Massachusetts Department of Conservation and Recreation
Bureau of Planning and Resource Protection
Resource Management Planning Program

RESOURCE MANAGEMENT PLAN

Lowell/Great Brook Planning Unit

Including Lowell-Dracut-Tyngsborough State Forest, Lowell Heritage State Park, Great Brook Farm State Park, Carlisle State Forest, Warren H. Manning State Forest, Billerica State Forest, and Governor Thomas Dudley State Park

October 2014

dcr
Massachusetts

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RESOURCE MANAGEMENT PLAN

2014

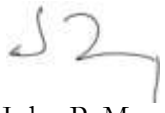
Deval L. Patrick, Governor
Maeve Vallely Bartlett, Secretary
John P. Murray, Commissioner
Kevin J. Whalen, Deputy Commissioner for Park Operations

Resource Management Plans provide guidance for managing properties under the stewardship of the Department of Conservation and Recreation (DCR). They are intended to be working documents for setting priorities, enabling the DCR to adapt to changing fiscal, social, and environmental conditions. The planning process provides a forum for communication and cooperation with park visitors and the surrounding communities to ensure transparency in the DCR's stewardship efforts.

The Lowell/Great Brook Planning Unit is as diverse as the DCR's park system as a whole. From the collection of highly significant cultural resources and urban green spaces that make up Lowell Heritage State Park, to the historic working agricultural landscape of Great Brook Farm State Park, to the roughly 1,500 acres that encompass five other heavily wooded properties in the planning unit, visitors can enjoy a range of urban, rural, and backwoods experiences all within a seven mile radius. It is really pretty remarkable.

There are also many educational and recreational opportunities available within the planning unit, from learning about the 19th century textile industry and the inner workings of a dairy farm, to hiking, biking, and cross-country skiing by moonlight, the properties provide a little bit of everything for everyone. In several cases, the DCR has partnered with private and public entities to further enhance these opportunities, and ensure that the planning unit is able to be enjoyed today, and for years to come.

This Resource Management Plan provides recommendations that protect the natural and cultural resources of each property, while providing for compatible recreation, so that they are available for future generations.



John P. Murray
Commissioner

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, dams and parkways. Led by Commissioner John P. Murray, the agency's mission is to protect, promote and enhance our common wealth of natural, cultural and recreational resources. To learn more about the DCR, our facilities and our programs, please visit us at www.mass.gov/dcr. Contact us at mass.parks@state.ma.us.

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EXECUTIVE SUMMARY

INTRODUCTION

The Department of Conservation and Recreation (DCR) is directed by a legislative mandate (M.G.L. Chapter 21, Section 2F) to prepare management plans for every reservation, park and forest, to provide guidelines for the management and stewardship of natural and cultural resources, and ensure consistency between recreation, resource protection and sustainable forest management. The legislative mandate also requires the incorporation of public review and input into the development of management plans, and review and adoption by the DCR Stewardship Council.

Resource Management Plans (RMPs) consider the past, present and future of a reservation, park or forest. Through an assessment of resources and their existing conditions, clear management goals and objectives are developed, and short and long-term implementation action plans are identified for the management of properties under the stewardship of the DCR. RMPs are written to meet the information needs of a diverse audience: from the decision-makers directly involved in the operation and management of a property, to a variety of outside stakeholders. RMPs are intended to be working documents for setting priorities, budgeting and resource allocation, and establishing guidelines for balancing sustainable recreation with the stewardship of natural and cultural resources. Finally, RMPs are of value to users that are interested in learning more about specific properties, the challenges the DCR faces and how decisions affecting the properties are made.

This plan covers the Lowell/Great Brook Planning Unit in the municipalities of Lowell, Dracut, Tyngsborough, Carlisle, Chelmsford and Billerica, Massachusetts.

THE LOWELL/GREAT BROOK PLANNING UNIT

The Lowell/Great Brook Planning Unit is very diverse and can be viewed as a microcosmic representation of the DCR state park system as a whole. From the collection of highly significant cultural resources and urban green spaces that make up Lowell Heritage State Park, to the historic working agricultural landscape of Great Brook Farm State Park, to the roughly 1,500 acres encompassing the five other heavily wooded properties in the planning unit, and a range of recreational uses in between, there are few characteristics that can be applied to the planning unit as a whole. In addition, there are several partnerships and co-management relationships in place at many of these properties. The defining characteristics for the individual properties are as follows:

Lowell-Dracut-Tyngsborough State Forest

A large swath of protected open space that is predominantly wooded, with many low wet areas and little park infrastructure, Lowell-Dracut-Tyngsborough State Forest provides miles of trails and recreational access for the nearby urban population, along with habitat protection that is regionally important. There are also three Conservation Restrictions associated with the forest, totaling approximately 73 acres.

Lowell Heritage State Park

An urban park encompassing a variety of parcels within the City of Lowell and operated through multiple shared management systems, this property was established to showcase the history of the city. The DCR owns numerous historic, and a few more recently constructed, buildings and structures, including four gatehouses that are a part of canal operations and the Mack building; green spaces ranging from a small Victorian garden to the one-mile-long Vandenberg esplanade along the Merrimack River; and some unusual resources, including air rights over many of the city's canals. Lowell Heritage State Park provides both interpretive opportunities and recreational access in a dense urban setting.

Great Brook Farm State Park

A working dairy farm connected to miles of trails that are used for a variety of recreational activities, Great Brook Farm includes historic buildings and resources alongside a new "smart" barn with a robotic milking system, interpretive programming and a cross-country ski concession.

Carlisle State Forest

A small wooded property protected from forestry activities at the turn of the 20th century in order to conserve an older stand of exceptionally large eastern white pines. Undeveloped and used primarily by local residents, this small gem provides recreational access and habitat protection.

Warren H. Manning State Forest

A largely wooded property with a small recreation area, complete with a spray deck, picnic area and fitness trail. Named for the preeminent landscape architect that advocated, and donated land for, the protection of public woodlands in the Town of Billerica, this property provides recreational opportunities and habitat protection in a suburban environment.

Billerica State Forest

An undeveloped and largely wooded property bordering Route 3, this property provides recreational access and habitat protection.

Governor Thomas Dudley State Park

The smallest facility within the planning unit, this 11-acre park is a small wooded parcel that provides access to the Concord River and links to other protected open space.

MANAGEMENT PRINCIPLE AND GOALS

Through the Resource Management Planning process, a principle for managing the Lowell/Great Brook Planning Unit was established and four associated goals developed.

Management Principle

Protect the natural and cultural resources of the planning unit and provide enhanced recreational and educational opportunities for visitors through the creative use of state resources and partnerships.

Management Goals

The following four management goals have been developed to achieve the management principle. These goals are of equal importance, and are not presented in order of priority.

Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.

Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.

Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.

Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.

PRIORITY RECOMMENDATIONS

Recommendations are characterized on the basis of priority (i.e., High, Medium, or Low) and resource availability. High priority recommendations are those that address regulatory compliance or public health and safety; prevent immediate damage to, or loss of, resources; or repair or replace damaged equipment or systems critical to park operations. They are typically time sensitive. Medium priority recommendations maintain existing resources and visitor experiences. Low priority recommendations enhance resources or visitor experiences; they are not time sensitive.

Resource availability considers both funding and labor. A resource availability of one indicates that funding and/or labor are available to implement the recommendation. A resource availability of two indicates that funding and/or labor are not currently available, but may become so in the near future (i.e., the next five years). A resource availability of three indicates that funding and/or labor are not anticipated in the next five years. Resources to implement these recommendations may, or may not, become available after five years.

This RMP identifies 160 management recommendations; 77 are classified as high priorities. Resources are currently available to implement 43 of these high priority recommendations. It is anticipated that resources will be available within the next five years to implement 27 additional high priority recommendations. These recommendations, and the lead DCR unit responsible for their implementation, are identified in the Action Plan that accompanies this Executive Summary.

Table ES.1. Summary of management recommendations.

Priority	Resource Availability 1	2	3	*Total*
High	43	27	7	*77*
Medium	14	32	7	*53*
Low	7	13	10	*30*
Total	*64*	*72*	*24*	

PUBLIC PARTICIPATION IN DEVELOPING THIS RMP

Notice of a public meeting and the DCR's intent to prepare a Resource Management Plan for the Lowell/Great Brook Planning Unit appeared in the July 11, 2012 issue of the Environmental Monitor. Additional announcements were posted on the DCR website and press releases were provided to the local media. Announcements were also distributed to individuals, statewide, regional and local stakeholder organizations and local officials. An initial public meeting occurred on July 23, 2012 in the Hart Barn at Great Brook Farm State Park in Carlisle. Twenty people attended this initial meeting. Public input was received at the meeting and through e-mail received during a 30-day public comment period after the meeting.

A public meeting to present an overview of the draft RMP was held on July 21, 2014 in Alumni Hall at the University of Massachusetts Lowell; it was attended by 17 people. Notice of the meeting was published in the July 9, 2014 issue of the Environmental Monitor and posted on the DCR website. Press releases were provided to local media and notices were sent directly to individuals, stakeholder organizations and local officials. The draft RMP was made available on the DCR website, at the Powell Memorial Library in Lowell, Gleason Public Library in Carlisle, Billerica Public Library, Parker Memorial Library in Dracut, and Tyngsborough Public Library, as well as at the Great Brook Farm State Park Headquarters on July 22, 2014.

The public comment period on the draft RMP ran from July 22, 2014 through August 29, 2014. Eight sets of comments were received and incorporated into the final RMP (see Appendix B). This Resource Management Plan was submitted to the DCR's Stewardship Council on September 5, 2014 and was adopted by the Council on October 3, 2014.

