one-mile section into a two-mile road walk along busy state roads, which avoids the reservation entirely and loses the reservation's cultural and physical connection to other open spaces.

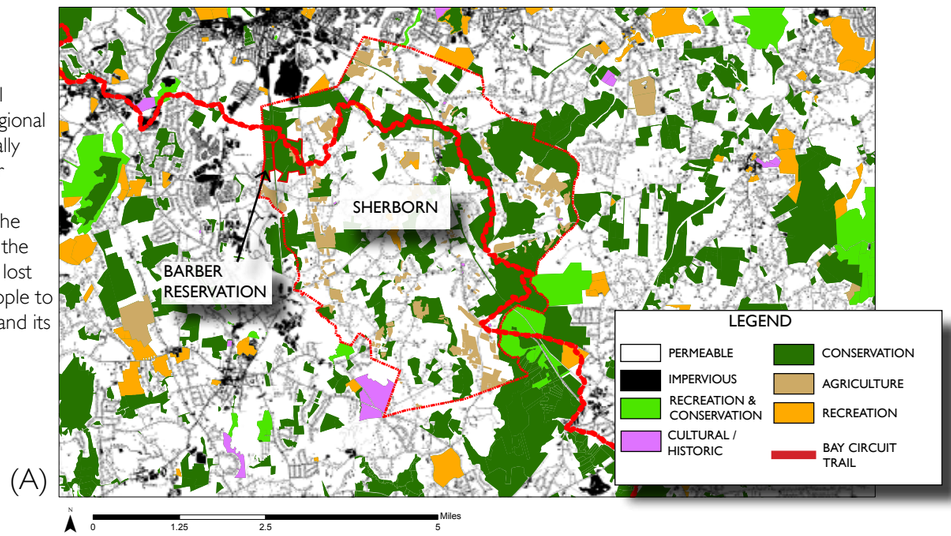

FIGURE 8.2: (A, B) The Bay Circuit Trail connected many regional open spaces, originally including the Barber Reservation. (C) Unfortunately, the current re-route of the Bay Circuit Trail is a lost opportunity for people to experience Barber and its habitat diversity.

Town of Sherborn Conservation Commission & The Land Management Task Force

Emily Davis & Brandon Tennis
The Conway School, Spring 2014

Listening to the Landscape
Managing the
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SITE ANALYSIS
TRAIL CONNECTIONS

The old homestead is the primary entrance to Barber, but is underutilized and unattractive.

Existing conditions of the old homestead area

The old homestead is the main access point onto the Barber Reservation and serves as the center of human activity as people come and go from the parking lot. Remnants of the historic homestead, such as an old foundation, a barn, and the area of a former tennis court, no longer serve their original functions, leaving this area underutilized. Tree species typical of a homestead, such as black walnuts and apples, also remain on the site. These old homestead features could be salvaged or re-purposed, so that they function as an integral space.

Partly dry upland and partly wet lowland, the homestead landscape reflects that of the overall reservation. Water drains from east to west and pools on top of poorly drained soils, as is indicated by the prevalence of cattails and skunk cabbage in the wet lawn. The slopes and saturated conditions hinder people from accessing much of the old homestead, including most of the fruit and nut trees, although the homestead infrastructure remains accessible on fairly flat, dry land.

Lawn

A lawn dominates the vegetation of the homestead area, and without frequent maintenance the grass is allowed to grow high throughout the summer season, discouraging access to many parts of the homestead that are not on the main trail. When the grasses are mown, stormwater volume increases into the adjacent stream and wet lawn.

Trails

The utility road that serves as access to the hayfields is the most predominant trail from the parking lot, although three other trails lead off into different directions, two of which are obscured by vegetation and saturated soils. A small trail leading just around the homestead area could help make use of this space while improving the reservation's "curb appeal."

Slopes

Steep slopes characterize much of the old homestead area. No trails traverse these slopes and most of the areas downhill are unvisited. These slopes are also vegetated by mown grasses, with increased stormwater runoff volume and velocity from the homestead into the adjacent intermittent stream.

Invasive Species

Many invasive plant species have responded to the previous disturbance of the homestead by out-growing the native plant species. Eradicating invasive plants requires keen observation and diligence. Establishing some kind of management of this area can support efforts to control the spread of invasive species.

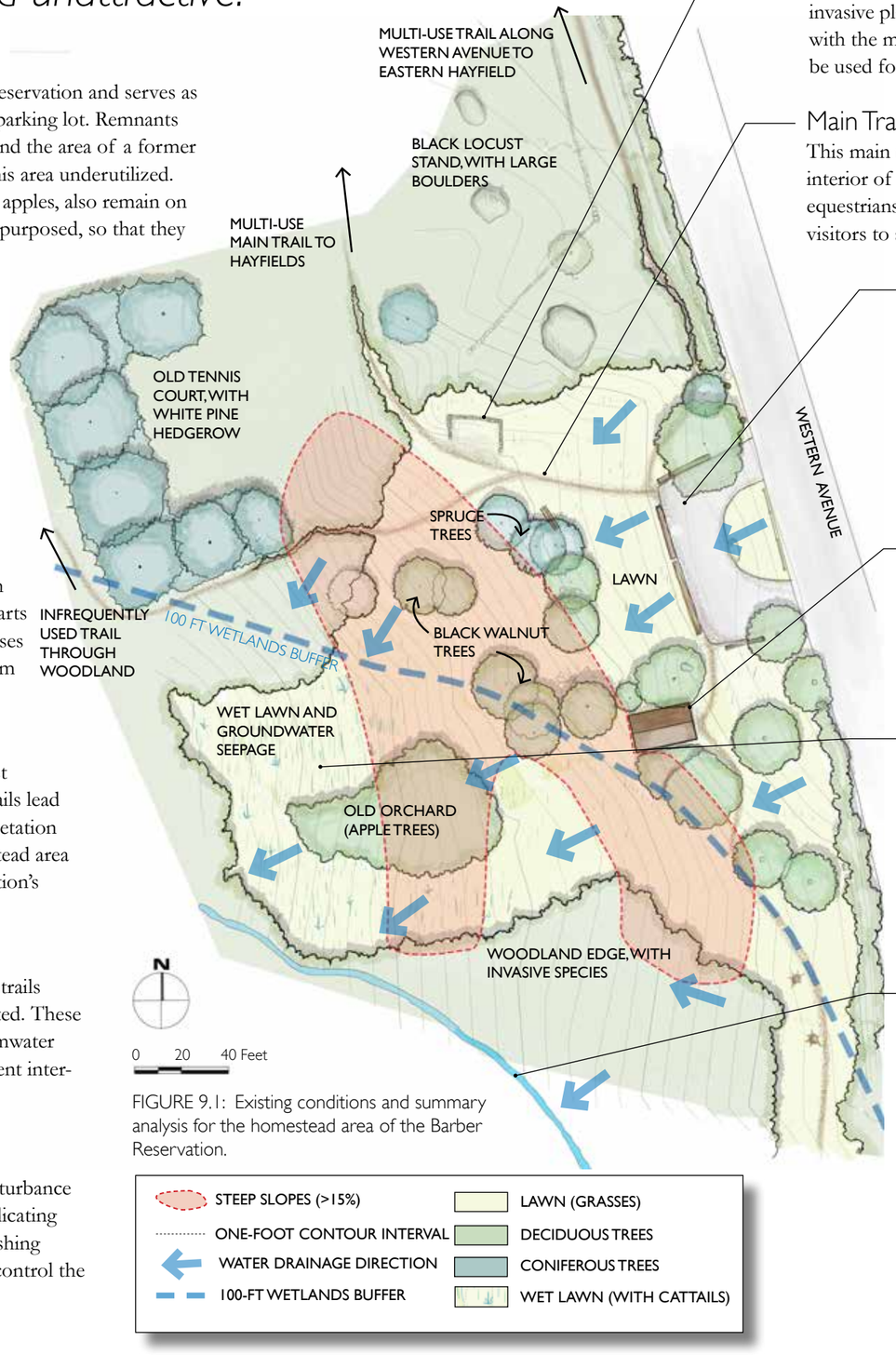

FIGURE 9.1: Existing conditions and summary analysis for the homestead area of the Barber Reservation.

Old Foundation

A small stone foundation still exists where the old farmhouse once stood. Currently, it serves no function, and needs to be regularly mowed to manage the invasive plant species that occupy this footprint. It is facing towards and level with the main trail, potentially making the foundation a valuable trail structure to be used for sitting, gathering, or hosting outdoor classes.

Main Trail to Hayfields

This main trail is also a utility road, and acts as the primary entrance into the interior of the reservation. It is used by trucks (during haying operations), equestrians, hikers, and dog-walkers. This is a direct route, and does not encourage visitors to spend time in the homestead.

Gravel Parking Lot

The gravel parking lot can hold five to six small cars, or one truck with a horse trailer, at a time. There is a consistent flow of vehicles in and out of the parking lot throughout the day, although mid-day visitors generally use the parking lot for a lunch or work break, and rarely wander beyond the gravel lot. If the number of visitors to the reservation were to increase, this parking area may need to be redesigned to accommodate more vehicles.

Barn

The old homestead's barn is still standing. Members of the Land Management Task Force are pursuing renovations for the barn, and hope the barn can serve the reservation more meaningfully than it is currently.

Seeps and Saturated Soils

A depression captures water draining from groundwater seeps in this wet lawn. The locally occurring poorly draining soils hold the water until it slowly percolates; however, because of the prevalence of moisture-loving vegetation, it is reasonable to believe that the water table is either perched or otherwise naturally high in this area, indicating an ability to hold water through multiple seasons.

Intermittent Stream and Resource Area

A stream runs near the homestead's southern woodland edge, and eventually flows down into the beaver pond. This small intermittent stream's 100-foot resource area (designated by state law) covers the core homestead area, and much of the water draining from the east drains into this stream. There may be an opportunity to slow and store this water as it moves through the landscape, thereby reducing the amount of flow entering the stream, and subsequently the beaver pond. Due to the legal restrictions upon land alterations in wetlands habitats, permitting may be needed for certain projects in the homestead area.

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Emily Davis & Brandon Tennis
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Listening to the Landscape
Managing the
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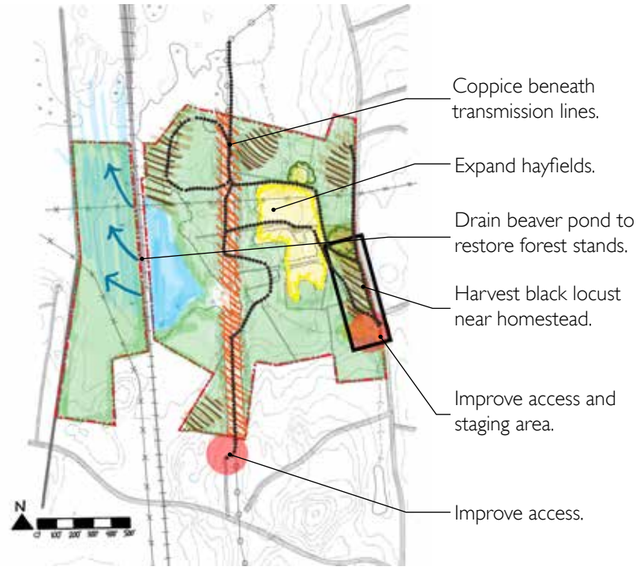
SITE ANALYSIS
HOMESTEAD AREA

The vision for Barber's future guides its management.

A successful management plan is only accomplished with a clear vision of land use; therefore, vision precedes management. The Conway team prepared a series of alternatives for the Barber Reservation in respects to the Land Management Task Force's guiding principles, community feedback, and sound ecological analysis. These alternatives are schematic, and were created as a design exercise to test either the functional or contrasting relationships of different landscape elements.

The proposed plan (see Sheet 11) and final management recommendations integrate landscape elements of each conceptual alternative. Ultimately, the design balances the intentions and functions of these three visions in an attempt to accommodate the requirements of utility corridors, the habitat needs of wildlife, and the public's desire for continued use and recreation.

Alternative 1
"Harvest natural products"

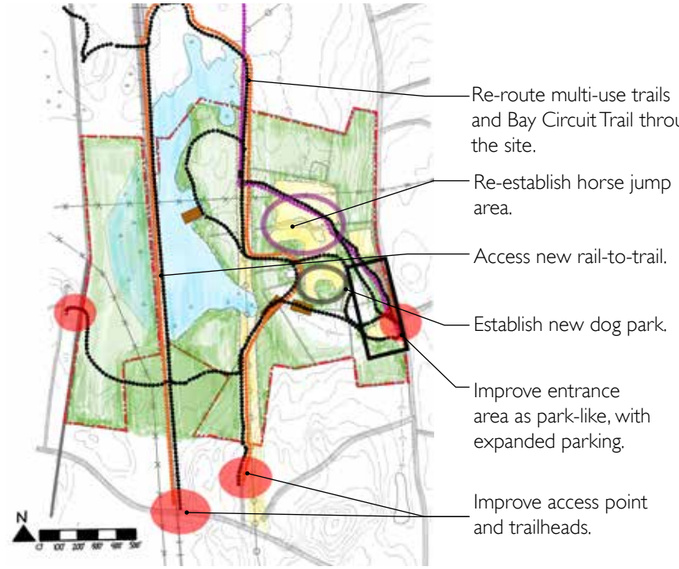


Key Management Strategies:

- Invasive species: Harvest and thin in targeted areas.
- Forestry: Thin in sloped and wetland areas. Harvest on uplands. Release canopy. Coppice in areas of early succession.
- Hayfield: Intensively maintain as no-till agriculture.
- Beaver Pond: Drain water into original wetland complex to reclaim forest stands.
- Utilities: Integrate utility maintenance with forest management. Use transmission line corridor as an access point.
- People: Recreation management is secondary.

Promotes education and awareness of local resource heritage, but with potentially high ecological integrity costs for low yields.
Impactful on an already impacted site.

Alternative 2
"Promote public use"

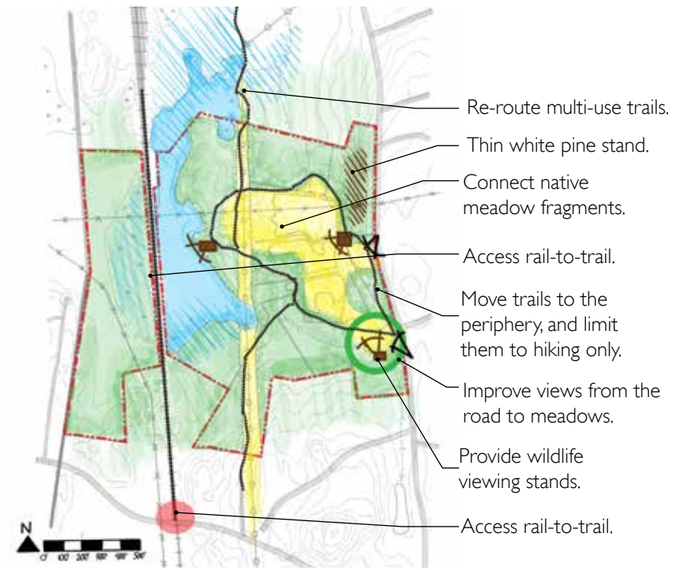


Key Management Strategies:

- Invasive species: Intensively manage around high use areas such as the parking lot and in a proposed dog park.
- Forestry: Clear and thin for trails and access.
- Hayfield: Replant as native meadow for recreation and aesthetics.
- Utilities: Allow public access is through utility corridors.
- People: Accommodate mixed user groups, improve access and signage.

Maximizes social and cultural value, while reconnecting Barber to other open spaces.
However, it is high-impact, expensive, and does not prioritize biodiversity, natural resources, or ecosystem function.

Alternative 3
"Promote biodiversity"



Key Management Strategies:

- Invasive species: Intensively manage and restore native plant communities.
- Forestry: Thin in select areas to release canopy and diversify white pine monocultures.
- Hayfield: Expand and replant as native meadow.
- Beaver Pond: Allow to develop naturally.
- Utilities: Integrate utility corridors with meadow management.
- People: Concentrate and limit public access.

Maximizes ecological health, in accordance with client's goals and principles, but only serves hiking and wildlife viewing user groups. Landscape re-wilding is slow to establish and potentially unpredictable.

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Listening to the Landscape
Managing the
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DESIGN ALTERNATIVES

Proposed Plan

Promoting restoration & integrity

This proposed design accommodates the need for public access and recreation and creates more cultural value for residents by providing facilities, trails, and structures across the landscape, including access to unique landscape features.

The beaver pond and the hayfields are allowed to expand, therefore increasing their habitat function, value, and ecosystem services, such as water retention.

Finally, utility corridors are used as points of access onto the reservation and their maintenance is integrated into the overall management plan.

Re-Routed Bay Circuit Trail

The Bay Circuit Trail is reconnected to the Barber Reservation via a route around the northern edge of the beaver pond through the Humphrey's Conservation Area. This trail alignment has to remain flexible as it is within a potentially dynamic landscape. Rerouting to the north may be necessary in response to changes in the beaver pond.

Bridge to Rail-to-Trail

A bridge is constructed across the northern branch of the beaver pond to connect to the regional rail-to-trail path extending from the south, providing another entrance into the Barber Reservation. Using this route, visitors have easy access to the beaver habitat and the chance to view wildlife. This bridge would help establish permanent regional trail connections to the Barber Reservation via the rail-trail and the Bay Circuit Trail by crossing over the beaver pond instead of traversing the wetlands around it.

Beaver Pond Viewing Boardwalk

Visitors also have the option to view wildlife from a boardwalk. The boardwalk allows people to step away from the woods-edge and out into the edge of the active beaver pond. The boardwalk can be reached from two directions by a footpath that meanders around the interior edge of the pond. Because the boardwalk lies inside of the dynamic landscape buffer, it is movable.

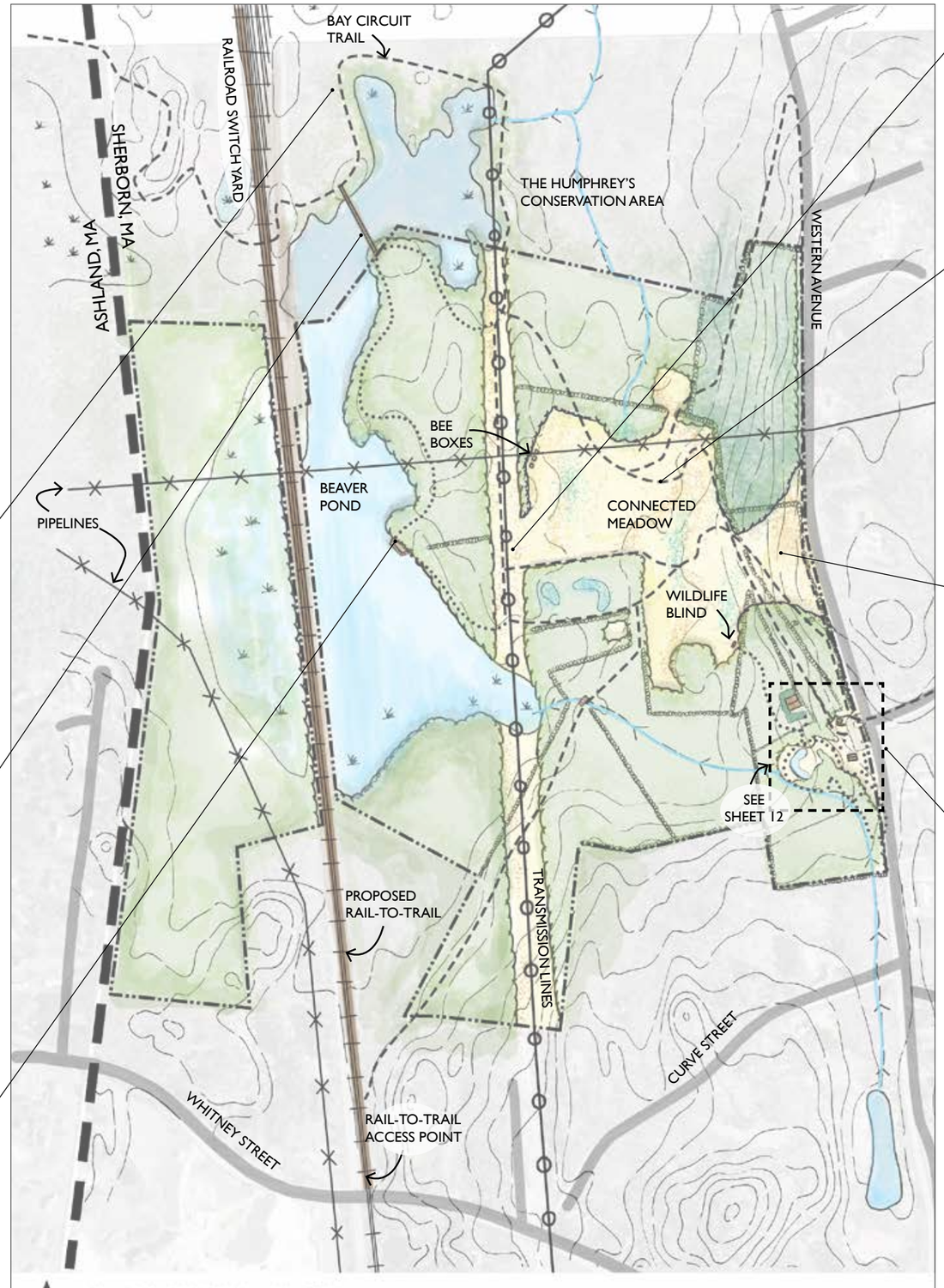

Figure 11.1: The Barber Reservation Proposed Plan

Integrating Utility Maintenance with Meadow

The meadow is connected to the transmission line corridor to enhance the potential for wildlife migration in and out of the interior of the reservation. This connection could increase the reservation's wildlife value and biodiversity.

Designated Horse Paths

The trails on the Barber Reservation are designated for different uses, separating mixed-use and hiking-only trails and minimizing site disturbance by following gentle slopes across contours. Areas of pooling water are avoided and the wildlife blind is buffered, reducing conflict between user groups. Turning radii are kept obtuse to reduce erosion from high-impact use (such as with horses) and to eliminate the occurrence of cut-throughs across steeper slopes.

Expanded Native Meadow

The hayfields are connected by removing the hedgerows and removing the stone walls between them. They are then re-seeded as a native meadow, thereby increasing the site's biodiversity and providing habitat for field-nesting birds. The meadow is expanded to include road frontage, allowing views into the reservation and across the fields.

New Park-like Entrance

The entrance experience is improved by creating a more engaging environment that also improves ecological functioning and presents cultural values. The old homestead lawn is replanted as a community food forest.

The parking area is improved to accommodate more visitors, as well as potential staging operations for timber, biochar, and food production (see Sheets 12-14).

A community pavilion sits on the impacted site of the former tennis court. As this is the area with the most invasive plant species, impact is concentrated here to reduce their population and help control their spread.

(Not for construction. This drawing is part of a student project, and not based on a legal survey.)

Town of Sherborn Conservation Commission & The Land Management Task Force

Emily Davis & Brandon Tennis
The Conway School, Spring 2014

Listening to the Landscape
Managing the
Barber Reservation
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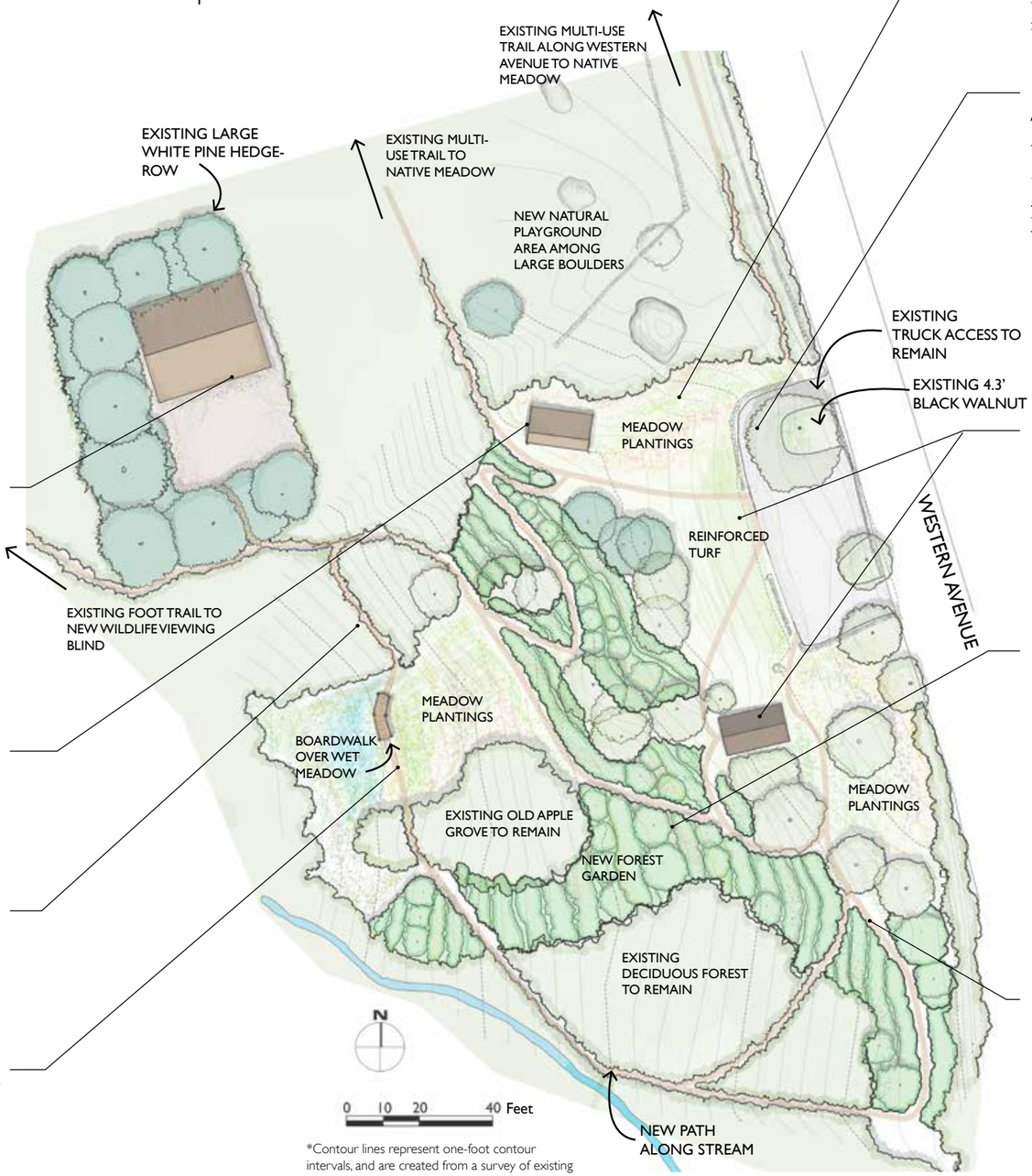
PROPOSED PLAN

Homestead Plan

The old homestead becomes a park

The old homestead, which is the main access point onto the site and the center of human activity in Barber, becomes a day-park. The proposed design builds on existing use patterns to create more recreation, educational, and productive spaces in the homestead, as well as increase the reservation's curb appeal. Visitors now have the option to interact with the landscape immediately upon arrival. Walking paths lead visitors around the homestead to the renovated barn, a lean-to, a forest garden, a wet meadow, a stream, and a staging area for on-site processing of forest products such as timber, biochar, and food.

FIGURE 12.1: Proposed Homestead Area



*Contour lines represent one-foot contour intervals, and are created from a survey of existing conditions. The proposed plan may require grading changes that are not shown in this plan.

Community Pavilion

This structure is built in the footprint of the former tennis court (in the last construction phases of the homestead area), and provides a space for staging or gathering for public or educational events in Barber while offering the area as a focus for intensive invasive plant species removal.

Trailhead Lean-to

The original stone foundation is rehabilitated, and covered with an open-air lean-to. This allows visitors a shaded place for gathering, picnicking, or resting before or after a walk.