Action Plan 2014-2019

Priority Action	DCR Lead Unit(s)
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.	
Remove the debris at the former headquarters site that poses a threat to significant resources (i.e., the pump house cellar hole) and public safety (i.e., glass bottles). [LDT SF]	Mass Parks
Address the culverts within the forest that are blocked and/or collapsing. [LDT SF]	MassParks, Planning and Engineering
Remove the graffiti from Sheep Rock and work with the Environmental Police to curb the illegal activities that take place at the site. [LDT SF]	MassParks and Planning
Assess the condition of the interior and exterior of the Rynne bathhouse and make repairs, where necessary. [Lowell Heritage SP]	MassParks, Planning and Engineering
Meet with the National Park Service to develop and implement a preservation plan for the Hamilton Wasteway Gatehouse. [Lowell Heritage SP]	MassParks, Planning and Engineering
Revisit the draft Comprehensive Interpretive Plan; revise and update it as necessary and finalize. [Great Brook Farm SP]	MassParks
Develop interpretive programs, opportunities and products as identified in the Comprehensive Interpretive Plan, working to expand interpretive offerings beyond the "smart" barn tours. [Great Brook Farm SP]	MassParks
Clear the debris currently built up around the beaver deceivers to maintain water flow and keep them operational. [Great Brook Farm SP]	MassParks
Routinely monitor "The City," particularly the Garrison House site, for stability and potential disturbances. [Great Brook Farm SP]	MassParks and Planning
Remove the broken sign at the Garrison House site. [Great Brook Farm SP]	MassParks
North Schoolhouse: Carefully remove the English ivy from the walls, with guidance from the DCR's Office of Cultural Resources. [Great Brook Farm SP]	MassParks and Planning
Main Farm House: Install an appropriate gutter, with guidance from the DCR's Office of Cultural Resources. [Great Brook Farm SP]	Planning
Main Farm House: Complete minor repairs to the siding and front door sill, with guidance from the DCR's Office of Cultural Resources. [Great Brook Farm SP]	Planning
Tie Stall Barn: Assess the stability of the foundation in areas where it has visibly been compromised and repair as necessary, with guidance from the DCR's Office of Cultural Resources. [Great Brook Farm SP]	Planning and Engineering
Litchfield House: Complete repairs to the barn. [Great Brook Farm SP]	Planning
Keep the vegetation on Old North Road trimmed back to ensure emergency access capabilities. [Great Brook Farm SP]	MassParks
Review all buildings for visibility of street numbers, and correct where needed. [Great Brook Farm SP]	MassParks
Update the inventory of the large eastern white pine trees, last done in 1980. [Carlisle SF]	Forestry
After completing the tree inventory update, revisit the Land Stewardship Zoning to determine if any changes are applicable. [Carlisle SF]	Planning and Forestry
Monitor for invasive pests, especially hemlock wooly adelgid. Propose biological or chemical controls, if warranted, on the specimen trees. [Carlisle SF]	Forestry
Clean up the dumping debris located off of Rangeway Road and continue to monitor the area for illegal dumping. [Manning SF]	MassParks
Dismantle the fire ring located at the top of Gilson Hill to discourage use. [Billerica SF]	MassParks
Clean up the dumping debris located adjacent to Winning Street and continue to monitor the area for illegal dumping. [Billerica SF]	MassParks

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Action Plan 2014-2019 (Continued)

Priority Action	DCR Lead Unit(s)
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.	
Review and update or create, where appropriate, a trail map for each of the properties in the planning unit and make the maps available through multiple outlets. [Planning Unit]	MassParks and External Affairs
Work with the Environmental Police to curb the illegal recreation activities (e.g., off-highway vehicle use and paintball games) taking place at the forest. [LDT SF]	MassParks
Post signs that clearly indicate the boundary of the forest's "No Hunting Areas." [LDT SF]	MassParks and Forestry
Formalize the main parking area at the forest's main entrance on Trotting Park Road in Lowell; consider signing and expanding the area, lining the spaces and designating at least one accessible space. [LDT SF]	MassParks and Planning
Improve the trail signage within the forest, adding trail names and intersection numbers where appropriate. [LDT SF]	MassParks and Forestry
Post fish consumption advisory signs in multiple, locally spoken languages at popular fishing spots along the Merrimack River and Lowell Canal System. [Lowell Heritage SP]	MassParks and External Affairs
Ensure that all of the violations noted in the 2013 inspection of the Lord pool are addressed in the upcoming modernization project. [Lowell Heritage SP]	Engineering
Update the inventory of benches on the Vandenberg esplanade and make repairs, or replacements, where necessary. [Lowell Heritage SP]	MassParks and Planning
Develop a trails plan, assessing trail density and incorporating critical information developed through the hydrological study to better address areas that have trail washout problems. [Great Brook Farm SP]	Planning
Securely cover the open well located southeast of the Litchfield House. [Great Brook Farm SP]	MassParks
Reassess all boardwalk crossings to identify older ones in need of replacement, including those on the Acorn Trail. [Great Brook Farm SP]	MassParks
Establish designated accessible spaces in the parking lot, the total number to be determined in consultation with the DCR's Universal Access Program. [Manning SF]	Engineering
Goal 3. Address vacant infrastructure to improve visitor experiences and DCR operational responsibilities.	
Former Regional HQ Site: Remove the former sign holder and pavement to let the site return to a natural state. [Great Brook Farm SP]	MassParks and Engineering
Tie Stall Barn: Address the outstanding permit issues for the event space and renew discussions about future use. [Great Brook Farm SP]	MassParks and Engineering
Farnham Smith's Cabin: Undertake a structural assessment and feasibility study to determine if reuse is possible and develop some potential options. [Great Brook Farm SP]	MassParks, Planning and Engineering
Cabin Shed: Access and clean out the interior of the shed, so that it does not become a potential nuisance. [Great Brook Farm SP]	MassParks
Boat House: Complete and submit an MHC Inventory form. [Great Brook Farm SP]	Planning
Boat House: Undertake demolition. [Great Brook Farm SP]	Engineering
District 6 Fire Control Office: Assess for any reuse possibilities by the park and/or the region, such as accommodating the storage needs currently being met by the Hadley House and Anderson Barn. [Great Brook Farm SP]	MassParks, Planning and Forestry
Hadley House: Investigate alternative uses for the property, possibly making it available to be moved. If not possible, identify a funding source for demolition before it becomes an attractive nuisance. [Great Brook Farm SP]	MassParks, Planning and Engineering

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Action Plan 2014-2019 (Continued)

Priority Action	DCR Lead Unit(s)
Goal 3. Address vacant infrastructure to improve visitor experiences and DCR operational responsibilities.	
Manseau House: Assess for inclusion in the Historic Curatorship Program. If not a good candidate, identify a funding source for demolition before it becomes an attractive nuisance. [Great Brook Farm SP]	MassParks, Planning and Engineering
North Farm House and Barn: Make sure the buildings are secure and routinely monitored to ensure they are not damaged or broken into. [Great Brook Farm SP]	MassParks
North Farm House and Barn: Work with the current long-term leaseholders of other facilities within the park to identify any potential complementary reuses for this property, and explore putting out a Request for Proposals. [Great Brook Farm SP]	MassParks, Planning and External Affairs
Anderson Barn: Explore any potential interest in, and options for, permitting use of the barn by others, and relocate current storage closer to the Park Headquarters. [Great Brook Farm SP]	MassParks and Planning
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.	
Establish webpages on the DCR website for the properties in the planning unit that currently do not have a webpage. [Planning Unit]	MassParks and External Affairs
Establish relationships with local neighborhood associations and other local citizens groups that are interested in these properties. [Planning Unit]	MassParks and External Affairs
Renew the agreement with the Greater Lowell Indian Cultural Association. [LDT SF]	MassParks and Legal
Arrange a meeting between the Dracut Water Supply District and appropriate DCR staff to discuss their need to replace the reservoir at the forest. [LDT SF]	MassParks and Legal
Work with the Merrimack Valley Chapter of the New England Mountain Bike Association to review and approve, where appropriate, the existing technical features in the forest. [LDT SF]	MassParks, Planning and Legal
Develop a formal agreement with the Merrimack Valley Chapter of the New England Mountain Bike Association regarding the review and approval of their trail maintenance, repair and construction projects within the forest. [LDT SF]	MassParks, Planning and Legal
Determine the owner of the Hadley House and establish an agreement that guides the management and use of the building. [Lowell Heritage SP]	MassParks, Planning and Legal
Install DCR signs at the parking areas along the Vandenberg esplanade, next to the Lord pool and on Broadway Street. [Lowell Heritage SP]	MassParks
Renew the agreements with the City of Lowell related to their management of the regatta field and Rynne beach, as well as their use of the Rynne bathhouse. [Lowell Heritage SP]	MassParks and Legal
Renew the agreement with the stakeholders in the Lowell Canal System. [Lowell Heritage SP]	MassParks and Legal
Renew the agreement with the New England Electric Railway Historical Society / Seashore Trolley Museum. [Lowell Heritage SP]	MassParks and Legal
Establish an agreement with the Boston & Maine Railroad Historical Society regarding their maintenance of the B&M 410. [Lowell Heritage SP]	MassParks and Legal
Finalize the transfer of the Bellegarde boathouse, obtaining a copy of the items listed in Section 4.4. and executing the care, custody, management and control agreement. [Lowell Heritage SP]	Legal
Conduct annual meetings with lease holders and annual property inspections of leased property as specified in lease agreements and permits. [Great Brook Farm SP]	MassParks and Legal
Hounds House: Update and renew the expired lease agreement with the Old North Bridge Hounds. [Great Brook Farm SP]	Legal
Clear the vegetation from around the former DEM sign stanchion and hang a new DCR entrance sign from the existing sign stanchion. [Carlisle SF]	MassParks

Continued on next page.

Action Plan 2014-2019 (Continued)

Priority Action	DCR Lead Unit(s)
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.	
Work with the Town of Billerica to get a Special Use Permit in place, formalizing their operation of the recreation area. [Manning SF]	MassParks and Legal
Hold bi-annual meetings with the Town of Billerica Recreation Department to discuss programs, events and the maintenance and operation of the recreation area. [Manning SF]	MassParks and External Affairs
Provide DCR information on the informational kiosk. [Manning SF]	External Affairs
Install a DCR entrance sign for the forest. [Billerica SF]	MassParks
Hold an annual meeting with the MA Department of Fish & Game and the Town of Billerica Conservation Commission to discuss any issues, plans or projects. [Dudley SP]	MassParks
With the MA Department of Fish & Game and the Town of Billerica Conservation Commission, conduct the stipulated five-year review of the management agreement. [Dudley SP]	MassParks and Legal
Working with the MA Department of Fish & Game and the Town of Billerica, identify an appropriate location for an entrance sign that recognizes the partners. [Dudley SP]	MassParks

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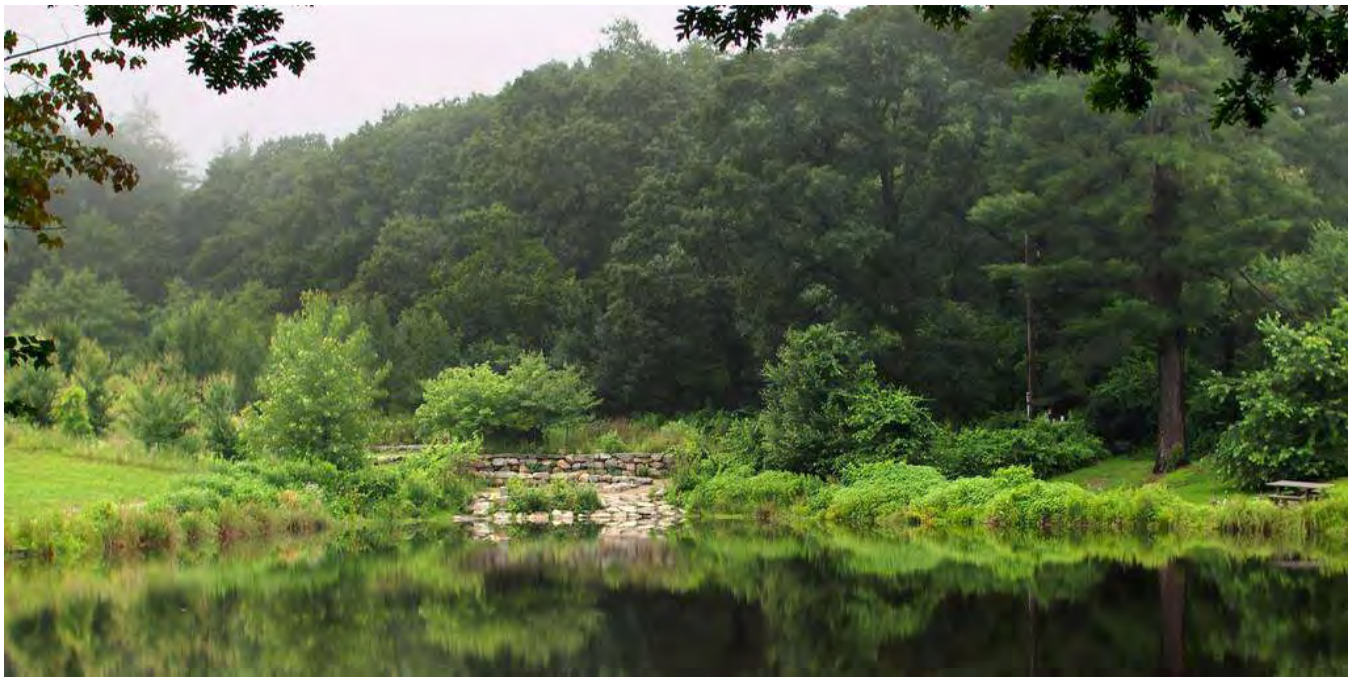

Great Brook Farm State Park (Peter E. Lee; CC BY-NC 2.0; cropped from original)

SECTION 1. INTRODUCTION

1.1. MISSION OF THE DEPARTMENT OF CONSERVATION AND RECREATION

The Department of Conservation and Recreation (DCR) is responsible for the stewardship of Massachusetts' forests, parks, reservations, greenways, historic sites and landscapes, seashores, lakes, ponds, reservoirs and watersheds. The mission of the DCR is:

"To protect, promote and enhance our common wealth of natural, cultural and recreational resources for the well-being of all."

In meeting today's responsibilities and planning for tomorrow, the DCR's focus is on:

- Improving outdoor recreational opportunities and natural resource conservation;
- Restoring and improving our facilities;
- Expanding public involvement in carrying out our mission; and
- Establishing first-rate management systems and practices.

The DCR was created pursuant to state legislation that, in 2003, merged the former Metropolitan District Commission and the former Department of Environmental Management. The DCR manages over 300,000 acres of the state's forests, parks, beaches, mountains, ponds, rivers and trails. The agency has broad management responsibilities for the preservation, maintenance and enhancement of the natural, scenic, historic and aesthetic qualities within these areas.

The health and happiness of people across Massachusetts depend on the accessibility and quality of our green spaces, natural and cultural resources, recreation facilities and great historic landscapes. The DCR continues to improve this vital connection between people and their environment.

1.2. INTRODUCTION TO RESOURCE MANAGEMENT PLANS

The DCR is directed by a legislative mandate (M.G.L. Chapter 21, Section 2F) to prepare management plans for every reservation, park and forest, to provide guidelines for the management and stewardship of natural and cultural resources and ensure consistency between recreation, resource protection and sustainable forest management. The legislative mandate also requires the incorporation of

public review and input into the development of management plans, and review and adoption by the DCR Stewardship Council.

Resource Management Plans (RMPs) consider the past, present and future of a reservation, park or forest. Through an assessment of resources and their existing conditions, clear management goals and objectives are developed, and short and long-term implementation action plans are identified for the management of properties under the stewardship of the DCR. RMPs are written to meet the information needs of a diverse audience: from the decision-makers directly involved in the operation and management of a property, to a variety of outside stakeholders. RMPs are intended to be working documents for setting priorities, budgeting and resource allocation, and establishing guidelines for balancing sustainable recreation with the stewardship of natural and cultural resources. Finally, RMPs are of value to users that are interested in learning more about specific properties, the challenges the DCR faces and how decisions affecting the properties are made.

DCR staff undertook a statewide survey in 2008–2009 to assess the level of existing resource and planning data available, and correlate that with operations and management considerations. This assessment was used to identify groupings of properties that should be included together in a single RMP, i.e. planning units. The statewide survey was also used to develop a tiered sequence for preparing RMPs. The Lowell/Great Brook Planning Unit is ranked 6th out of the 80 planning units identified statewide.

1.3. THE PLANNING PROCESS

RMPs are developed by the DCR's Resource Management Planning Program through an iterative process of data gathering and analyses, public input, review and revision. Administrative, cultural, ecological, recreation, social and spatial information is gathered. Sources of information include interviews with DCR staff, site visits, administrative files and reports, legal documents, spatial data and municipal and regional plans. An initial public meeting is convened to provide an opportunity to discuss the properties included in the RMP and to solicit public input for the plan. The public meeting is announced in the Environmental Monitor and advertised electronically and through local media outlets.

An inventory of available information on natural, cultural, recreation and operational resources, and an assessment of their existing conditions, is the foundation of an RMP, from which recommendations for stewardship can be made. The draft is distributed within the DCR for internal review and is repeatedly reviewed and revised to produce a draft RMP for public review and comment.

A second public meeting is convened to present an overview of the draft RMP's findings and recommendations and to solicit input. Once again, the public meeting is announced in the Environmental Monitor and advertised electronically and through local media outlets. After the second public meeting, the draft RMP is made available to the public via the DCR website and local libraries. The meeting is followed by a 30-day public comment period. Comments made during the meeting and written comments received during the public comment period are taken into consideration and used to further develop the RMP.

Once revised, a final draft RMP is submitted to the DCR Stewardship Council for review and adoption. The Stewardship Council is a 13-member citizen advisory board (appointed by the Governor) that works with the DCR to provide a safe, accessible, well-maintained and well-managed system of open spaces and recreation facilities that are managed and maintained on behalf of the public.

Once adopted, the Commissioner of the DCR files copies of the RMP with the Secretary of State and the Joint Committee on Environment, Natural Resources and Agriculture of the Massachusetts General Court and posts the adopted plan on the DCR website for use. The adopted RMP provides structure and guidance for the operation and management of properties included in the plan.

1.4. PUBLIC PARTICIPATION

Notice of a public meeting and the DCR's intent to prepare a Resource Management Plan for the Lowell/Great Brook Planning Unit appeared in the July 11, 2012 issue of the Environmental Monitor. Additional announcements were posted on the DCR website and press releases were provided to the local media. Announcements were also distributed to

individuals, statewide, regional and local stakeholder organizations and local officials. An initial public meeting occurred on July 23, 2012 in the Hart Barn at Great Brook Farm State Park in Carlisle. Twenty people attended this initial meeting. Public input was received at the meeting and through e-mail received during a 30-day public comment period after the meeting.

During the development of this plan, an online survey was created using Survey Monkey, in order to promote greater citizen participation and obtain additional information about visitor use. Announcements of this survey were distributed electronically to stakeholders and signs were posted at individual properties. Surveys were created and made available in English and Spanish, in an effort to reach out to a broad constituency. One hundred and sixty one (161) surveys were submitted, nearly all of which were related to Great Brook Farm State Park and Lowell-Dracut-Tyngsborough State Forest.