Barrier-free Path

Most of the paths circulating around the homestead area are placed so they require minimal grading to achieve a 5% slope. The looped trail system in the homestead area is now accessible to many user groups.

Wet Meadow Boardwalk

A boardwalk is built over the wet area of this lawn, around a groundwater seep. The boardwalk provides water and wetland education opportunities while traversing saturated soils to complete a loop trail. Being inside of the resource area, boardwalk and trail construction will require permitting.

Meadow in Original Lawn

Meadow plants and wildflowers are seeded in this existing homestead lawn, creating an inviting entrance that reflects the large native meadow in the interior of the reservation.

Improved Gravel Parking Lot

The parking lot largely retains its existing footprint, but incorporates an informal truck access path just to the north. A new stone wall separates the edge of the parking lot and Western Avenue. The large 4.3' black walnut tree remains, shading part of the parking area.

Staging Area and Renovated Barn

The area between the parking lot and the renovated barn is planted with reinforced turf, thereby allowing staging to occur near parked utility vehicles and the barn. This historic barn can be used by community members or coordinators working in the food forest.

Community Food Forest on Contour

A productive food forest is planted for community use and education. Swales and berms on contour store and infiltrate runoff down the slope, as fruit and nut trees, shrubs, herbaceous plants, and productive ground covers are planted together to mimic natural plant communities. Permitting would be required to build the swales and berms. A forest garden can be established on contour without swales and berms, but plantings would be limited to moisture-loving species primarily. The existing old apple orchard is revived by understory thinning and pruning and incorporated in this forest garden.

Series of Short Loop Trails

This one-tenth-mile outer trail allows visitors to walk a short loop in the homestead area that takes them past the pond, the food forest, and the woodland stream, and along the historic renovated barn. A series of inner loops allow for shorter walks.

(Not for construction. This drawing is part of a student project, and not based on a legal survey.)

Town of Sherborn Conservation Commission & The Land Management Task Force

Emily Davis & Brandon Tennis
The Conway School, Spring 2014

Listening to the Landscape
Managing the
Barber Reservation
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DESIGN DETAILS
HOMESTEAD PLAN

Homestead Phasing

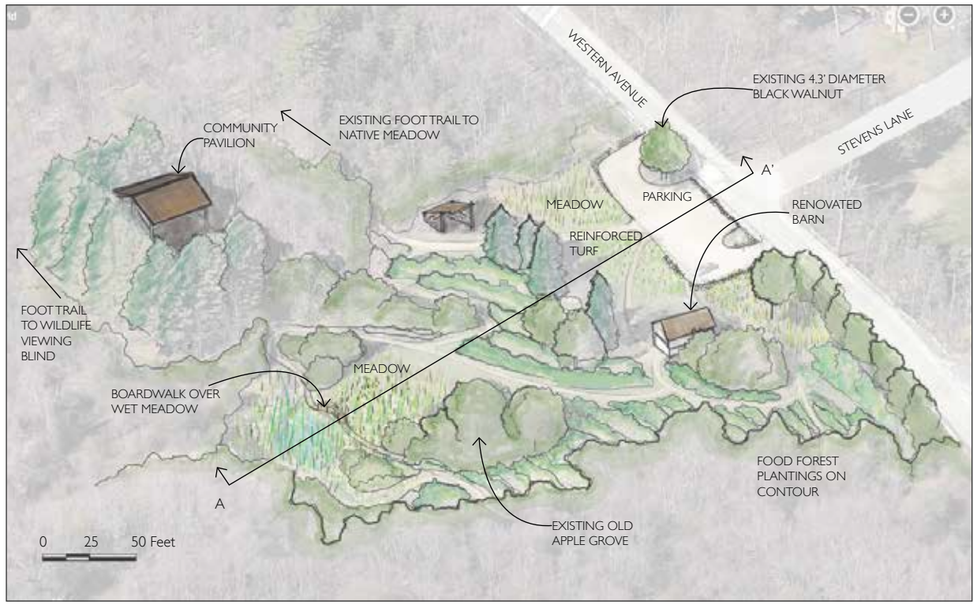

Figure 13.1: Aerial perspective of the proposed homestead area, featuring the community food forest and pavilion.

Phase 1: Late summer

- All excavation and berming should be done in late summer when the water table is low and enough growing season remains to establish a cover crop for the fall and winter. A cover crop will stabilize the newly disturbed soil and limit weed growth.
- Fill and grading for the staging area and extend the parking lot can also be done at this time while machinery is already on site. Reinforced turf should be dug into place and lightly mulched to prevent erosion.
- Building the trailhead lean-to during this initial phase may give community members a sense of progress while construction continues into the next season.

Phase 2: Spring

- Walking paths should be staked out early in the spring and observed throughout the wettest season so adjustments in the design can be made before the paths are made permanent.
- Bare-root trees and shrubs that were ordered during the winter should be planted after having their roots soaked in an all-natural mycorrhizal dip that helps the plant roots quickly establish with the fungi present in the soil. Heavy mulching is recommended to hold in moisture and suppress weed growth.
- A light tilling of the soil should be done after seasonal deluges but before the last spring rains, followed by the seeding and matting of native meadow plant species. A polyculture mix of nitrogen-fixing and dynamic-accumulating plant species should be sown throughout the forest garden (see Appendix I for a food forest plant palette).

Phase 3: Early summer

- Walking paths should be built in early summer once the meadow has begun to establish. If the meadow has grown too high, the paths should be mowed before the tread is dug, lined, and lightly filled with crushed gravel or heavily topped with wood chips from trees chipped on site.

Phase 4: Mid-summer to mid-fall

- Newly planted trees and shrubs should be watered if rain fall is scarce throughout the summer. End-of-the-season donated plants should be planted in early fall, heavily watered, and thickly mulched to protect against the winter freeze-and-thaw cycle.

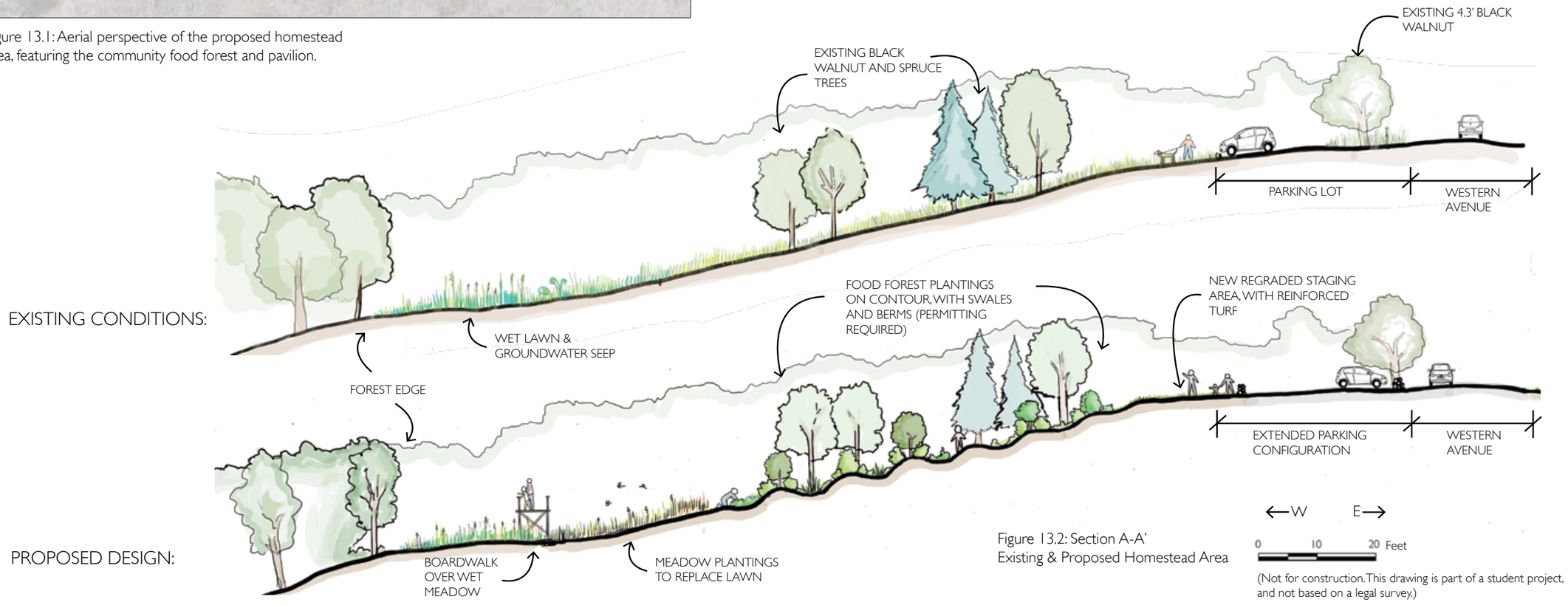

Figure 13.2: Section A-A'
Existing & Proposed Homestead Area

(Not for construction. This drawing is part of a student project, and not based on a legal survey.)

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DESIGN DETAILS
HOMESTEAD PHASING

Homestead Management

FIGURE 14.1: A forest garden grows a wide array of food and medicinal plants. Swales and berms create microclimates that increase the diversity of plant species.

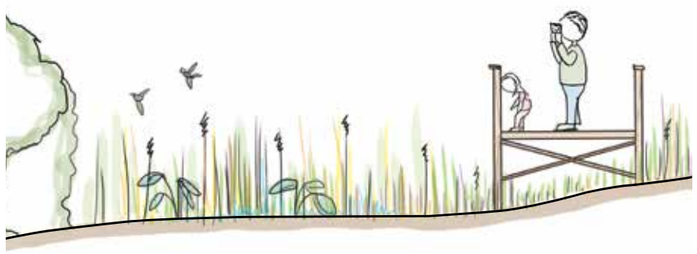

FIGURE 14.2: The constructed boardwalk over the wet meadow.

Forest garden

A forest garden is a perennial polyculture of plants that provides food and (herbal) medicine. Its structure mimics a forest's, with canopy and understory trees, shrubs, herbs, roots, and potentially vines (see Figure 14.1). Site conditions determine what plants can be grown, but some specific site conditions can be modified to accommodate the grower's choice. Swales and berms built on contour capture rain water and percolate it toward the root systems of the crop plants while reducing runoff into the nearby stream. Berms also create microclimates and allow fruit trees to be raised up out of the site's saturated conditions. The swales, on the other hand, provide water for crop plants that prefer saturated conditions. The proposed area for swales and berms lies inside of the one-hundred-foot stream buffer and would require permitting. A forest garden can be established without swales and berms (eliminating aspects of permitting requirements) but would serve less species diversity as well as loose the potential to mitigate the homestead's impact on the nearby stream and the farther away beaver pond.

The large black walnuts on site are already the beginning of a forest garden. They create the canopy and provide protein-rich nuts. However, the natural juglone chemical within black walnut roots and leaves alters soil to the detriment of many other plant species. Although a limited array of food and medicinal plants can be grown beneath black walnuts, some thinning of the current walnut stand can open up niches for other valuable plants (see Appendix II for a list of juglone-tolerant forest garden plants).

The many wild apple trees on site can also become a part of a forest garden. Thinning the large patches of apple trees would make the stand healthier and more productive. Generally, pruning and thinning is not necessary in a forest garden unless maximizing yields is the goal.

Once established with the right mixture of plants, forest gardens can do well with very little maintenance. It is important, though, that plants that fix nitrogen and mine the subsoil for nutrients are included. These plants increase fertility much like a gardener adds compost to her garden beds. Providing compost and mulch while the forest garden gets established, however, may be essential for a healthy, productive start.

Wet meadow boardwalk

The new boardwalk that is built over a section of the wet meadow in the western side of the homestead area is a part of the meandering short loop trail. The boardwalk may be viewed from the parking area, thus inviting people to walk the trail around the homestead. The boardwalk gives visitors an opportunity to experience the wet meadow (see Figure 14.2) without disturbing it, and also provides views back up-slope to the established community food forest. This boardwalk is also a smaller version of some other features of the site, particularly the beaver pond observation deck and the bridge that re-routes the Bay Circuit Trail. Along with these other proposed features, the wet meadow boardwalk allows visitors to access the otherwise inaccessible special habitats and unique landscape features of Barber.

Staging area and renovated barn

The area west of the parking lot is graded and raised with reinforced turf, which creates a staging area for forest products near the renovated barn. In this area, there is enough room to run a portable saw mill, and so it can serve as a timber staging area for trees thinned from the forest or cut from the expanded meadow. As other systems are put into place, the staging area can also serve as a holding spot for grazing animals, a managed burn area to make biochar, and an outdoor area for processing forest garden products.

The renovated barn can serve many functions as well—for example, forest garden food processing, a gathering area for workday events, or dry storage for cut boards.

Goats, biochar, and a natural playground

The flat forested area just north of the parking lot is populated with invasive plant species and poison ivy. But beneath these noxious weeds lie large boulders, exposed bedrock, and a thin understory layer ideal for a natural playground.

It can be very difficult and expensive to eradicate invasive plant species, but combining multiple methods (such as mechanical removal and targeted grazing) may be an effective way to establish control over their spread with limited resources. For example, once large woody plants are mechanically removed in an area, goats can be used to browse the young shoots beneath the canopy. Goats will eat woody vegetation such as black locust saplings, multiflora rose, and bittersweet vines, as well as poison ivy.

With the exception of poison ivy, these noxious species can also be removed by hand and made into biochar. Biochar is the material that results from burning vegetation in a airless environment to produce charcoal. Biochar not only sequesters carbon, but the charcoal can be added to the forest garden to improve the structure, tilth, water retention, and nutrient density of garden soils. Biochar is cheap and easy to make (see Figure 14.3).