A public meeting to present an overview of the draft RMP was held on July 21, 2014 in Alumni Hall at the University of Massachusetts Lowell; it was attended by 17 people. Notice of the meeting was published in the July 9, 2014 issue of the Environmental Monitor and posted on the DCR website. Press releases were provided to local media and notices were sent directly to individuals, stakeholder organizations and local officials. The draft RMP was made available on the DCR website, at the Powell Memorial Library in Lowell, Gleason Public Library in Carlisle, Billerica Public Library, Parker Memorial Library in Dracut, and Tyngsborough Public Library, as well as at the Great Brook Farm State Park Headquarters on July 22, 2014.

The public comment period on the draft RMP ran from July 22, 2014 through August 29, 2014. Eight sets of comments were received and incorporated into the final RMP (see Appendix B). This Resource Management Plan was submitted to the DCR's Stewardship Council on September 5, 2014 and was adopted by the Council on October 3, 2014.

1.5. Properties Included in this RMP

This plan covers the Lowell/Great Brook Planning Unit, which includes:

- Lowell-Dracut-Tyngsborough State Forest
- Three Conservation Restrictions abutting Lowell-Dracut-Tyngsborough State Forest
- Lowell Heritage State Park
- Great Brook Farm State Park
- Carlisle State Forest
- Warren H. Manning State Forest
- Billerica State Forest
- Governor Thomas Dudley State Park

Locations of these properties are indicated on Figure 1. A Conservation Restriction is a legal document that limits the uses of a property in order to protect specific open space values of that land. Although these properties are not owned in fee by the DCR, they are included in the plan because of their physical proximity to Lowell-Dracut-Tyngsborough State Forest and the DCR's responsibility for overseeing the stipulations of the restrictions.

1.6. Defining Characteristics

The Lowell/Great Brook Planning Unit is very diverse and can be viewed as a microcosmic representation of the DCR state park system as a whole. From the collection of highly significant cultural resources and urban green spaces that make up Lowell Heritage State Park, to the historic working agricultural landscape of Great Brook Farm State Park, to the roughly 1,500 acres encompassing the five other heavily wooded properties in the planning unit, and a range of recreational uses in between, there are few characteristics that can be applied to the planning unit as a whole. In addition, there are several partnerships and co-management relationships in place at many of these properties. The defining characteristics for the individual properties are as follows:

Lowell-Dracut-Tyngsborough State Forest

A large swath of protected open space that is predominantly wooded, with many low wet areas and little park infrastructure, Lowell-Dracut-Tyngsborough State Forest provides miles of trails and recreational access for the nearby urban population, along with habitat protection that is regionally important. There are also three Conservation Restrictions associated with the forest, totaling approximately 73 acres.

Placeholder for Figure 1.

Lowell Heritage State Park

An urban park encompassing a variety of parcels within the City of Lowell and operated through multiple shared management systems, this property was established to showcase the history of the city. The DCR owns numerous historic, and a few more recently constructed, buildings and structures, including four gatehouses that are a part of canal operations and the Mack building; green spaces ranging from a small Victorian garden to the one-mile-long Vandenberg esplanade along the Merrimack River; and some unusual resources, including air rights over many of the city's canals. Lowell Heritage State Park provides both interpretive opportunities and recreational access in a dense urban setting.

Great Brook Farm State Park

A working dairy farm connected to miles of trails that are used for a variety of recreational activities, Great Brook Farm includes historic buildings and resources alongside a new "smart" barn with a robotic milking system, interpretive programming and a cross-country ski concession.

Carlisle State Forest

A small wooded property protected from forestry activities at the turn of the 20th century in order to conserve an older stand of exceptionally large eastern white pines. Undeveloped and used primarily by local residents, this small gem provides recreational access and habitat protection.

Warren H. Manning State Forest

A largely wooded property with a small recreation area, complete with a spray deck, picnic area and fitness trail. Named for the preeminent landscape architect that advocated, and donated land for, the protection of public woodlands in the Town of Billerica, this property provides recreational opportunities and habitat protection in a suburban environment.

Billerica State Forest

An undeveloped and largely wooded property bordering Route 3, this property provides recreational access and habitat protection.

Governor Thomas Dudley State Park

The smallest facility within the planning unit, this 11-acre park is a small wooded parcel that provides access to the Concord River and links to other protected open space.

1.7. Management Principle and Goals

Through the Resource Management Planning process, a principle for managing the Lowell/Great Brook Planning Unit was established and four associated goals developed.

Management Principle

Protect the natural and cultural resources of the planning unit and provide enhanced recreational and educational opportunities for visitors through the creative use of state resources and partnerships.

Management Goals

The following four management goals have been developed to achieve the management principle. These goals are of equal importance, and are not presented in order of priority.

Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.

Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.

Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.

Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.

1.8. Regional Context

The Lowell/Great Brook Planning Unit is located within Middlesex County; the towns of Billerica, Chelmsford, Dracut and Tyngsborough and the City of Lowell are all in the northern section of Middlesex County, while the Town of Carlisle is in the southern portion of the county. Lowell is the urban focus for this region, while Carlisle provides a rural respite. The towns of Billerica, Chelmsford, Dracut and Tyngsborough are all suburban in character.

Rivers have indelibly influenced the settlement, land use and development of the communities in this region from pre-historic times through today. The

City of Lowell is located at the confluence of the Merrimack and Concord rivers. The mighty Merrimack River, flowing from Franklin, New Hampshire to the Atlantic Ocean is the engine that drove the industrial development of the City of Lowell. Flowing through Tyngsborough and Lowell, the river also serves as the southern boundary of Dracut. The smaller Concord River, a tributary of the Merrimack, flows through Lowell and Billerica, and is the southeast boundary for Carlisle.

The pre-contact Native American population in this region utilized these rivers for travel and subsistence, with major anadramous fish runs on the Concord and Merrimack. The region's landscape provided additional resources for subsistence through freshwater ponds and fertile soils ideal for agricultural use, particularly along the rivers. Traditional hunting and gathering likely occurred in the upland areas, which supported other subsistence activities.

Pawtucket Falls on the Merrimack River served as a regional focus of settlement (MHC 1980*a*). The falls became an important fishing ground and the Merrimack River served as a trade corridor. The area appears to have been extensively settled by native peoples and may have served as a population core area.

The Merrimack River was first visited by the French explorer Samuel de Champlain in 1605 as he explored the New England coast. A Praying Indian town, Wamesit, was established by John Eliot by the 1640s in what is now Lowell in an effort to Christianize native peoples. European settlement started in earnest in the mid 17th century. Settlement through the second half of 17th century was dispersed, with small clusters of colonists in frontier communities relying primarily on subsistence farming, fishing and small mills that were set up on the rivers and streams in the region.

Population in the region began to uptick in the early to mid 18th century, as villages took shape in town centers and near mills, and transportation improvements made in the region helped facilitate travel and trade. By the turn of the 19th century, small scale granite quarrying and early manufacturing started to develop. Construction began on the Middlesex Canal in 1794, connecting Lowell and the Merrimack Valley to Boston, and opened for use in 1804. Twenty-seven miles in length, running through several communities including Billerica, Chelmsford, Tyngsborough and current day Lowell, the Middlesex Canal provided a transportation connection to haul goods and passengers from Boston to New Hampshire (Middlesex Canal Association 1993).

A range of small industries began to develop and take advantage of both the local water power and the proximity to the Middlesex Canal. The textile industry in Lowell began in the 1820s with the establishment of the first major textile mill, the Merrimack Manufacturing Company. Others quickly followed over the course of the next dozen years, building off the early success and the application of the innovative system of manufacturing utilized here and the development of a system of power canals to run large mills. Additional industrial development also began in Chelmsford and to a smaller degree in Dracut.

The City of Lowell was established in 1826, from parts of Chelmsford, Dracut and Tewksbury (MHC 1980*a*). Rapid growth ensued in Lowell, with the manufacturing base downtown and a series of suburban outlying neighborhoods. Railroads were introduced to the region, providing a more effective (and non-seasonal) form of transportation, and the Middlesex Canal was closed in 1853 (Middlesex Canal Commission n.d.).

Many nearby communities also experienced population growth, and new immigrant populations headed to the region to work in manufacturing in Lowell (facilitated by streetcar lines providing access) and nearby towns. Carlisle however remained very rural throughout the 19th century, with agriculture as the dominant focus of the local economy.

The Great Depression impacted the textile industry and the region saw a big decline in manufacturing. New highways provided enhanced regional access and, with the exception of a population decline in Lowell, the nearby communities continued to grow. Post WWII suburban expansion impacted much of the region, however Lowell struggled and Carlisle maintained its rural economy and character. The 1970s saw the establishment of Lowell Heritage State Park and brought the National Park Service to Lowell, as well as renovated mills, new immigrant communities and a growing interest in urban areas, which brought revitalization to downtown Lowell.

Table 1.1. Physical, Ecological and Political Settings of the Lowell/Great Brook Planning Unit

Planning Unit: Lowell/Great Brook

Location:		
	City of Lowell	Middlesex County
	Town of Dracut	Middlesex County
	Town of Tyngsborough	Middlesex County
	Town of Carlisle	Middlesex County
	Town of Chelmsford	Middlesex County
	Town of Billerica	Middlesex County

DCR Management Structure: Walden Complex
Metro West District
North Region

Properties:	***Landscape Designation***	***City/Town***	***Area (acres)[a]***	***Perimeter (miles)[a]***
Lowell-Dracut-Tyngsborough State Forest	Parkland	Lowell	320	15
		Dracut	554	
		Tyngsborough	236	
Lowell Heritage State Park	Parkland	Lowell	87	18
Great Brook Farm State Park	Parkland	Carlisle	907	16
		Chelmsford	23	
Carlisle State Forest	Parkland	Carlisle	25	1
Warren H. Manning State Forest	Parkland	Billerica	183	5
Billerica State Forest	Parkland	Billerica	141	3
Governor Thomas Dudley State Park	Parkland	Billerica	11	1

Ecoregion: Southern New England Coastal Plains and Hills

Watersheds: Sudbury-Assabet-Concord (SuAsCo)
Merrimack River

Legislative Districts:

Senate District	*House District*
First Middlesex	Second Middlesex
Second Essex and Middlesex	Fourteenth Middlesex
Third Middlesex	Sixteenth Middlesex
Fourth Middlesex	Seventeenth Middlesex
	Eighteenth Middlesex
	Twenty-second Middlesex
	Thirty-sixth Middlesex

Conservation Restrictions:	***Property***	***City/Town***	***Area (acres)[a]***	***Fee Interest***
	Lowell-Dracut-Tyngsborough State Forest	Lowell	17	Northeast Radio, Inc.
	Lowell-Dracut-Tyngsborough State Forest	Dracut	9	Boisvert Family
	Lowell-Dracut-Tyngsborough State Forest	Tyngsborough	47	Town of Tyngsborough

Designations:	**Property**	**Designations**
	Lowell-Dracut-Tyngsborough State Forest	Priority Habitat
		BioMap2 Core Habitat
		BioMap2 Critical Natural Landscape

Continued on next page.

Table 1.1. Physical, Ecological and Political Settings of the Lowell/Great Brook Planning Unit (Continued)

Designations:	Property	Designations
	Lowell Heritage State Park	Priority Habitat
		BioMap2 Core Habitat
		BioMap2 Critical Natural Landscape
		Downtown Lowell Local Historic District
		City Hall District
		Locks and Canals National Register Historic District
		Locks and Canals National Historic Landmark
		Lowell National Historical Park and Preservation District
		Historic Civil Engineering Landmark
		Historic Mechanical Engineering Landmark
		Environmental Justice Population
	Great Brook Farm State Park	Priority Habitat
		BioMap2 Core Habitat
	Carlisle State Forest	National Wild & Scenic River
	Warren H. Manning State Forest	Priority Habitat
		BioMap2 Core Habitat
	Billerica State Forest	Priority Habitat
		BioMap2 Core Habitat
	Governor Thomas Dudley State Park	BioMap2 Core Habitat
		BioMap2 Critical Natural Landscape

a. These values were calculated in GIS and rounded to the nearest whole number.

1.9. VISITATION

Visitation information for the planning unit is negligible, due in part to reduced DCR staffing and established management agreements with other entities, as well as physical constraints that make it difficult to capture the information (e.g., little or no infrastructure at a property, multiple entry points for a property, etc.).

The online survey that was undertaken as part of this RMP (see Section 1.4. Public Participation) did not provide a lot of information that could objectively be drawn from in order to get a sense of the complete visitor profile and experience for individual properties, or the planning unit as a whole. While there was a high response rate for both Lowell-Dracut-Tyngsborough State Forest and Great Brook Farm State Park, 78 responses for each, the remaining properties had minimal response rates, ranging from zero to three. This is due to the fact that the survey was very well publicized within the mountain biking community, and many members of that community responded to the survey for the two properties in the planning unit that are utilized the most for mountain biking. Despite promoting the survey to a wide variety of stakeholders, without active park friends groups for these properties to help promote the survey within other user communities, responses from outside the mountain biking community were low.

Lowell-Dracut-Tyngsborough State Forest

The state forest is not staffed and, as a result, there are no visitor estimates; however, the property is well-known as a popular mountain biking destination. Respondents to the online survey, most of whom were part of the mountain biking community, identified the state forest's convenient location and trail network as characteristics of the property that they liked the best. Among the ways that the state forest could be improved, respondents indicated enforcing regulations related to off-highway vehicle (OHV) use, adding more parking and trail signage, naming more trails and updating the trail map.

Lowell Heritage State Park

Although Lowell Heritage State Park is staffed, as an urban property with individual parcels spread across the city, visitor data is especially difficult to capture. Fortunately, the National Park Service (NPS), a partner in Lowell through their Lowell National Historical Park, collects and publicizes annual visitation data based on the number of visitors that enter their visitor center and exhibits,

and attend special events on park property. While these estimates do not provide any insight into the level of visitorship on the DCR's Vandenberg esplanade, they do highlight the number of people who view, and in some cases tour, DCR property in downtown Lowell (see Section 4 for more information).

Since 1982, annual visitation rates at Lowell National Historical Park have exceeded 400,000 (NPS 2014*a*). In 2013, over 500,000 visitors enjoyed the park (NPS 2014*a*). Half of those individuals visited the park in July and August, with July being the most popular month (174,530 visitors; NPS 2014*a*). The majority of July visitors were "Special Event Visitors," and likely participated in the Lowell Folk Festival, a very popular event held in downtown Lowell each year (NPS 2014*a*). Peak visitation for the DCR's Francis Gate Park and Pawtucket Gatehouse were in August (2,022 visitors) and September (1,292 visitors), respectively (NPS 2014*a*).

Great Brook Farm State Park

Visitation increased ten-fold at Great Brook Farm State Park between the establishment of the park (1974) and the mid-1990s, but it is now on a downward slope. In the early 1980s, the annual visitation rate was approximately 20,000–25,000, while in 1996 car counters recorded approximately 205,000 visitors enjoying the park. In the late 1990s, staffing and programming began to decrease and in the early 2000s, a parking fee was established, collectively leading to a decline in visitation. By 2010, annual visitation decreased to roughly 120,000. Although the completion of the Smart Barn in 2011 seems to have generated a small spike in visitation, recent estimates are steadily decreasing, and are now at approximately 100,000 visitors per year.

Due to the wide range of activities available, unlike some of the other properties in this planning unit, Great Brook Farm State Park has high year-round visitation. The online survey indicated little seasonal variation in park use by regular visitors. Mid-week visitation includes a fair amount of older visitors, primarily active retirees who like to walk the trails. Through the online survey, park users provided high praise for the variety and quality of trails, as well as the appeal of the active farm and ice cream stand for visiting with children.

Carlisle State Forest

In the absence of a formal parking lot and on site staff, visitation estimates are not available for Carlisle State Forest. Visitation is believed to be quite low, and primarily by local residents.

Warren H. Manning State Forest

The DCR does not have estimates on visitation for this property. The spray deck area is very popular with young families during the summer and the Town of Billerica, who manages the spray deck area, reports that on hot days, the parking lot often reaches capacity (Hannon-Rizza 2013).

Billerica State Forest

Without a formal parking lot and the presence of on site staff, visitation estimates are not available for Billerica State Forest.

Governor Thomas Dudley State Park

As a facility that is managed by the Town of Billerica and not staffed, the DCR does not have estimates of visitation levels at Governor Thomas Dudley State Park.

In a survey conducted during the preparation of the 2008 update to the Billerica Open Space and Recreation Plan, only three of the 68 respondents included Dudley Park, as it is locally known, as one of the open space or recreation properties that their family utilized in town (Northern Middlesex Council of Governments 2008).

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Park Serve Day at Lowell-Dracut-Tyngsborough State Forest (DCR)

SECTION 2. MANAGEMENT RESOURCES AND PRACTICES

2.1. INTRODUCTION

The Lowell/Great Brook Planning Unit contains a diverse set of natural, cultural and recreation resources. Managing these resources can be challenging, due to the competing demands of resource protection and providing public access to recreational opportunities. Effective management of this two-pronged goal requires an understanding of various laws, regulations, policies and legal agreements, all while maximizing limited operational resources.

This section describes the resources available to the entire planning unit, as well as relevant management practices, regulations, policies and legal considerations. Variations to these resources and practices, which occur at the property-level, are addressed in Section 3 through Section 9.

2.2. NATURAL RESOURCES

Research Permits are required for all ecological research on DCR property. Additional state (e.g., Scientific Collecting) and federal (e.g., Bird Banding and Marking) permits may be required, depending on the nature of research. Research within wetland and river jurisdictional areas may also require regulatory review and approval from the local conservation commission.

Water Resources

Storm Water Management

Activities on DCR properties that affect the quantity or quality of storm water are regulated by a National Pollutant Discharge Elimination System (NPDES) storm water management plan (DCR 2007*a*). The plan describes control measures that the DCR uses to satisfy NPDES Phase II permit requirements for transportation and non-traditional Municipal Separate Storm Sewer Systems (MS4s). Best Management Practices (BMPs) are also identified in the plan, some of which are implemented at the agency-level (e.g., the detection and elimination of illicit discharges, catch basin cleaning), while others are implemented at the property-level (e.g., the stenciling of catch basins).

Wetlands Protection

Activities within a wetland resource area or buffer are regulated by the Massachusetts Wetland Protection Act. (See Appendix F for additional information.)

Rare Species

The Massachusetts Endangered Species Act (MESA) protects rare species and their habitats by prohibiting the "take" of any plant or animal listed as Endangered, Threatened or Special Concern. Projects within Priority Habitat of Rare Species must undergo review by the Natural Heritage & Endangered Species Program (NHESP), unless otherwise exempted under the law.

The term "project" refers not only to the construction of buildings and infrastructure, but also to activities that involve grading or the destruction of plant life. (See 321 CMR 10.00 for the full definition of "project.") Many staff and volunteer activities that take place within the planning unit (e.g., invasive species removal, trail construction and maintenance, and habitat improvement activities) meet the definition of "project" and must go through regulatory review, if they occur in Priority Habitat.

State agencies, such as the DCR, have special obligations under MESA. First, agencies are directed to use their authorities in furtherance of the purposes of MESA and "use all practicable means and measures to avoid or minimize damage." Next, they are required to submit draft management plans, such as RMPs, to the NHESP for review. Finally, state-owned lands "that provide habitat for state-listed species shall be managed for the benefit of such listed species;" agencies "shall give management priority to the protection, conservation, and restoration of" state-listed species on state-owned lands. All "practicable means and measures shall be taken to resolve conflicts between the protection, conservation, and restoration of state-listed species…and other uses of such lands in favor of the listed species."