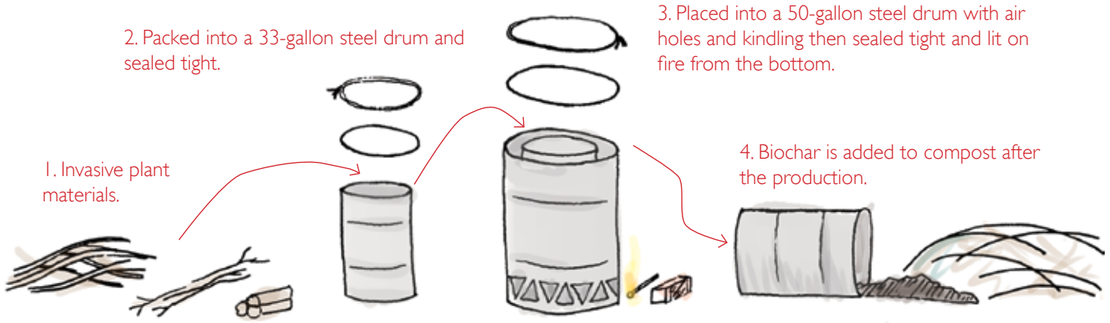

FIGURE 14.3 The biomass of removed invasive plant species is made into biochar—a carbon-sequestered soil amendment that may be added directly to compost in the forest garden for improved tilth and fertility.

PHOTO 14.1: Biochar improves both the tilth and fertility in soils conducive to a forest garden.

Native Meadow Plan

Native meadows provide integrity and beauty, and are productive landscapes.

Because of their size and the declining number of similar fields in the region, Barber's fields have the potential to increase the reservation's ecological value if they are maintained according to the needs of wildlife through such actions as expanding the size, limiting woody vegetation, and establishing native meadow plant species.

In this proposed design, which focuses on maintaining the integrity of the landscape, the fields are connected by removing the physical barriers (hedgerows and stone walls) between them, and by clearing some forest. This increases the amount of space in the interior of the fields, therefore creating important core meadow habitat for ground-nesting birds and reducing the amount of forest edge. The fields are also connected to the transmission line corridor, which is already functioning as an early-succession species migration route.

NSTAR owns and maintains the transmission line corridor that crosses the Barber Reservation. The company's five-year vegetation management plan includes working with landowners toward alternative land uses (such as meadows):

> "Wherever practical, as determined by the Senior Arborist or NSTAR management, NSTAR will cooperate with landowners through whose property NSTAR owns easements, to facilitate 'alternative land use' practices by the landowner's that may reduce or eliminate the need for vegetation management by NSTAR," (NSTAR Electric and Gas, 26 February 2013, section 12, pp. 39).

A corridor provides linear or migration routes on the landscape, and a node is an area on the landscape that provides contiguous habitat, with certain edge characteristics that help that habitat. Field species, and possibly even rare species from south of the Barber Reservation (see Sheet 7), may be able to arrive at Barber via NSTAR's corridor, then use the expanded meadow as their core habitat.

This design also converts the hayfields to native meadow. This is proposed because the hay currently harvested from the site is not optimal or very valuable due to poor soil conditions, the haying operations are a financial burden on the Town of Sherborn, and the fields do not support rare species habitat. Also, the mixed-use recreation on the site often impacts the quality of the hay (i.e., trails cutting across the hayfields reduce their productivity).

Conversely, a native meadow is more suited to the existing soil conditions, helps to meet the ecological functioning goals for the Barber Reservation, and could provide even more recreational opportunities for surrounding communities. For the purposes of increasing biodiversity, creating an efficient working landscape (through livestock grazing and bee-keeping), and improving aesthetic qualities (with views from the road and across the expanse of native meadows), this plan proposes that a native meadow would best serve the Barber Reservation.

pH	6.4	near neutral
Nitrogen	7 ppm	low
Phosphorus	4 ppm	low
Potassium	27 ppm	low
Calcium	337 ppm	low-medium
Magnesium	71 ppm	medium

FIGURE 15.2: Soil test results from UMass Extension soil testing services, showing soil chemistry of the hayfields, which are identified as nutrient deficient.

FIGURE 15.1: Proposed connected and expanded native meadow.

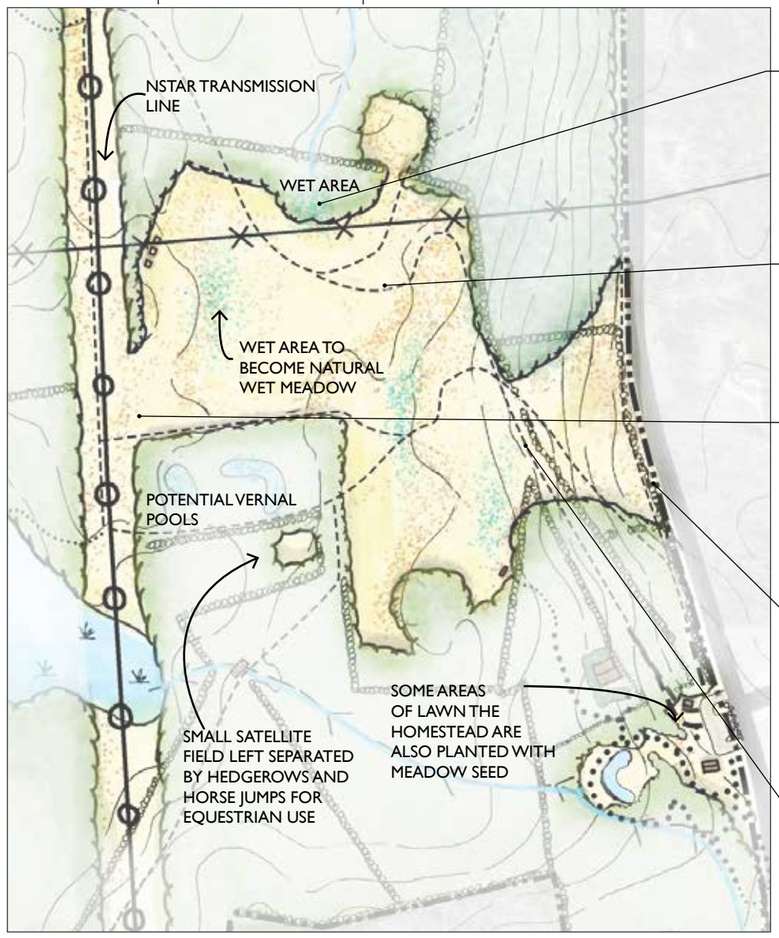

FIGURE 15.3: Comparisons of management requirements and yields of native meadows and hayfields.

Meadow	Hayfield
Supports a higher degree of biodiversity	Is a plant monoculture
Can grow readily from existing soil conditions (requires no input)	Demands inputs (specifically, lime and nitrogen)
Provides diverse color, texture, and strata (vegetative layers)	Provides little color, few textures, and one strata
Provides pollinator habitat	Limited pollinator habitat
Provides rare species habitat	May provide for some ground-bird species if harvest is delayed late into the season
Dynamic and changing through seasons and years	Harvest is an abrupt change in ecosystem dynamics
Potential to produce honey, goal milk, meat	Produces lower quality hay
Managed by rotational grazing or mowing once established	Managed by tractor for soil amendment, fertility, seeding, and harvest each year

Town of Sherborn Conservation Commission &
The Land Management Task Force

Emily Davis & Brandon Tennis
The Conway School, Spring 2014

Listening to the Landscape
Managing the
Barber Reservation
Sherborn, MA

DESIGN DETAILS
NATIVE MEADOW PLAN

Native Meadow Phasing

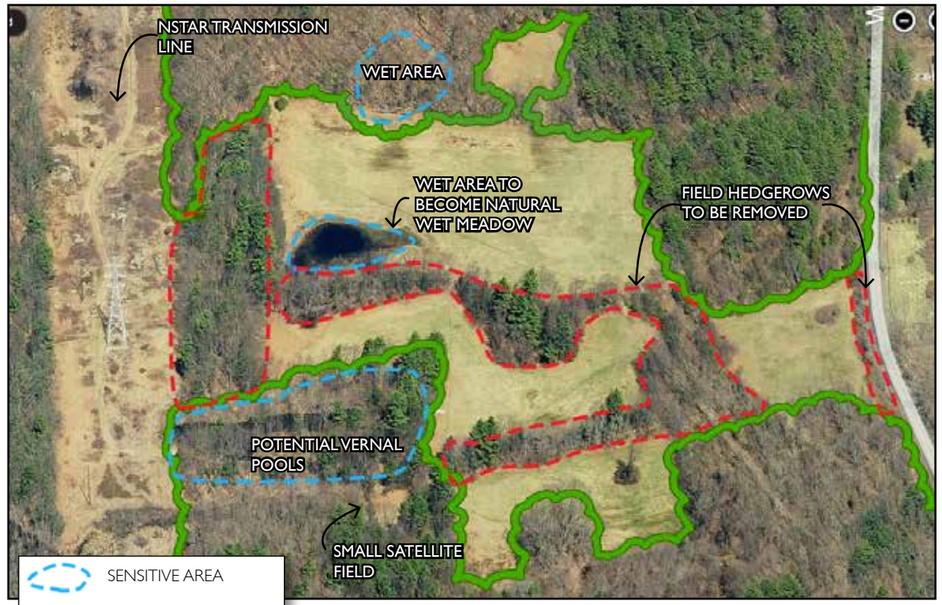

FIGURE 16.1: Bird's-eye imagery shows the areas of forest and hedge that would be cleared in the proposed plan, as well as sensitive areas that require protection during project implementation.

Phase 1: Fall

- Any thinning of the surrounding forest that requires using hayfields should be completed before investing time and energy into establishing a meadow. Skidding trees across an establishing meadow can result in patchy growth patterns, invasion of non-native species, erosion, or outright damage to the meadow.
- Removing field hedgerows and stone walls should also be done before the meadow is established. Although they provide historical context, stone walls will require on-going maintenance to keep clear of woody vegetation. They can be reused elsewhere where maintenance energies are already focused, such as in lining the parking lot.
- Opening up new areas for meadow development should also precede meadow establishment. Stumps of the felled trees can be ground or inoculated with mycelium to expedite decomposition.
- Plant a cover crop of winter wheat immediately after the timber harvest, thereby preventing weed establishment at this time in the project phasing.

Phase 2: Winter

- Cut and lay the winter wheat cover crop in late winter before it goes to seed.

Phase 3: Spring

- A native meadow established in the spring favors grasses and sedges as opposed to wildflowers. If a meadow dominated by native grasses is desired, this is the time to lightly scarify the land and sow seed. Sow forbs along with the grasses, understanding that wildflowers will generally not begin to grow until the following year and that germination may be poor; plan for acceptable loss by sowing more heavily.
- If a native wildflower meadow is desired, now is the time to plant summer buckwheat as another cover crop, which will also help suppress weed growth in the meadow.

Phase 4: Summer

- Cut and till-in the summer buckwheat cover crop in mid to late summer before it goes to seed. Lightly scarify the land and sow seed. Sow grasses along with the forbs, understanding that grass seed germination may be poor; plan for acceptable loss by sowing more heavily.

Phase 5: Grazing goats in transmission line corridor

- At any time in the process (but after the active vernal pool season in the spring) goats can be grazed on the transmission line corridor. Fence the goats around concentrated areas of invasive plant species such as glossy buckthorn. At the same time, mechanically remove any isolated patches of invasive plant species.
- After the invasive plant species have been eradicated, lightly scarify the soil and sow a cover crop according to the season. Cut the cover crop before it goes to seed and sow another cover crop according to the season. Graze goats amongst the cover crop any time that a concentration of invasive species grows up. Otherwise mechanically remove any isolated patches of invasive plant species.
- Continue this process until the regeneration of invasive plant species is under control. Then sow the native meadow according to the season.

Phase 6: Once the meadow is established

- Once the interior and corridor meadow is established, the remaining hedge can be cut to establish the connection between corridor and node. Again, tree stumps can be ground down or inoculate with mycelium to expedite decomposition.
- Begin establishing a meadow in this area be repeating Phases 1 through 4.

FIGURE 16.2:
(A) Annuals bloom in a first-year meadow while biennials focus their energy on establishing deep root systems for perennial growth.
(B) Perennials add to the density and strata of a second-year meadow while root systems continue to grow deeper.
(C) A third-year meadow blooms throughout growing seasons and establishes high yields of pollen and nectar for bees and butterflies. Foliage and root systems increase in size, height/depth, and density.

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The Conway School, Spring 2014

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Managing the
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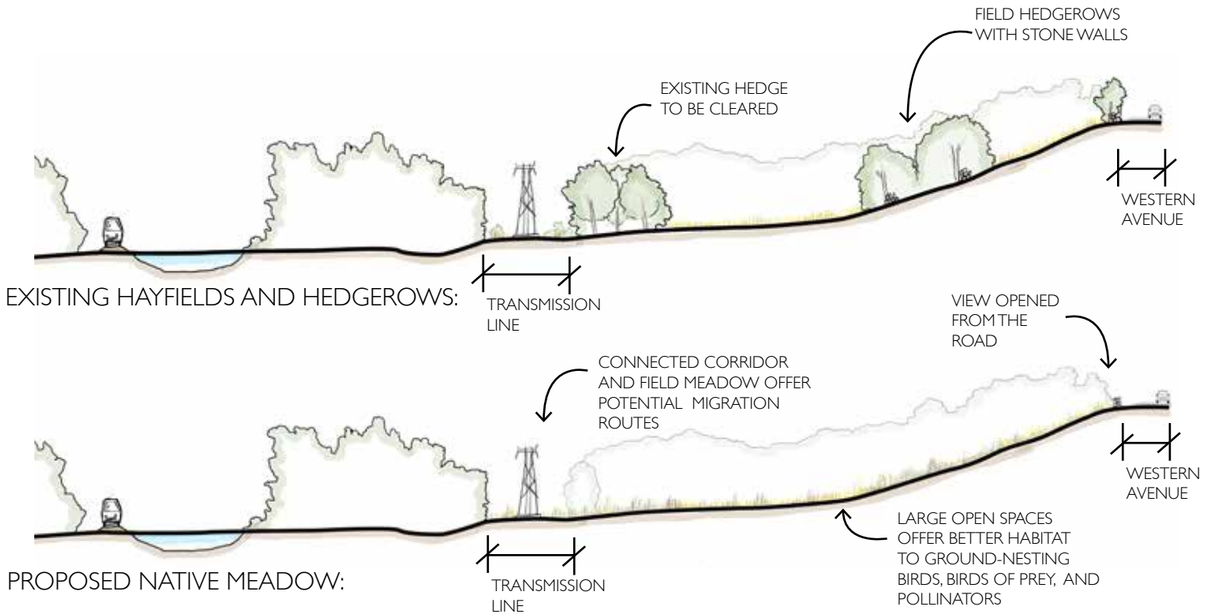
DESIGN DETAILS
NATIVE MEADOW PHASING

Native Meadow Features



←W E→ (Not to scale)

FIGURE 17.1: Existing and proposed meadow area, with proposed meadow features potentially supporting more wildlife diversity.