Additional information on MESA and its implementing regulations is available on the NHESP's website: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/mass-endangered-species-act-mesa.

Vegetation

There is no single management plan for the planning unit's vegetation. The *de facto* management policy is to permit populations of most species of plants to increase or decrease without human intervention. Exceptions include the maintenance of lawns and other turf areas, the removal of hazardous trees and vegetation cutting associated with the management of plant or wildlife habitat.

Continuous Forest Inventory (CFI) monitoring plots are located throughout the planning unit. The number of these one-fifth acre, circular plots varies by property. A series of forestry related metrics, including the number of trees five or more inches in diameter, tree regeneration, the amount of coarse woody debris, and presence of invasive plants and tree diseases, are collected at each plot. On average, each plot is visited, and data collected, once every ten years.

Wildlife

There is no single wildlife management plan for the planning unit. The *de facto* management policy is to permit most wildlife populations to increase or decrease without human intervention. Exceptions to this include the hunting of game species and fishing at select properties. Hunting, trapping, and fishing are managed through a variety of regulations (see Section 2.4, below).

2.3. Cultural Resources

The DCR's Office of Cultural Resources (OCR) provides technical assistance on issues relating to archaeology and the preservation of landscapes, buildings, structures and objects. It also conducts a coordinated program of basic and applied research to support planning for, and management of, cultural resources on DCR properties through project management and resource management planning. The OCR also nominates properties for inclusion on the State and National Registers. A copy of the DCR Cultural Resources Policy has been included as Appendix D.

The OCR is also responsible for overseeing the historic preservation regulatory compliance responsibilities of the agency. It assesses regulatory needs and, when applicable, notifies the Massachusetts Historical Commission (MHC) through the filing of a Project Notification Form or Environmental Notification Form for any proposed projects undertaken, funded, permitted or licensed, in whole or in part, by the agency. This is done so that the MHC may make a Determination of Effect of the project on historic and archaeological

resources. Finally, the OCR coordinates all archaeological survey, testing and excavation with the State Archaeologist at the MHC through an archaeological permit.

Buildings, structures, landscapes, sites and objects that are a minimum of 50 years old, retain historic integrity and are of significance on the local, statewide or national level may be listed on the National Register of Historic Places. Repairs, rehabilitation and other preservation activities on listed and eligible resources follow guidelines in the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (Weeks and Grimmer 1995).

Massachusetts law requires the review of all subsurface disturbances on state property. The DCR's Archaeologist holds an archaeological permit from the MHC that allows them to provide initial review of activities that result in subsurface disturbance. They are the primary reviewer of such projects and activities in the Lowell/Great Brook Planning Unit.

The inspection, investigation or removal of underwater archaeological resources is also regulated under Massachusetts law (M.G.L. 6:179–180). No person may remove, displace, damage or destroy any underwater archaeological resource, except in conformity with permits issued by the Massachusetts Board of Underwater Archaeological Resources. This applies to both inland and coastal waters. All archaeological resources in the waters of the planning unit are subject to this law.

Two of the properties within this planning unit are part of the OCR's Historic Curatorship Program, a program in which curators are selected through a competitive process to rehabilitate and maintain historic buildings in exchange for long term leases. The Historic Curatorship Program Manager is responsible for ensuring compliance with work and maintenance plans; maintaining investment accounting totals from curator reports; ensuring up to date insurance coverage; scheduling annual or bi-annual inspections; coordinating public benefit activities; and enforcing compliance with other lease terms and responsibilities.

2.4. Recreation Resources

Regulations guiding the recreational use of forests and parks may be found in 304 CMR 12.00. (See Appendix F for a summary of these regulations.) In general, all public use of DCR property must take place from dawn through dusk.

Permits

Special Use Permits are required for "any commercial or special activity or event upon the lands or waters" of all DCR properties (304 CMR 12.17; Appendix F). Non-commercial activities requiring a Special Use Permit include, but are not limited to: concerts, charity walks, road races, cultural festivals, community service projects, small weddings and gatherings with amplified sound. Research on recreation and recreationists requires a Research Permit. Commercial filming, photography, and videography are regulated through Filming and Photography Permits. Additional information on these permits, and how they may be obtained, is available on the DCR's website: http://www.mass.gov/eea/agencies/dcr/massparks/permits-rentals/dcr-permits.html.

Camping

Camping on DCR property is restricted to designated campsites or cabins; there are no permanent camping areas in the planning unit.

Geocaching

There is no Massachusetts regulation or agency policy on the placement of geocaches on DCR property. In their absence, geocaches may be placed at any location not identified as closed to the public.

Hunting and Fishing

Hunting and freshwater fishing are addressed in Massachusetts regulations 304 CMR 12.00, 321 CMR 3.00 and 321 CMR 4.00, and the official Massachusetts hunting, freshwater fishing and trapping regulations that are published annually. In general, all DCR properties are open to hunting, fishing and trapping unless otherwise specified in the Forests and Parks Rules (304 CMR 12.00). Summaries of these and other applicable regulations are presented in Appendix F.

Officers from the Executive Office of Energy and Environmental Affairs' Office of Law Enforcement (i.e., Massachusetts Environmental Police) enforce hunting, fishing and off-highway vehicle (OHV) use.

Trail Use

Dogs may accompany trail users provided the animals are kept under control and do not interfere with any other visitor's enjoyment of DCR property (304 CMR 12.00; Appendix F).

With the exception of DCR, public safety and utility company vehicles, motor vehicles are generally not permitted on the trails in the planning unit.

A March 15, 2011 Department of Justice ruling allows individuals with mobility disabilities to use "other power-driven mobility devices" on trails. Such devices include any device powered by batteries, fuel or other engines that are used by individuals with mobility disabilities for the purpose of locomotion. Use of such devices may be restricted on trails due to factors such as: the type, size, weight and speed of the device; the volume of pedestrian traffic; the design and operational characteristics of the device; whether or not the device may be operated safely; and the potential for substantial risk of serious harm to the environment or natural and cultural resources. None of the trails within the planning unit have been assessed for their compatibility with these devices.

2.5. INFRASTRUCTURE

Property Boundary

The Management Forester or Assistant Management Forester attempts to locate and mark property boundaries in association with forest inventory activities. They also mark the boundaries of new properties as they are acquired. Boundary marking typically involves locating and painting cement bounds or pipes, and posting boundary signs.

Buildings and Structures

The management of DCR-owned buildings is performed by DCR employees or contractors. Minor maintenance and repair is performed by on-site staff. More technical repairs (e.g., plumbing and electrical) are performed by DCR in-house trades staff or by trade or engineering contractors (e.g., well repair) whose activities are coordinated through the agency's Parks Support Operation Program. Major repairs are performed solely by licensed contractors.

Roads

The DCR maintains and repairs forest and park roads, and parkways. Management of traffic and related systems is supervised by the Parkways Section of the DCR's Division of Engineering and guided by the American Association of State Highway and Transportation Officials standards, the *Manual on Uniform Traffic Control Devices* (FHA 2012) and the *Historic Parkway Preservation Treatment Guidelines* (DCR 2007*b*), if applicable. Public roads adjacent to DCR properties are maintained and repaired by either local municipalities or the Massachusetts Department of Transportation (MassDOT).

Snow removal is performed by the DCR, MassDOT and local municipalities. In general, the municipalities or MassDOT plow the public roads adjacent to forests and parks, and the DCR is responsible for plowing internal roads.

Parking

The DCR is responsible for maintaining and repairing its parking areas. Most snow removal is performed by the DCR.

Trails

A variety of regulations and policies guide the management of trails. The design, management and marking of trails are guided by the DCR *Trails Guidelines and Best Practices Manual* (DCR 2012*a*). Additional regulations, such as the Massachusetts Endangered Species Act and Wetlands Protection Act, and the DCR Cultural Resources Policy may also apply, depending on location. These regulations and policies apply to DCR employee, partner and volunteer activities.

In accordance with DCR practices, trail maintenance and construction activities should be implemented in the following order, in accordance with the regulations, policies and guidance identified above:

1. Maintain appropriate existing trails and fire roads.
2. Close or improve existing trails with known public safety hazards.
3. Close or relocate existing trails that adversely impact documented state-listed species, in consultation with the DCR's Bureau of

Planning, Design and Resource Protection, and NHESP staff.

4. Close, relocate or improve existing trails that impact vernal pools.
5. Close, relocate or improve wetland crossings on existing trails that impact wetlands, streams or ponds.
6. Close redundant, dead end and unauthorized trails.
7. Close, relocate or improve existing eroded and poor condition trail segments.
8. Construct new trail connections to enhance desired, authorized recreational experiences; create additional loop opportunities; and form new connections between access points and important features.

Signs and Kiosks

The format and placement of regulatory and informational signs are governed by the *Manual of Uniform Traffic Control Devices* (FHA 2012) and guided by the DCR *Graphics Standards Manual* (DCR n.d.). The design and construction of kiosks are solely governed by the graphics manual.

Informational kiosks are managed by park staff as new information becomes available; they also perform kiosk installation and repair.

Memorials and Markers

The placement of markers or plaques is not explicitly addressed in the Forests and Parks Rules (see 304 CMR 12.00; Appendix F). However, the DCR does have a Memorial and Commemorative Gifts Policy (#EAP-2006-01) that "describes the circumstances and protocol for accepting donations offered by members of the public to commemorate an individual or individuals, in a manner that ensures that: the gift is consistent with Department standards and park management and design plans; the item installed is needed in the affected facility and properly located; and the gift is properly acknowledged."

This policy clearly states, "The Department will not accept the placement or construction…of plaques, signs, statues, structures, or other items that are solely of a memorial or commemorative nature." Any items that were placed on DCR property "prior to the adoption of this policy [October 27, 2006] and that do not meet the standards contained in this policy may remain in place" with certain provisions or exceptions (see #EAP-2006-01 for more information).