FIGURE 17.2: Meadows serve pollinators; (A) butterfly feeding on wild bergamot, (B) bumble-bee feeding on milkweed, (C) bumble-bee feeding on wild germander.

Nesting season

If a field is mowed, mowing should be limited to late in the season (i.e., after August) to reduce impact on nesting ground-birds. Pets should also be kept on a leash or restricted from meadows altogether during ground-bird nesting season because their instinctual nature and curiosity may harm an adult bird or prevent it from tending to its nest. In general, horses should be kept on the trail around meadow habitats that are preserved for wildlife habitat value, so as it minimize site disturbance.

Bees and bats

Beyond ground-birds, meadows provide habitat for an array of wildlife such as song birds, birds-of-prey, mammals of all sizes, snakes, hundreds of insects, and thousands of important soil microbes. But importantly meadows also serve pollinators such as bees and butterflies, which feed exclusively on nectar and pollen (see Figure 17.2), which is just one reason why it is important for meadows on conservation lands to be managed organically. A native meadow can support these pollinators in a time of colony collapse disorder. Bee boxes set up out of the wind and in the morning sun in a secluded part of the meadow can provide learning opportunities, as well as other value-added products for a local farmer.

With an abundance of insects, meadows also offer bats plenty of food. Rotational grazing of small managed areas preserves the habitat needed by meadow insects, and in return provides bats with an abundant food source. Bats can significantly reduce the mosquito populations across the wetland complex. Like bee boxes, bat boxes can be placed around the meadow. A trophic cascade of herbicides ingested by insects, and then ingested by bats has seriously affected New England's bat populations—which is another reason why the meadow should be managed organically.

FIGURE 17.3: Bee boxes house bee colonies in a secluded but accessible area of the meadow. Bees benefit greatly from a wildflower meadow and in return produce value-added honey, which may be harvested for the community.

Native Meadow Grazing

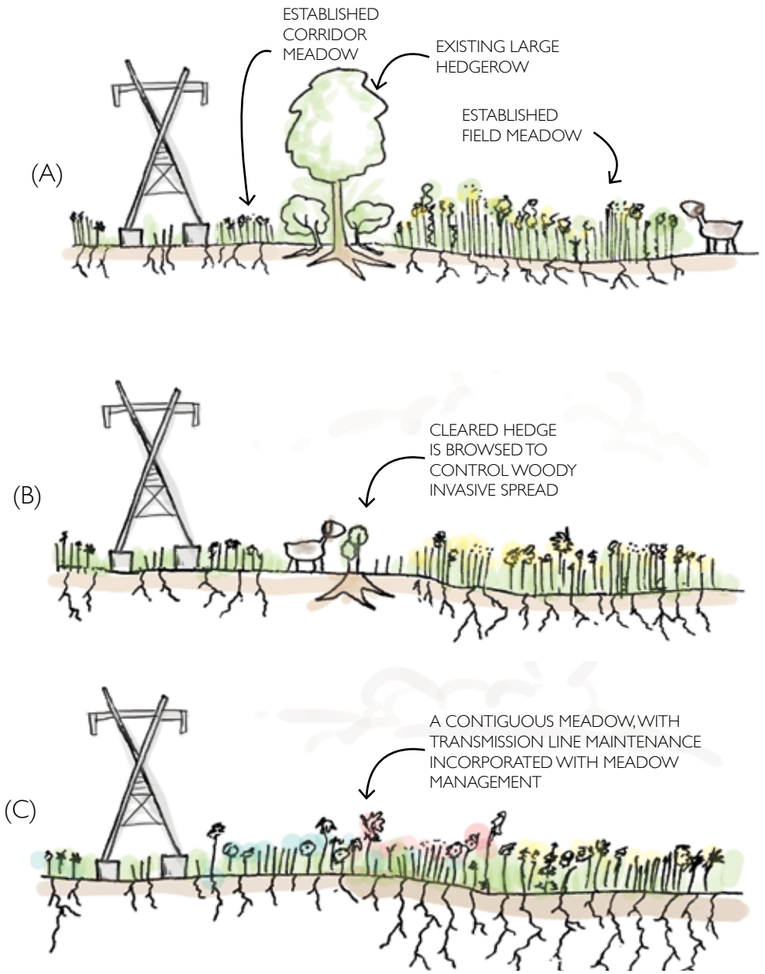


FIGURE 18.1: Once field meadows and corridor meadows beneath the transmission lines are established (A), the remaining hedge may be thinned. The established meadows buffer against invasive plant species that may sprout in the wake of the hedge removal. Goats graze in the disturbed area (B) as needed to control the regrowth of woody species and potential invasive plants. With time, the field and corridor meadow are connected (C).

Rotation and grazing

Meadows are dynamic and will change in species, color, texture, and strata over time and most forbs are biennials and will not bloom until their second or third year. Meadow disturbances, such as periodic mowing, burning, or livestock grazing, are not only necessary to control the growth of woody shrub and tree species, but also to promote the early-succession growth of meadow species, especially that of forbs.

To accomplish this, meadows could be grazed or mowed on a rotation. In this plan, grazing is preferred to mowing in part because it promotes Sherborn's rural character with traditional agrarian field management techniques commonplace in Sherborn's historic working landscapes. This form of natural resource stewardship also potentially generates yields from goat or sheep products that can help support a small agricultural business without the inputs or machinery necessary for hay production. Grazing is slower than mowing and can reduce the risk of meadow species mortality (especially for wood and box turtles). Corralling goats or sheep into a small area allows targeted management of woody species or outbreaks of invasive plants. Lastly, unlike mowers, grazing animals deposit waste that fertilizes the meadow.

Care should be taken to browse or graze animals in areas of invasive plants that are not yet fruiting. Their digestive systems pass the seeds of many plants, included undesired bittersweet, multiflora rose, and buckthorn. However, if browsing occurs when the plants are still young and have not yet fruited, this is not an issue.

Rotational grazing can occur within a single growing season or over an expanse of two to three years, depending on site-specific conditions. As long as woody species are not allowed to grow, the more time between rotations will benefit the meadow, since this allows the meadow to age and develop diversity in species composition and plant structure. A meadow should not be grazed or mowed until the meadow species have firmly established themselves—saving the meadow from patchiness, bare soil, or the invasion of invasive species. If, however, any of the above conditions present themselves early in the meadow's establishment, repeat the procedure for meadow establishment in that localized area.

Rotation can also be done by dividing the meadow into smaller managed areas to be grazed over time in the same year or over an expanse of two to three years depending on the site-specific conditions. This strategy allows wildlife to retreat to ungrazed areas of meadow and preserves the meadow strata (structure provided by varying heights of meadow plants) that is important for wildlife to thrive. Grazing complements this style of rotation well by having the animals graze all plants within an area before moving on. Otherwise, most grazing animals will eat preferred species first and move on without accomplishing the specific management goals. Grazing (or mowing for that matter) should not be overdone. Meadow plants need to rebound from being cut or eaten. Plants will slough off root hairs every time they are disturbed. This promotes healthy soil structure and food webs. However, if a plant is overgrazed (which can also happen with careless mowing), the roots may not be able to provide for the foliage, while the foliage may not be able to provide for the roots, and the plant will die. This can be avoided by moving the grazing animals off a plot when the herbaceous plants are grazed to the ground, and then allowing enough time for the plants to regenerate to full size.

Success of grazing goats

Mass Audubon uses goat grazing on the seven acres of its Habitat Education Center in Weston, Massachusetts. Besides providing the service of meadow reclamation and invasive plant control, the goats have become a major attraction for families and school groups. Moved every two to three weeks to a new 40- to 50-square-foot area, six Nigerian dwarf goats eat and live happily inside a solar-powered electric fence. Property manager Sandy Vorce reports that the dwarf goats successfully feed on buckthorn, bittersweet, and multiflora rose, which suggests that equal success may be achievable in establishing and maintaining a meadow within the transmission line corridor on the Barber Reservation; such a meadow would also comply with the utility maintenance requirements.

FIGURE 18.2: Comparison of goat browsing, sheep grazing, and mowing meadow maintenance strategies.

	Goat browsing	Sheep grazing	Mowing
Target vegetation	woody shrubs and trees	forbs and grasses	woody shrubs, trees, forbs, grasses
Agricultural products	milk, meat	milk, meat, wool	none
Ecosystem services	fertilizer	fertilizer	mulch
Pollution	none	none	noise and air
Wildlife mortality	rare	rare	common
Rotation duration	dependent on herd size	dependent on herd size	fast
Set-up maintenance	yes (water, truck access, strip mowing, fencing)	yes (water, truck access, strip mowing, fencing)	no
Necessitates tending	yes	yes	no
Education and fun	strong	strong	weak

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Managing the
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DESIGN DETAILS
NATIVE MEADOW GRAZING

Trails Plan

A new trail system establishes sustainable use and minimizes impact.

A network of trails is proposed in the Barber Reservation that limits heavy use in impact areas, makes connections to other regional trails, and still creates good recreational opportunities for visitors. Many of the trails are left multi-use as they are currently—with hikers, dog-walkers, mountain bikers, and equestrians having equal access. But some trails in sensitive areas, such as the trail that winds along the eastern edge of the beaver pond, is limited to foot-traffic only.

The proposed Barber trails also connect to the other regional trails (the proposed rail-to-trail and the Bay Circuit Trail). The Town of Sherborn has expressed interest in obtaining ownership of the railroad right-of-way from CSX, and converting it to a regional rail-to-trail. Although it is understand that this project would require large time and energy inputs to complete, this plan incorporates this feature. The Bay Circuit Trail is routed to the north of the beaver pond, regaining part of its original route through Barber. With time, a bridge across the beaver pond (anchored on high bedrock exposures near the water) would provide a beautiful and educational trail experience for this regional trail.

A small footpath around the sensitive wetland area controls the impact on the beaver pond, by restricting access to foot traffic only (excluding uses such as mountain biking or horse-back riding). A wildlife viewing boardwalk is constructed on the higher bedrock features, with views out onto the pond.

The future rail-to-trail creates a potentially significant access point directly into a scenic area of Barber, and also reduces the amount of traffic into the reservation from Western Avenue.

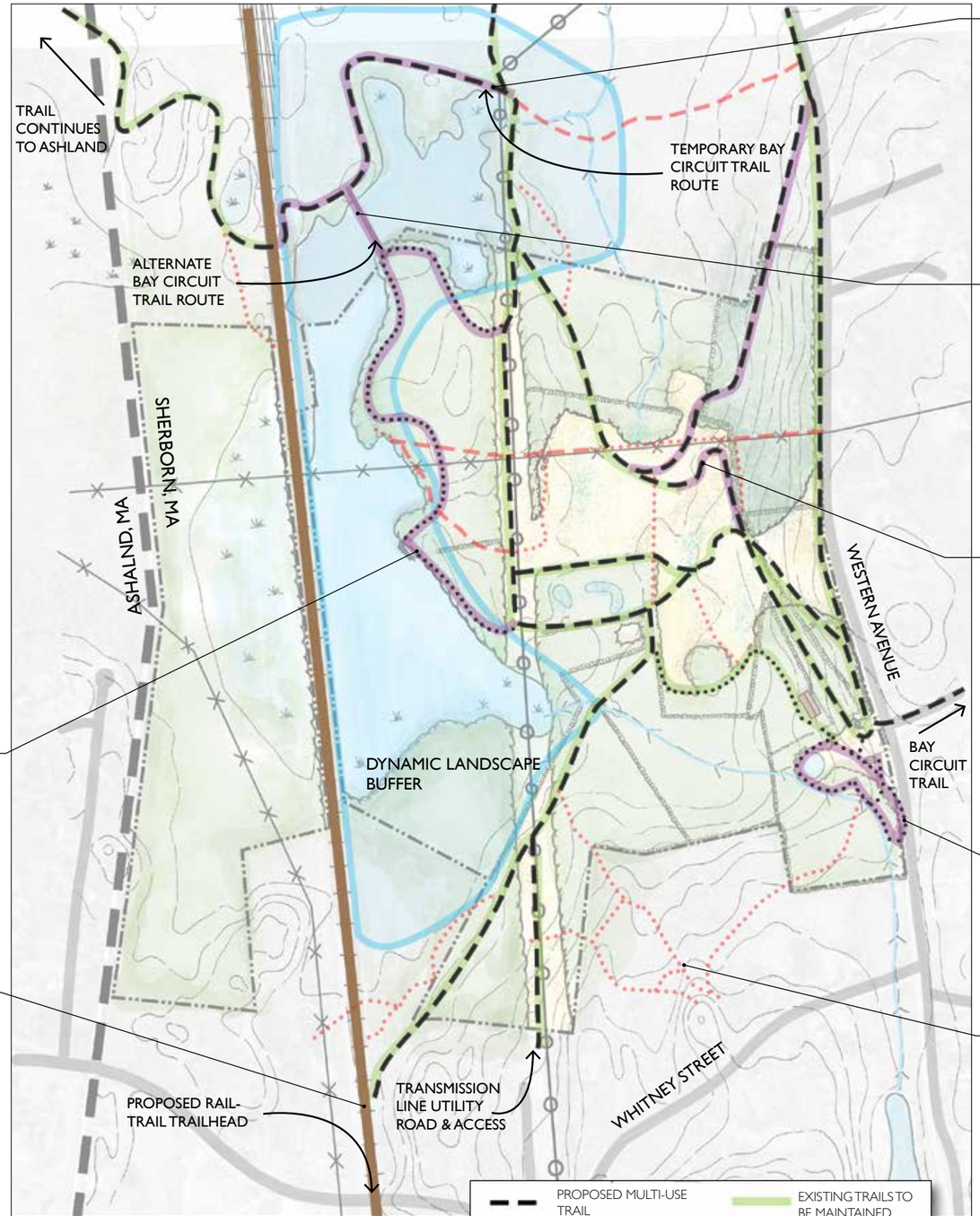

FIGURE 19.1: The proposed trail system, with existing trail routes.