2.6. Interpretive Services

Regional interpretive staff provides programming in the planning unit. There is no Comprehensive Interpretive Plan (CIP) for the entire planning unit, nor are there programs offered at every property in the planning unit.

2.7. Operational Resources

DCR Staffing

The DCR manages its forests, parks and reservations through the Division of State Parks and Recreation, otherwise known as the MassParks Division. Resources within the MassParks Division, including finances, staffing and physical equipment, are organized by regions, districts and complexes. Under this organizational structure, the Lowell/Great Brook Planning Unit is within the North Region, Metro West District and Walden Complex.

North Region

The North Region is comprised of three districts: Metro West, Middlesex Essex and Coastal. Specialized staffing resources assigned to the North Region are available on an as needed basis to the planning unit. This includes services related to interpretation, public outreach and safety, and engineering. The region is headed by a North Region Director who reports to the Deputy Director of MassParks.

Metro West District

The Metro West District is comprised of two complexes: Walden and Hopkinton. The district includes a functionally and geographically varied set of properties in the DCR system. Management is provided by a Metro West District Manager who reports to the North Region Director.

Walden Complex

The Walden Complex includes Walden Pond State Reservation in Concord and Lincoln; Carlisle State Forest and Great Brook Farm State Park in Carlisle; Billerica State Forest, Warren H. Manning State Forest and Governor Thomas Dudley State Park in

Billerica; Lowell Heritage State Park, the John J. Janas Skating Rink and Raymond J. Lord Memorial Swimming Pool in Lowell; and Lowell-Dracut-Tyngsborough State Forest.

The Forest and Park Supervisor at Walden Pond State Reservation also serves as the Walden Complex Field Operation Team (FOT) Leader. The team leader is responsible for coordinating the operational needs for each facility in the Walden Complex, through the use of Field Operation Teams. The Walden Complex FOT Leader reports to the Metro West District Manager.

Table 2.1. DCR Staffing Resources in the Walden Complex, by Reporting Location[a]

Job Title[b]	Type[c]	Reporting Location
Walden Pond State Reservation		
Walden Complex FOT Leader	Y	Concord
Forest and Parks Supervisor II	Y	Concord
Clerk I	Y	Concord
Visitor Services Supervisor I	Y	Concord
Park Interpreter (2)	S	Concord
Forest and Parks Supervisor I (3)	S	Concord
Summer Worker (4)	S	Concord
Laborer I (8)	S	Concord
Recreation Facility Supervisor I	S	Concord
Park Ranger	S	Concord
Lifeguard II	S	Concord
Lifeguard I (12)	S	Concord
Great Brook Farm State Park		
Forest and Parks Supervisor III	Y	Carlisle
Laborer II	Y	Carlisle
Laborer I (3)	S	Carlisle
Park Interpreter	S	Carlisle
Park Ranger	S	Carlisle
Lowell Heritage State Park		
Forest and Parks Supervisor I	Y	Lowell
Laborer I (2)	S	Lowell
Raymond J. Lord Memorial Swimming Pool		
Recreation Facility Supervisor III	S	Lowell
Recreation Facility Supervisor I	S	Lowell
Lifeguard II	S	Lowell
Lifeguard I (10)	S	Lowell
Summer Worker (2)	S	Lowell

a. Includes staff from the Division of State Parks and Recreation who worked exclusively within the Walden Complex in 2013.
b. The number of multiple employees with the same job title are indicated in parentheses.
c. Type: Y = Year-round; S = Seasonal.

Park staff are responsible for a number of management activities in order to keep the properties clean and accessible for use year-round. Duties include cleaning bathrooms, picking up litter and emptying trash barrels. Due to current limited staffing levels, these activities are not always able to be performed on a daily basis. Mowing and trimming is performed on an as needed basis, typically weekly, during the warmer months of the year.

Bureau of Forestry and Fire Control

The Bureau manages a variety of programs, including management forestry, forest fire control, forest health and urban/community forestry, that provide technical assistance and services on forestry related issues to DCR forests, parks and reservations. Bureau staff and assets are organized into districts that generally follow county boundaries.

Middlesex County is divided into two fire districts; the Lowell/Great Brook Planning Unit falls within Fire District 6, which is based out of Great Brook Farm State Park. Beyond fighting fires and managing prescribed burns, Bureau staff maintain the planning unit's fire roads.

Bureau of Ranger Services

The Bureau of Ranger Services includes field ranger staff who provide outreach related to Massachusetts regulations and public safety services. While other DCR districts have an assigned District Ranger, the Metro West District does not.

Division of Engineering

The Division of Engineering is responsible for the engineering and construction of parkways, dams, buildings and recreation facilities. It also provides a Regional Engineer to oversee day-to-day repair and construction projects, and to maintain a working relationship with the Regional Director in identifying capital improvement priorities. The Division also provides catch basin cleaning at Lowell Heritage State Park in support of park operations.

Bureau of Planning, Design and Resource Protection

This Bureau prepares RMPs and Trail System Plans; develops and updates GIS data; provides technical assistance with the management of archaeological and historic resources; identifies and acquires properties to be added to the DCR system; maintains an archive of park documents; provides technical support on ecological resources and the monitoring

of CRs; and designs and manages projects to enhance DCR properties.

Office of External Affairs and Partnerships

The Office of External Affairs and Partnerships works to enhance the DCR's constituency of supporters and users by: working in partnership with park users and supporters to develop and sustain community-based stakeholder groups; facilitating external financial assistance for the planning, design and construction of capital projects; managing the DCR partnerships Matching Funds Program, which leverages private contributions to improve DCR-owned and managed facilities; and serving as a dedicated point of contact for individuals and nonprofit, institutional and community-based organizations.

Supplemental Staffing

Volunteers

Volunteers can provide a variety of human and intellectual resources to support the management and maintenance of the properties in the Lowell/Great Brook Planning Unit. Volunteer services include clean-ups, trail maintenance, monitoring, botanical surveys, grant writing, interpretive programming and others. Volunteers may be individuals or members of groups, businesses or organizations, and may be organized by DCR staff or partner organizations.

All volunteer activities must be conducted with prior approval and supervision of the DCR, and in accordance with DCR standards and volunteer policies, including documentation through a Volunteer/Stewardship Agreement Form, Volunteer Release Form and Volunteer Service Log (DCR 2013).

Law Enforcement and Public Safety

The Massachusetts State Police has primary law enforcement authority on state-owned lands. Local police provide additional law enforcement in the planning unit, within their respective jurisdictions. The Executive Office of Energy and Environmental Affairs' Office of Law Enforcement (i.e., the Massachusetts Environmental Police) provides primary enforcement of hunting, fishing, boating, OHV and snowmobile regulations.

DCR Rangers are not law enforcement officers, but have the authority to enforce DCR regulations and issue citations (i.e., parking tickets and dogs off leash) on DCR property. They also coordinate search and rescue activities in forests, parks and reservations.

Municipalities provide emergency fire and medical response to incidents on state lands. DCR Forest Fire Control District 6 provides assistance to municipalities in the detection, suppression and prevention of wildfires. DCR Rangers may provide first aid.

General Budgetary Info

Operating Budget

The annual operating budget supports daily operations and maintenance, including utilities, supplies, equipment leases, administration, and the maintenance and minor repair of facilities, vehicles and equipment. In Fiscal Year 2013, the Lowell/Great Brook Planning Unit operating budget, excluding personnel costs, was $16,725. Funds are also available from the region for specific projects or activities within the planning unit.

Capital Budget

The capital budget supports projects (e.g., construction and repair) and items (i.e., equipment) with a per-unit cost of at least $5,000 and an expected lifespan of at least seven years.

Capital projects are identified and funded through a five-year capital plan. These plans identify proposed capital projects, their costs and the year in which they are to be funded. In fiscal years 2012 through 2014, improvements to the Mack building and Rynne bathhouse were completed at Lowell Heritage State Park. These projects cost $134,471. At Great Brook Farm State Park, the Fiscal Year 2012 projects were related to the design of the dairy barn and construction of a modular storage building, which cost $110,096. An additional project in Fiscal Year 2013 involved masonry work at the Hart Barn and cost $9,320.

Capital plans are extensively reviewed within the DCR, approved by the Commissioner and included in the DCR's annual budget. This budget is then reviewed by the Executive Office of Energy and Environmental Affairs, the Executive Office of Administration and Finance, and the Governor. Additional capital initiatives may be identified and

added to the budget by the Commissioner, Secretary or the Governor during this review process.

Deferred Maintenance

These funds are used for infrastructure repair that exceed typical maintenance, but do not rise to the level of a capital project. They may also be used to address emergency capital projects for which funds have not been allocated. Each region is allotted deferred maintenance funds on an annual basis; the Regional Director determines how these funds are to be used. Recent deferred maintenance projects within the planning unit include $4,500 to bring the fire security system in buildings along the Vandenberg esplanade up to compliance; $1,000 to fix the communication and video system at the Mack building; and approximately $3,000 to repair trails and build boardwalks at Great Brook Farm State Park.

Supplemental Funding

Grants

Federal and private funds, in the form of grants, are periodically awarded on a competitive basis to the DCR for park maintenance and operation activities (e.g., recreational trails grants). There have been no recent grants awarded to the planning unit.

Earmarks

Earmarks are funds directed to specific projects by the Massachusetts General Court via the annual state budget. There have been no recent earmarks for the planning unit.

Conservation Trust Fund

This trust fund uses donations to support special initiatives that go above and beyond basic property maintenance. It is funded through charitable contributions to the DCR, including those donations placed into the "iron rangers" (i.e., a secure metal donation box) located at Lowell Heritage State Park (1) and Great Brook Farm State Park (2). In 2013, Lowell Heritage State Park received over $1,000 in charitable contributions, while Great Brook Farm State Park received over $225. As of February 11, 2014, there is approximately $2,915 in the Conservation Trust Fund for Lowell Heritage State Park and $5,550 in the fund for Great Brook Farm State Park.