The Bay Circuit Trail is rerouted to the north, through Barber and the Humphrey's Conservation Area, and within the delineated "dynamic landscape buffer" (see Sheet 6). This means that this trail may continue to be re-routed until a more permanent route across the pond is established.

A long bridge spanning the beaver pond allows the Bay Circuit Trail to be re-routed through Barber and over the beaver pond. This gives visitors a chance to view this scenic and beneficial habitat. This bridge would require intensive planning and design, and it would be a late-phase project.

Horse trails around the property are designed and constructed to reduce site disturbance by minimizing erosion associated with equestrian activities. Creating distinct trail loops can lead to pleasant recreational opportunities for cross-country horse-back riding, and clear trail signs reduce confusion or potential trail misuse.

A short loop trail and other accessible paths are located in the homestead area and around the food forest. Horse use is limited in this area, because of potentially erosive (steep and wet) trail conditions.

The existing network of footpaths may be causing additional disturbance in this area of concentrated invasive species. Unless actively maintained, they should be closed.

(Not for construction. This drawing is part of a student project, and not based on a legal survey.)

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DESIGN DETAILS
TRAILS PLAN

Trails Phasing

FIGURE 20.1: Blazed posts line the meadow trail to help establish new trail patterns while the meadow gets established. The meadow trail stays close to the meadow edge, and provides a climbing-turn to prevent cross-contour erosion.

FIGURE 20.2: A wildlife blind provides views across a secluded area of meadow and is approached from behind by a hiking-only trail from the woods.

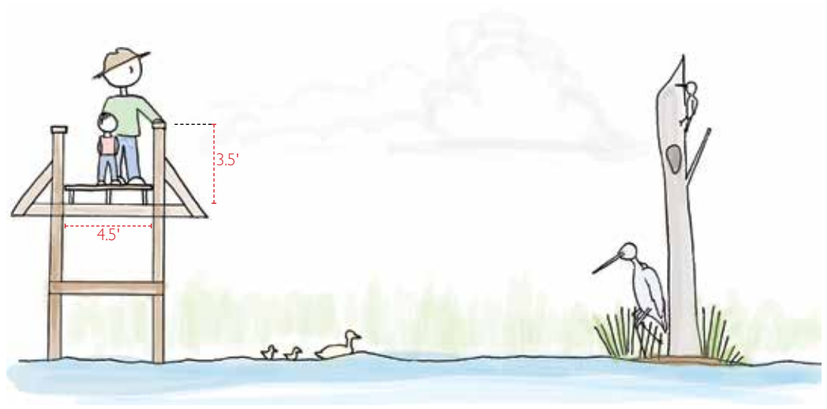

FIGURE 20.3: A foot-bridge permanently reestablishes the Bay Circuit Trail across the scenic beaver pond.

Phase 1

Begin working with equestrians to direct their use to new trail patterns. Re-establish equestrian infrastructure before spending the time and energy on establishing a meadow. Moving and restoring horse jumps will require equipment that may negatively impact a meadow and can result in patchy growth patterns, invasion of non-native species, erosion, or outright damage to the meadow in its early stages.

Phase 2

Unlike the trails concentrated around the homestead area, trails across the reservation traverse a more gently sloped landscape and do not necessitate a built tread. Instead, blazed posts should be erected to make new trail patterns obvious. Meadow trails should be kept defined by laid out brush, mowings, or low-cost wooden ballards (especially along climbing turns) until both the trails and meadow become more established.

Phase 3

Trails that currently exist but are not included in the proposed design should be closed and restored to natural forest through soil de-compaction and revegetation. This is a good time to address erosion issues on trails to be closed. Dig drainage swales or construct water diversion structures (such as water bars or check steps) to assist in restoration efforts.

Phase 4

Build and designate hiking-only trails. The corridors for these trails should be significantly smaller than they are now, so they encourage human-scale trail use only. The beaver pond loop trail should be built before the implementation of the observation deck. The observation deck can be built in sections as funding becomes available and incorporated into the loop trail. The section of trail bypassed by the completed observation deck can be restored through soil de-compaction and revegetation.

As specific-use trails are developed, signage becomes important to define trail use. A trailhead kiosk should provide a trail map of the reservation and trail junctions should be signed for type of use, direction, and location of landscape and built features.

Phase 5

Redirecting the Bay Circuit Trail through the reservation should begin once the interior trail system is established. All trails should be considered and accepted as dynamic structures, that may change in response to environmental conditions.

This is especially true for the beaver pond loop trail and the redirected Bay Circuit Trail. The beaver pond may expand to the north, continuing to redirect the Bay Circuit Trail around the northern edge of the pond, where there is enough space for the trail to migrate into the Humphrey's Conservation Area (as pond expansion necessitates) without losing the connection between the Barber Reservation and the trail's original route.

A partnership between the Appalachian Mountain Club, Sherborn Forest and Trails Association, and Sherborn's equestrians would make this dynamic trail design within the reservation much more successful, since coordinated efforts are generally more effective.

An agreement should be made to allow the Bay Circuit Trail to cross the railroad switchyard to avoid re-routing it to Whitney Street and subsequently Route 126 in Ashland. Securing an easement with the property owner just south of the reservation as well as with the CSX railroad company would be necessary to redirect the Bay Circuit Trail through the reservation if crossing the switchyard in the north is unacceptable. In either case, reestablishing the Bay Circuit Trail in the Barber Reservation is contingent upon agreements with the CSX railroad company.

In addition

Once an agreement is reached to allow the Bay Circuit Trail to cross the railroad switchyard, a one-hundred-foot-long footbridge should be built to make the new route of the Bay Circuit Trail permanent on the reservation's landscape than what a dynamic trail design can provide, thus avoiding continuous re-routing. This, again, may be most successful through a partnership between the Appalachian Mountain Club and the Sherborn Forest and Trails Association.

FIGURE 20.4: Examples. (A) A bridge across wetlands, (B) A log bench made of black locust, (C) A bog-bridge sill made of invasive tree material.

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DESIGN DETAILS
TRAILS PHASING

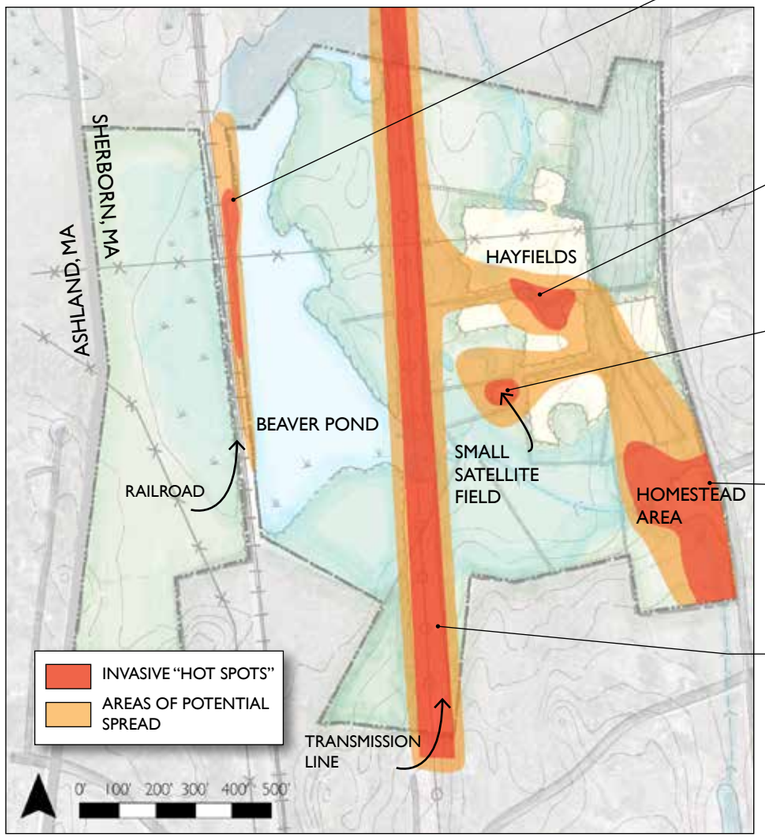
Invasive Plant Management

Because of the persistent nature of many invasive plant species, it is often impractical to expend energy in efforts to fully eradicate them. Instead, it may be more effective to identify areas where focused attention should be directed, and where management is likely to be successful.

To begin to identify focus areas, ecologically sensitive, vulnerable, or valuable areas are identified. In this case, the wetlands, beaver pond, and meadows have the most ecological integrity on the site, due to their size and habitat value. Therefore, it would be appropriate to focus efforts on maintaining these habitats. Next, invasive area "hot spots," or disturbed areas with high invasive plant concentrations, should be located. The hot spots are mapped in relationship to the ecologically sensitive areas, to determine if the invasive plants threaten to migrate into those places. It would be best if efforts were focused on invasive plant management in these areas.

Buckthorns beneath the transmission line corridor, Asiatic bittersweet in the meadow, and Japanese knotweed along the railroad adjacent to the beaver pond all threaten to migrate into ecologically valuable areas. By examining those plant species' ecologies, prevalence on the Barber Reservation, and proximity to vulnerable areas on the property, priority management has been identified for Barber (Figure 21.1). See Appendix III for a table of more information on invasive plant species' ecologies, and their priority ranking on the Barber Reservation.

Figure 21.1: Proposed priority management areas for invasive plant species



Japanese knotweed grows along the edge of the beaver pond, which is a naturally dynamic landscape that will likely change in the future. If the beaver pond drains, and the land transitions to a beaver meadow, it may be vulnerable to invasive species migration.

Asiatic bittersweet and multiflora rose in this central hedgerow may potentially expand into the fields without proper management.

Shade-tolerant buckthorn in this early succession old field may spread into the surrounding forest.

Multi-flora rose, Asiatic bittersweet, and black locust dominate the historically disturbed homestead area.

Buckthorns beneath the transmission lines provide an abundant seed source on the property, and may spread into the beaver pond area and/or the native meadow.

Phase 1: Focusing efforts

The proposed invasive management plan is integrated with other proposed management solutions, such as a developed and concentrated homestead redesign, the meadow establishment, and rotational livestock grazing. These activities will concentrate human energy in a given area, and therefore make land management more efficient and effective. Management strategies in the homestead area (see Sheet 14) and native meadow (see Sheet 16) are proposed so that they can be integrated with a holistic invasive species management program, and reduce the growing capacity of the identified invasive plant species of concern within them.

The invasive plants that require focused attention are:

- Buckthorn in the small old field and beneath the transmission lines.
- Asiatic bittersweet in the old hedgerow in the center of the proposed native meadow.
- Asiatic bittersweet and multi-flora rose in the homestead area, and especially around the proposed community pavilion area.
- Japanese knotweed adjacent to the beaver pond, which should be monitored closely if beaver pond water levels change.

These plants in the proposed priority areas are chosen for focused attention because of their proximity to sensitive or vulnerable habitats, their aggressive spreading mechanisms, and the feasibility of effective management on Barber.

Mechanical (hand) removal is recommended in the first phase, since it would be more effective in removing the large woody masses of the plants (especially large bittersweet vines), and would properly remove any fruit or seeds on the plants. When these larger plants are removed, their biomass can be used in the creation of biochar on site. This is an effective method for recycling the plant's nutrients and reducing the costs of compost or fertilizer (see Sheet 14 for more details).

Phase 2: Following through

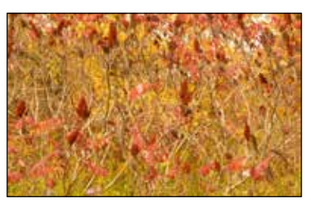
After large-scale removal in the first phase, annual cutting or removal will be required for long-term management. This would remove the species that are migrating into areas of forest, wetland, or meadow, thereby concentrating their populations in the highly impacted or managed areas (such as the homestead area).

This phase can be done with targeted rotational grazing and/or mechanical removal. Goat browsing can target undesired plant species while improving soil fertility. Once the large woody plants are removed with their attached seeds, livestock grazing or browsing in managed areas will continue to keep the young plants cut, therefore reducing their growing capacity. Letting the animals browse in the late spring (or during the flowering phase, before the plants fruit) will ensure that they do not consume (and therefore spread) the plant's seeds. Additionally, this stage of the plant's lifecycle is when energy in the form of plant carbohydrates is sent from the roots and into the new growth. A plant is greatly weakened when it is cut or eaten at this time.

Phase 3: Monitoring & continued management

Finally, a continued monitoring program is recommended for invasive species management. The Land Management Task Force should decide on the extent of invasive species management for the Barber Reservation (i.e., a monitoring program or attempted small-scale eradication). But with any management plan, care should be taken to ensure that base-line species data is created, a more detailed and specific management plan is developed, and a monitoring program is established. More information and study would be needed to develop a detailed and comprehensive invasive species management plan.

FIGURE 21.2: (A) Sumac seeds grow in conical clusters and are favored by birds and insects. (B) Sumac hedges grow and spread readily by lateral root systems which can be established to compete with aggressive invasive vegetation such as glossy buckthorn.



Beaver Pond Management

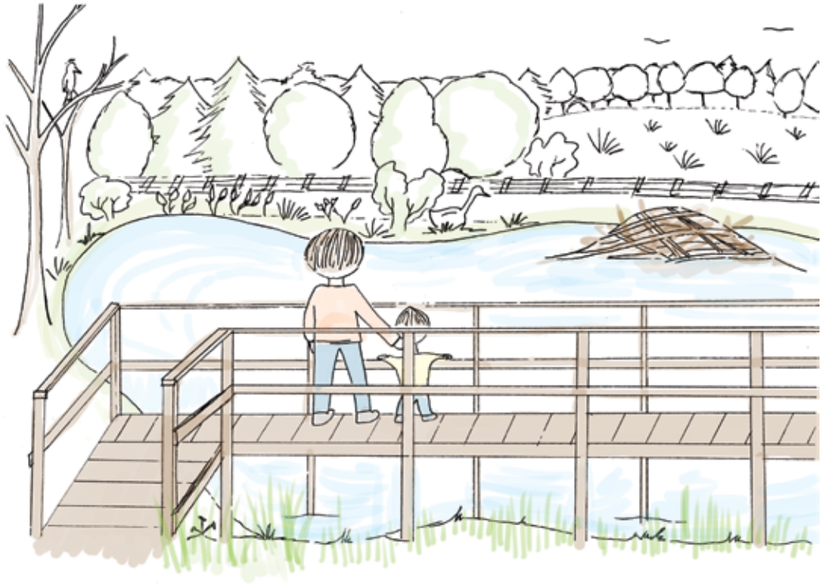


FIGURE 22.1: An observation boardwalk brings people close to the beaver pond—a dynamic ecosystem that supports a diversity of wildlife.

Beaver habitat & lifecycles

Beavers, like humans, are ecosystem engineers who alter their surroundings to best meet their needs. They do this solely for the sake of establishing a home and securing food supplies. Merely by attending to their needs, beavers engineer landscapes. Beaver ponds sequester carbon, trap sediment, and improve soil conditions. They also capture and store water, slowing its runoff, filtering environmental toxins, replenishing aquifers, and preventing erosion and downstream flood damage (beaversolutions.com).

Forested lowlands serve as optimal beaver habitat as water naturally drains into these areas and makes trees in close proximity readily available. Beavers rely on water for movement and protection. It is not uncommon for beavers to take advantage of natural or man-made dams (such as bedrock or railroad impoundments) to establish their dams, lodge, and foraging grounds.

Once a beaver finds these ideal conditions it will work to build a dam. In a man-made environment, building a dam may be as easy as blocking culverts. It is a daily chore to keep culverts unblocked once a beaver establishes itself and afterwards it is illegal to remove a beaver dam without the consent of the conservation commission, which also needs to adhere to state regulations.

There are two types of beaver dams. One works to hinder the flow of water to add depth to the pond. A deep pond is important for winter shelter and food storage. A low pond can freeze a beaver or ruin its winter cache of stored branches and leaves.

Another type of dam works to distribute a stream out of its channel. This adds width to the pond. A wide pond fills in other channels that have intentionally been dug by beavers to provide direct access to forage farther from the lodge. Eventually a beaver will eat itself out of a home and need to move on. Subsequently, the dam will break down since the beaver will no longer be tending to it.

Barber is good beaver habitat

Accommodating beavers on the Barber Reservation is convenient because the natural lay of the land minimizes the potential flooding of private property elsewhere. And even if beavers were removed from this location, more beavers would likely move in from the neighboring wetland complex. Flow devices may be installed to control the depth of the pond but this would most likely just displace beavers to other areas of the reservation or to the conservation land to the north, since all of these areas are lowlands dammed by the same railroad impoundment.

In addition, the height of water in the Barber beaver pond in particular contains and drowns Japanese knotweed along the railroad corridor.

Beaver ponds attract other wildlife, including mammals, birds, fish, and obligate species—some of which may be rare or endangered. Once a pond is abandoned and the dam breaks down, the landscape will convert to a meadow ecosystem providing habitat for new populations of plants and animals (see Sheet 6). However, in most parts of New England a forest will eventually reemerge and the cycle will begin anew.

The ability to access the beaver pond by trails and observation platforms can provide an exceptional opportunity to witness a moment of living natural history on the Barber Reservation.

PHOTO 22.1: More and larger animals, such as osprey and bald eagles, will be attracted to the beaver pond as it continues to grow and mature, since it provides them with great habitat and food sources.

PHOTO 22.2: Meadows, shrubs, and trees will regrow in the wake of beaver activity.

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DESIGN DETAILS
BEAVER POND MANAGEMENT

Forestry Recommendations

The proposed plan incorporates elements of timber harvesting and forestry practices, largely based on recommendations outlined in the 2012 Benjamin/Farrell *Forest Stewardship Plan*, prepared for the Town of Sherborn Conservation Commission. The plan adopted an all-ages management approach, which develops varying age classes within forest stands, thus improving habitat value and overall biodiversity.

The plan identifies 74 individual forest stands and develops a ten-year forest stewardship program based on the improvement of those stands for habitat enhancement. The proposed plan does not incorporate all of the recommendations of the Benjamin/Farrell management program, since some of the recommendations are not aligned with the design strategies and management goals of this project (such as the salvage of timber from the sensitive beaver pond). But in some cases, the forestry plan does include recommendations for individual selection harvest and improvement thinning for increased stand health that are in accord with the proposed plan.

In the following areas, the Benjamin/Farrel recommendations can be adopted, based on their access (especially along the transmission line corridor), their ability to withstand site disturbance cause by timbering, and the need for forest clearing for native meadow establishment.

Light harvest in mixed oak stand (Stand 9)
Mixed oaks are the primary species in this upland forest stand. To improve the growing conditions for some of the younger hardwoods and white pines, this stand has been identified for light individual selection harvest and improvement thinning for crown release. It is possible that some of the timber products produced from this stand could be sold to mitigate some of the other management costs on the property.

This stand can be accessed via utility access routes beneath the transmission lines, or by multi-use trails from the homestead and across the meadow during non-nesting times.

Forest clearing for meadow establishment
The existing forest in this area is cleared to give way to an expanded native meadow. Currently, this forest stand (Stand 27) contains white pine and mixed oak for light harvest, which could bring some financial return. The forest here is generally well-drained upland, and timbering operations won't negatively impact any sensitive habitats.

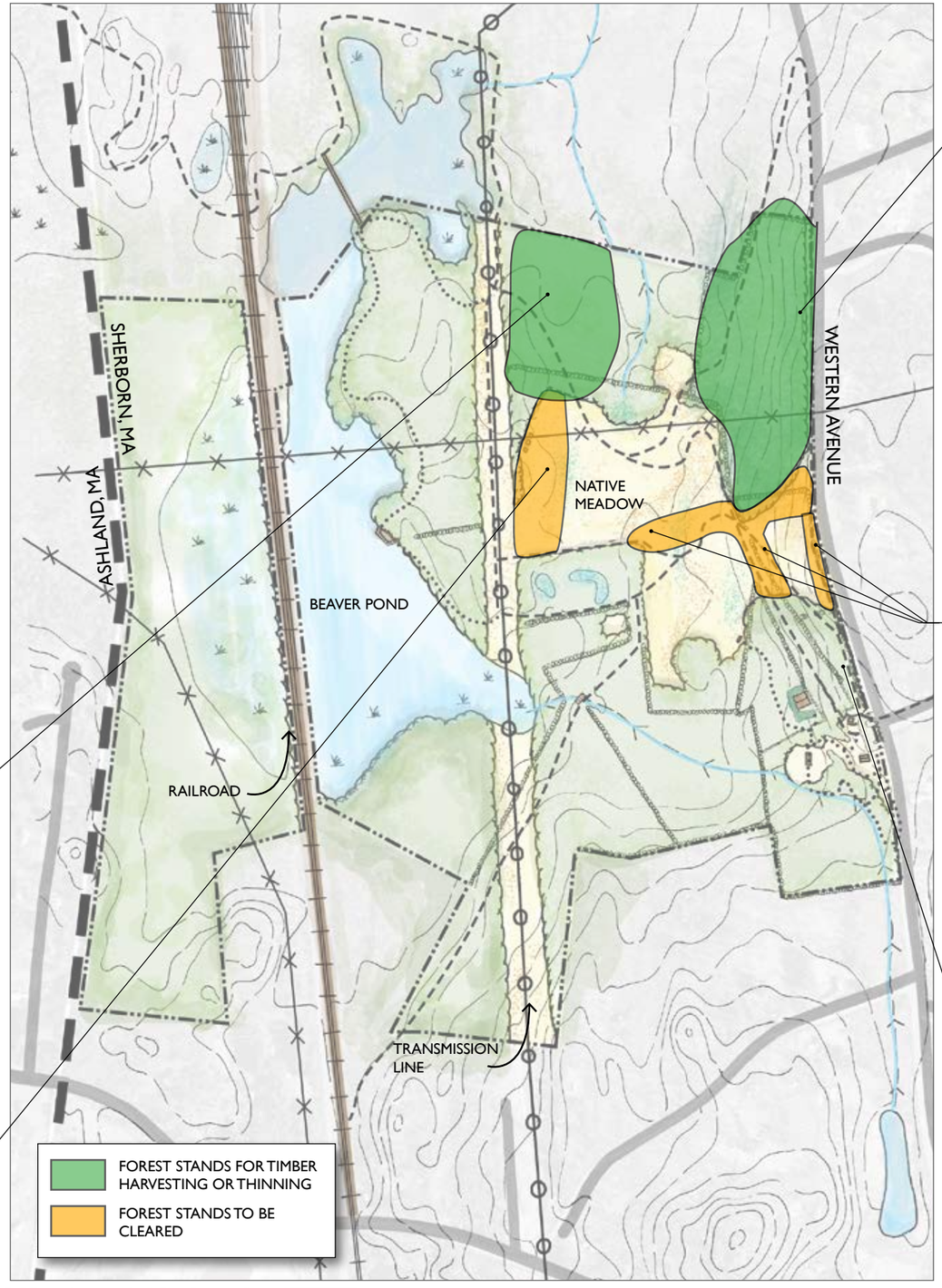

FIGURE 23.1: Proposed areas of active forest clearing or timber harvesting. Forest stands not included in active management should be left to mature.

Light harvest in white pine stand (Stand 13)
White pines and a few young mixed hardwoods are found in this forest stand. A light individual harvest would stimulate the natural regeneration of the younger hardwoods beneath the tall white pine canopy. The white pine and mixed oaks were identified by Benjamin/Farrell to have some long-term commercial value, and so timbering in this stand could help mitigate some of the costs of land management for the rest of the site.

Access to this stand that prevents erosion or site degradation of high-impact utility vehicles is from the mixed-use trail that follows the western side of Western Avenue.

Forest clearing for meadow establishment
The existing forest in this area is cleared to give way to an expanded native meadow, which meets the edge of Western Avenue. Currently, this area (Stands 30 and 31) offers some mixed oak poles for light harvest. These forest edges and hedgerows are composed of early-succession tree species and many invasive species such as glossy buckthorn, bittersweet, and barberry grow in the understory. Much care would have to be taken with their removal and management, as this area becomes native meadow.

No forestry or cutting in black locust stand
Black locust was a popular tree to plant in old homesteads, since it burns very hot, grows quickly to provide good fencing poles, and sprouts vigorously from the roots and stump when cut. For this reason, it would be best to not disturb the black locust trees in this area to help prevent their suckers from shooting up in other areas of the reservation. Although this plant is considered invasive in parts of Massachusetts, it should remain undisturbed and left to complete its natural lifecycle.

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DESIGN DETAILS
FORESTRY
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Next Steps

The Barber Reservation is complex and contains multiple ecosystems and habitats. The focus of this management plan is to assess the landscape and develop a general plan to protect or enhance its functions, including the social aspects of the site, such as recreation and agriculture.

The Conway design team has identified broad phasing and maintenance plans conducive to the site (see sheets 11-23) in support of the overall vision for the reservation. Initial steps to implement this plan must include detailed plans for the homestead, meadow, trails, and beaver pond areas. Because there are no urgent problems, the reservation could be managed much as it is now while the design and planning process continues until a more appropriate time for implementation.

First steps

Develop detailed designs for the homestead, including:

- barn renovation.
- parking lot expansion and staging area development.
- forest garden design and planting plan.
- pond/pool details.
- browsing plan for invasive species.

Develop detailed plans for the meadow, including:

- planting plan.
- rotational grazing plan.

Develop a detailed trails plan.

Monitor beaver population and expansion of pond.

Modify the forestry plan by:

- inventorying and protecting vernal pools.
- adhering to site restrictions identified in this plan.

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NEXT STEPS & REFERENCES

Juglone intolerant species for well-drained soils

Latin name	Common name	Characteristics
Achillea millefolium	yarrow	dynamic accumulator, medicinal (naturalized)
Astragalus spp.	vetch	nitrogen fixing
Baptisia spp.	wild indigos	nitrogen fixing
Castanea spp.	chestnuts	choice nuts (hybrids are blight resistant)
Chamaemelum nobile	chamomile	dynamic accumulator, tea (naturalized)
Ceanothus americanus	New Jersey tea	nitrogen fixing, tea
Comptonia peregrina	sweetfern	nitrogen fixing, tea
Lespedeza spp.	bush clovers	nitrogen fixing
Malus spp.	apples	choice edible fruit (naturalized)
Morus spp.	mulberries	choice edible fruit
Pyrus spp.	pears	choice edible fruit (naturalized)
Ribes spp.	currants	choice edible fruit
Ribes spp.	gooseberries	choice edible fruit
Rubus spp.	blackberries	choice edible fruit
Rumex spp.	docks	dynamic accumulator, edible, medicinal (naturalized)
Symphytum spp.	comfrey	dynamic accumulator (naturalized)
Taraxacum officinale	dandelion	dynamic accumulator, edible, medicinal (naturalized)
Tilia spp.	basswood	edible leaves
Viola spp.	violets	edible leaves and flowers

Juglone tolerant species for well-drained soils

Latin name	Common name	Characteristics
Amalanchier spp.	serviceberry	choice edible fruit
Carya spp.	hickory	edible nut
Cercis canadensis	redbud	nitrogen fixing
Corylus spp.	hazelnut	choice edible nut
Crataegus aestivalis	mayhaw	edible fruit
Cydonia oblonga	quince	edible fruit (naturalized)
Morus alba	white mulberry	choice edible fruit (naturalized)
Prunus spp.	some cherry varieties	choice edible fruit
Rosa spp.	wild rose varieties	edible fruit, medicinal
Rubus occidentalis	black raspberry	choice edible fruit
Trifolium repens	white clover	nitrogen fixing (naturalized)
Viburnum spp.	most viburnums	edible fruit

APPENDIX I: Forest garden plant palette compiled from materials by Dave Jacke, Dynamics Ecological Design.
www.edibleforestgardens.com

Juglone intolerant species for poorly-drained soils

Latin name	Common name	Characteristics
Allium tricoccum	ramps	choice edible leaves and bulb
Alnus spp.	alder	nitrogen fixing
Aronia spp.	chokeberry	choice edible
Laportaea canadensis	wood nettle	dynamic accumulator, tea
Vaccinium spp.	blueberry	choice edible

Below, left to right:
(A) Nitrogen-fixing bacteria live in the root nodules of red clover and help improve soil fertility.
(B) A groundcover of edible violets.
(C) Pawpaws are traditionally a southern tree fruit but even Connecticut has naturalized stands of pawpaw trees.


(A)


(B)


(C)

Juglone tolerant species for poorly-drained soils

Latin name	Common name	Characteristics
Asimina triloba	pawpaw	choice edible fruit (naturalized)
Crataegus spp.	hawthorn	edible fruit, medicinal
Lindera benzoin	spicebush	spice, tea
Polygonatum biflorum	giant solomon's seal	edible shoots
Sambucus canadensis	elderberry	medicinal, edible
Viburnum trilobum	highbush cranberry	edible


(D)


(E)


(F)


(G)

Above, left to right:
(D) Serviceberry is the first tree to bloom in the spring, and then fruits in June. (E) Ramps are prized for the bulbs, but harvesting only the leaves is just as good. (F) Oyster mushrooms should be grown on inoculated and labeled logs. (G) Wine caps grow on woodchips mulch.

Mushrooms

Latin name	Common name	Substrate
Pleurotus spp.	oyster	dead soft-hardwoods, straw
Lentinula spp.	shiitake	dead hardwoods
Stropharia rugosoannulata	wine cap	woodchips, straw

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APPENDIX I
FOOD FOREST PLANT PALETTE

Flowering time	Scientific name	Common name	Bloom color	Height	Soil	Pollinator	Larval host
Late Spring	*Aquilegia canadensis*	red columbine	red/yellow	12in.	wet	bees, butterflies	Columbine Dusky Wing butterfly
	Iris versicolor	iris	purple	2ft.	wet	insects	Canadian Tiger Swallowtail
	Penstemon digitalis	foxglove beardtongue	white	18-24in.	dry or wet	bees	Chalcedony Midget moth
	Viola pedata	bird-foot violet	blue/purple	6-8in.	wet	bees	Fritillaries butterfly
	Zizia aptera	heart-leaved golden Alexanders	yellow	18in.	wet	bees	Eastern Black Swallowtail butterfly caterpillars
Early Summer	*Baptisia australis*	false indigo	blue	4-5ft.	dry or wet	bees, butterflies	
	Baptisia tinctoria	yellow wild indigo	yellow	3ft.	dry or wet	bees, butterflies	Wild Indigo Duskywing butterfly
	Eupatorium maculatum	boneset	white	4ft.	dry or wet	bees, butterflies	
	Geum triflorum	prairie smoke	pink	1ft.	wet	insects	
	Lupinus perennis	sundial lupine	pale blue	24in.	dry or wet	bees, butterflies	Frosted elfin, Blue butterflies, rare Kamer Blue butterfly
	Monarda fistulosa	bergamont	lavender	5ft.	dry or wet	bees	
Late Summer	*Amorpha canescens*	lead plant	lavender	4ft.	dry or wet	bees	Dog Face butterfly
	Angelica atropupurea	purplestem angelica	white	3-4ft.	dry or wet	butterflies	Short-tailed Swallowtail butterfly
	Asclepia incarnata	swamp milkweed	pink	15-24in.	wet	butterflies, bees, insects	Monarch butterfly
	Eutrochium maculatium	Joe-Pye weed	pink	2-8ft.	wet	butterflies, insects	
	Liatris spicata	blazing star	purple	2ft.	wet	bees	
	Lilium canadense	Turk's cap lily	yellow	5ft.	wet	bees	
	Monarda didyma	bee balm	red/pink/purple	30in.	dry	bees, butterflies, hummingbirds	
	Oenothera biennis	evening primrose	yellow	4ft.	dry or wet	bees, butterflies	
	Pycanthemum muticum	clustered mountain-mint	white	2-3ft.	dry	bees, butterflies, moths	Spring Azure butterfly
	Solidago caesia	axillary goldenrod	yellow	24in.	dry	bees, butterflies, insects	Spring Azure butterfly
	Spiraea tomentosa	rosy meadowsweet	pink	24-36in.	wet	bees, butterflies, birds	Columbia silkmoth
	Teucrium canadense	American germander	white/violet	24-36in.	dry	bees	
	Verbena hastata	vervain	blue	5ft.	wet	bees, butterflies	
	Vernomia noveboracensis	New York ironweed	pink	3-4ft.	wet	butterflies	
	Veronicastrum virginicum	Culver's-root	white	3ft.	wet	bees	Buckeye butterfly
Early Fall	*Asclepias tuberosa*	butterfly milkweed	orange	12-18in.	dry or wet	bees, butterflies, hummingbirds, insects	
	Aster cordifolius	blue wood aster	lavender	4-5ft.	moist	bees, butterflies, inscets	Silvery Checkerspot butterfly
	Enchinacea purpurea	Purple coneflower	purple	24-36in.	dry or wet	bees, insects	
	Liatris spicata	blazing star	lavender	18-24in.	wet	bees, butterflies	
	Lonactis linariifolia	flax-leaf ankle-aster	lavender	12-18in.	dry or wet	bees	Chalcedony midget moth
	Tradescantia virginiana	spiderwort	blue	12-24in.	dry or wet	bees	
Late Fall	*Symphyotrichum novae-angliae*	New England aster	white/pink	12-30in.	dry or wet	bees, butterflies, birds	Cresent butterfly, Silvery Checkerspot butterfly
Grasses	*Andropogon gerardii*	big bluestem		4-5ft.	dry		Delaware skipper butterfly
	Elimus virginicus	wild rye		3ft.	dry		
	Panicum virgatum	switchgrass		3-6ft.	dry or wet		Leonard's skipper butterfly
	Scizachyrium scoparium	little bluestem		3ft.	dry		Delaware skipper butterfly
	Sorghastrum nutans	indian grass		3ft.	dry		

APPENDIX II: Meadow plant palette compiled from materials by the New England Wild Flower Society and Plants for a Future.
www.newenglandwild.org, www.pfaf.org

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APPENDIX II
NATIVE MEADOW PLANT
PALETTE

APPENDIX III: The ecology and priority ranking of invasive or noxious species found on the Barber Reservation.

Species	Prioritization Rank (from the USDA Invasive Species Impact Rank)	Prioritization Rank (as proposed for the Barber Reservation, see Sheet 21)	Ecology	Habitat	Potential Ecological Impacts	Spreading Mechanisms	Flowering & Fruiting (Ideal Timing for Control)	Recommended Action for Barber Reservation	Recommended native replacements
Glossy Buckthorn *Rhamnus frangula*	High	Medium	Tall woody shrub or small tree with a spreading crown. When cut, they re-sprout vigorously.	Shade tolerant, and can be found in wet meadows and wetlands, thickets, hedgerows, pastures, abandoned fields, roadsides, and forest understories.	Glossy buckthorn can aggressively move into wetland areas. It competes with other species for soil nutrients, creates a dense thicket, and shades other understory plants.	The abundant fruits are eaten by birds with long-distance dispersal ability. Seeds are quick to establish in sunny areas.	Flower: late May-first frost Fruit: early July-September	Mechanical removal or grazing of individual species within the forest understory. Establishing a shaded canopy in infested areas may help reduce populations, as plant vigor is correlated to sunlight.	Nannyberry (*Viburnum lentago*), hazelnut (*Corylus spp.*), chokecherry (*Prunus virginiana*), Aronia (*Aronia melanocarpa*)
Common Buckthorn *Rhamnus cathartica*	High	Medium	Tall woody shrub or small tree with a spreading crown. When cut, they re-sprout vigorously.	Shade tolerant, and can be found in thickets, hedgerows, pastures, abandoned fields, roadsides, and forest understories.	It competes with other species for soil nutrients, creates a dense thicket, and shades other understory plants.	The abundant fruits are eaten by birds with long-distance dispersal ability. Seeds are quick to establish in sunny areas.	Flower: May-June Fruit: August-September	Mechanical removal or grazing of individual species within the forest understory. Establishing a shaded canopy in infested areas may help reduce populations, as plant vigor is correlated to sunlight.	Nannyberry (*Viburnum lentago*), hazelnut (*Corylus spp.*), chokecherry (*Prunus virginiana*), Aronia (*Aronia melanocarpa*)
Asiatic Bittersweet *Celastrus orbiculatus*	High	High	Deciduous vine	Shade tolerant, but begins by invading sunny areas, such as open fields, along field, road, and path edges, and in any other areas that are sunny.	Uses existing trees and shrubs as "scaffolding" as it climbs to access sunlight, restricting the host's vascular system. Weakened, the tree is vulnerable to decreased sunlight and storm damage.	High seed production and good seed viability. Seed is dispersed by birds and other berry-feeding animals, and to a lesser extent, wind and water.	Flower: May-June Fruit: July-October	Small patches and new sprouts can be hand-pulled or grazed before the plant fruits. Complete control may depend on repeating control methods for several years.	American bittersweet (*Celastrus scandens*), Virginia creeper (*Parthenocissus quinquefolia*)
Multiflora Rose *Rosa multiflora*	Medium	Medium	Dense spreading shrub in the rose family, with arching canes and thorns.	Old fields, pastures, roadsides, and forest edges. Thrives in sunny areas and with well-drained soils.	Where it grows in dense thickets, it replaces surrounding vegetation, especially in old fields and pastures.	High seed production, with long seed viability (10-20 yrs). Birds and mammals eat the rose hips, dispersing the seeds.	Flower: May-June Fruit: July-August. (Fruits remain until following spring.)	Grazing or mechanical removal before plant fruits.	Native roses (pasture rose - *Rosa carolina*, prairie rose - *Rosa arkansana suffulta*)
Bush Honeysuckles *Lonicera spp.*	High	Low	Dense, upright deciduous shrubs with shallow roots.	Broad range of plant communities with varying levels of moisture and shade levels. Disturbed woodlands are generally most affected.	Vigorous growth in forest understories inhibits growth of woodland shrub and understory species.	The abundant fruits are eaten by birds with long-distance dispersal ability.	Flower: May-June Fruit: August-October (for *L. maacki*). Fruit: July-August (for *L. tartarica*).	Because of abundance on site and lack of feasibile control, none (except monitoring for spread in sensitive ecological areas).	Shadblow-Serviceberry (*Amelanchier canadensis*), Carolina allspice (*Calycanthus floridus*), Elderberry (*Sambucus spp.*), Trumpet honeysuckle (*Lonicera sempervirens*)
Winged Euonymus-Burning Bush *Euonymus alatus*	Low	Low	Large deciduous shrub.	Open woodlands, mature second-growth upland forests, open second growth lowland forests, small ravines in valley floor forests.	Forms a broad, closed crown and creates dense thicket-like shrub layer; shades out native herbs and crowds out native shrubs.	The abundant fruits are eaten by birds, with long-distance dispersal ability.	Flower: May-June Fruit: July-October	Because of small population clustering in already disturbed areas, none (except monitoring for spread in sensitive ecological areas).	Large fothergilla (*Fothergilla major*), Aronia (*Aronia spp.*), Virginia sweetspire (*Itea virginica*), blackhaw (*Viburnum prunifolium*), Strawberry bush (*Euonymus americanus*), eastern wahoo (*Euonymus atropurpureus*)
Japanese Barberry *Berberis thunbergii*	High	Low	Compact, spiny shrub.	Prefers well-drained soils. Found in woodland edges, roadsides, old fields, and open woods.	Competes with native woodland species, and adversely increases soil pH to become more acidic.	Seed and creeping roots. Branches root freely with contact to the ground. Birds and mammals eat and distribute the seeds.	Flower: May-June Fruit: July-October. (Fruits remain on plant through winter).	Because of low population densities on the site, none (except monitoring for spread in sensitive ecological areas).	Large fothergilla (*Fothergilla major*), winterberry holly (*Ilex verticillata*), currant (*Ribes americanum*), bush cinquefoil (*Potentilla fruticosa*), fragrant sumac (*Rhus aromatica*)
Black Locust *Robinia psuedoacacia*	High	Low	Leguminous deciduous tree.	Prefers well-drained and sunny woodlands. Commonly found in disturbed areas like pastures, degraded woods, thickets, old fields, and roadsides.	Dense clonal stands shade out understory vegetation.	Reproduces vegetatively by root suckering and stump sprouting. They can form dense groves of clones.	Flower: June Fruit: Fall, seed pods stay on plant until winter.	Because of prolific suckering when cut or disturbed, none.	Honey locust (*Gleditsia triacanthos*)
Poison Ivy *Toxicodendron radicans*	n/a (not considered invasive)	Low	Vine. Can climb up trees and shrubs, or grow along ground.	Prefers disturbed areas, especially woodlands and forest edges.	Though the vine can be competitive, it is generally not harmful to other native flora.	Propagates by seed, by leafy shoots sent up from the roots, and by stems that can take root where they touch the soil.	Flower: May-July Fruit: August-September	Because of abundance on site and lack of feasibile control, none (except for management with rotational grazing if possible in areas of potential human contact).	Poison ivy is native to the northeast.
Japanese Knotweed *Fallopia japonica*	High	Low	Large herbaceous perennial plant, with hollow stems and distinct raised nodes.	Stream-side banks, ditches, wetlands, roadsides, and disturbed areas.	An extremely competitive invader of significant riparian and wetland habitats, as well as lower-quality sites. Infestations can replace native species and degrade aquatic habitat. Once established, control can be labor-intensive.	Propagates via vigorous rhizome spread and shoots. Reproduces to a lesser extent with seeds that spread primarily by waterways.	Flower: July-September	Because lack of proper access and feasibility of control, currently none. If the beaver pond water level lowers, it may allow knotweed's spread down to the edge of the pond. It may be possible to grow sumac to prevent knotweed spread, since it's similar and dense root structure prevents knotweed's rhizomes from laterally spreading.	Goats beard (*Aruncus dioicus*), red-stemmed dogwood (*Cornus serisea*)

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APPENDIX III
INVASIVE PLANT SPECIES