Heritage Parks Fund

In Fiscal Year 2014, 20 benches within the Mack plaza at Lowell Heritage State Park were replaced using approximately $45,000 from this fund.

Dedicated Funds

Dedicated property funds may come from a variety of sources (e.g., telecommunication tower fees), and are limited to use at the property on which they are derived. There are no sources of dedicated funds for any property within the planning unit.

Retained Revenues

The state operating budget specifies the maximum amount of park revenue from fees, licenses and rents charged by DCR that may be retained by the agency in a given fiscal year (the amount changes yearly). Revenue is deposited in the state's general fund. The DCR may then use, or retain, up to 80% of this revenue for its operating expenses and improvements to facilities statewide.

Great Brook Farm State Park is the only property in this planning unit that currently generates any retained revenue. Revenue is collected from a number of different sources, including parking, annual pass sales, rental fees and event permits. In calendar year 2013, Great Brook Farm State Park collected $33,580 in parking fees, $12,240 in annual pass sales, $1,126 in event fees, and $16,680 in rental income (from lease holders), for a total of $63,626. This total does not include revenue or in-kind investments from the farm lease or the ski concession.

In-kind Contributions

In-kind contributions are the donation of goods or services, rather than funds. The Student Conservation Association (SCA) has provided work crews to assist with trail maintenance activities at Great Brook Farm State Park, contributing their time and labor. The New England Mountain Bike Association (NEMBA) also holds annual trail days at both Great Brook Farm State Park and Lowell-Dracut-Tyngsborough State Forest. NEMBA members assist with the maintenance of trails used for mountain biking purposes, providing labor and materials.

Spruce Swamp (DCR)

SECTION 3. LOWELL-DRACUT-TYNGSBOROUGH STATE FOREST

3.1. INTRODUCTION

Lowell-Dracut-Tyngsborough State Forest (1,109 acres) is a natural treasure of the Merrimack Valley. Its location between the urban centers of Lowell, MA and Nashua, NH make it unique and valuable, in terms of the recreational and educational opportunities available. The forest's network of trails provides access to largely undisturbed woodlands and wetlands, as well as several noteworthy cultural sites, for hikers, horseback riders and mountain bikers alike. It is an ideal location to discover the rich history of the region, from the influence of retreating glaciers to the course of human settlement over the last nine thousand years.

3.2. HISTORY OF PROPERTY

The history of Lowell-Dracut-Tyngsborough State Forest dates back thousands of years to Native American settlements along the Merrimack River. The principal tribe of the Merrimack Valley was the Pennacook, who were led by Passaconaway, and later by his son Wonalancet, two of the most renowned chiefs in New England. Both men were known for their mild dispositions, "preferring the ease and comforts of peace to the hardships and deprivations of war," and were respected by all of the smaller tribes in the region (Piotrowski 2002, 17).

At the start of King Philip's War in 1675, the Pennacook fled the Merrimack Valley to avoid having to take a side in the conflict. When Wonalancet returned to the area 10 years later, he sold all of his tribe's homelands to Jonathan Tyng and his partners, reserving only the right to fish and hunt. Soon after this "million-acre" sale, Wonalancet joined a tribe in Quebec, Canada and did not return to the area until 1692 (Crowley 1904; Piotrowski 2002, 18). It was at the request of a few hardy colonists, who were comforted by his presence, that Wonalancet moved back to Tyngsborough, where he lived with Jonathan Tyng in the Tyng Mansion until his death in 1696.

The area surrounding the state forest was slow to develop through the early decades of the 18th century, primarily due to unstable frontier conditions. After 1730, increased settlement took place throughout the area, especially along the riverine lowlands of the Merrimack. By 1800, Chelmsford (part of which would become Lowell), Dracut and Tyngsborough were flourishing. Farms,

quarries, mills and other small-scale manufacturing industries supported the regional economy. A series of transportation improvements throughout the 19th century, including roads and bridges, river ferries, canals and railroad corridors, maintained the vitality of the Merrimack Valley.

During the 19th century, the character of Dracut and Tyngsborough began to shift as Lowell established itself as the industrial powerhouse in the region. Both towns became popular vacation communities with established waterfront parks and resorts attracting seasonal visitors from Boston and New York. Lakeview Park (Dracut), Willowdale and Mount Rock (Tyngsborough) were just a few of the more popular destinations in the area, all of which were situated around Lake Mascuppic.

Land for Lowell-Dracut-Tyngsborough State Forest was first acquired by the Commonwealth between 1933 and 1936. During that time, federal Works Progress Administration projects were carried out in the forest, including the reconstruction of Trotting Park Road (Lowell and Tyngsborough); creation of scenic vistas from Whortleberry Hill; improvement of timber stands on Gage Hill; and construction of a tool shed and blacksmith shop. An old spring water bottling building, remnants of a company once located on the land, was repurposed as a forest headquarters (Stone & Webster Environmental Technology & Services 1998). In 1937, a 16- by 30-foot single-story woodshed and public comfort station was built at the headquarters site, which was located on the east side of Trotting Park Road (Lowell), south of the current main entrance to the state forest (Stone & Webster Environmental Technology & Services 1998).

By the early 1950s, there was considerable interest in developing the state forest into a major facility (see Appendix H). However, early efforts to act on this interest, such as the small recreation area and ski trail established near Whortleberry Hill, never became popular with visitors (Lambert 1972). For the next 20 years, the forest remained largely undeveloped; hiking and "some" snowmobiling were the principal recreation uses (DNR 1970, 2).

In 1970, the Department of Natural Resources (DNR) wrote a plan for the state forest to "help meet the increasing need for a variety of recreation and natural experiences in the rapidly suburbanizing Lowell region" (DNR 1970, 2). According to the plan, much of the forest was "to be left in its natural state, protected and enhanced as resource management areas" (DNR 1970, 2). However, specific recommendations were made for an organized interpretive trail system, an environmental education or visitor's center, a day use area for swimming and picnicking, and a group camping area. The plan also recommended acquiring an additional 300 acres of land to provide a larger buffer between the proposed development and more natural areas of the forest.

Several years after the DNR plan was written, but before any of its recommendations were implemented, Lowell-Dracut-Tyngsborough State Forest fell into a state of disrepair. The buildings at the headquarters site were boarded-up and the forest was "ravaged by vandalism" (Sylvester 1977). "Stripping and torching" cars was one of the more notorious activities that took place within the forest; in 1976, 85 burnt cars were found in the Dracut portion alone (Sylvester 1977). The lack of supervision over the forest's Cut-A-Cord Program led to further abuse, with permit holders reportedly taking three or four times their share of wood from the forest and reselling it at a much higher price (Sylvester 1977).

One bright spot in the forest's history during this time period was the partnership and agreement between the Department of Environmental Management and Greater Lowell Indian Cultural Association (GLICA). In 1978, an initial three-year Memorandum of Understanding was signed, which granted the GLICA access to 150 acres of the state forest where the group erected temporary wigwams and teepees, laid out a ceremonial circle and held cultural festivals (Anonymous 1981). The GLICA's presence enhanced the state forest's natural and cultural resources and helped curb some of the vandalism taking place there (Anonymous 1981).

In 1996, all of the buildings associated with the headquarters site were removed and forest operation and maintenance responsibilities shifted to eight year-round and seasonal staff based out of Lowell Heritage State Park (Stone & Webster Environmental Technology & Services 1998). Today, the state forest remains largely undeveloped and staff are based out of both Great Brook Farm State Park and Lowell Heritage State Park.

3.3. EXISTING CONDITIONS

Natural Resources

Physical Features

Topography. The state forest is shaped roughly like a bowl, with a large wetland near its center and several drumlins, or elongated hills, situated around its perimeter. The highest points within the forest are atop Whortleberry Hill (364 feet) and Gage or Huckleberry Hill (324 feet), both of which are located in the northernmost portion of the forest (see Figure 2).

Geology. The bedrock in the area of Lowell-Dracut-Tyngsborough State Forest is largely comprised of calcareous sandstones, siltstones and shale, with Ayer granite and Dracut diorite intruding near the Town of Dracut (Skehan 2001). The best examples of these formations fall outside of the forest, underlying the Merrimack River, near the University Avenue Bridge in Lowell (calcareous sandstones, siltstones and shale) and at Nickel Mine Hill, north of Methuen Street in Dracut (Dracut diorite; Skehan 2001).

Within the state forest itself, several large glacial erratics, or boulders, are recognized as significant natural and cultural resources (e.g., Horsehead Rock, Sheep Rock and Indian Head Rock). There is also evidence of multiple stone quarries within the forest, where granite and gneiss were collected as building material for Lowell's canal system and textile mills (Ali and Hudon n.d.).

Soils. Soils within the forest vary based on the topography. Poorly and very poorly drained sandy loams and Freetown or Swansea mucks are associated with the low-lying wetlands. These soils are considered severely limited for picnic areas, paths and trails (Peragallo 2009). Well to excessively drained sandy loams and exposed stones or boulders dominate the rolling to moderately steep hills. These soils range from being severely to slightly limited for picnic areas, paths and trails (Peragallo 2009). The severe limitations are strictly related to picnic areas and the soils being too sandy, too rocky or too steep.

Table 3.1. Soils of Lowell-Dracut-Tyngsborough State Forest

Soil Series	% of Forest	Drainage Class
Canton fine sandy loam	18.4	Well drained
Montauk fine sandy loam	14.0	Well drained
Freetown muck	13.8	Very poorly drained
Charlton-Hollis-Rock outcrop complex	7.0	Well to somewhat excessively drained
Hollis-Rock outcrop-Charlton complex	6.6	Well to somewhat excessively drained
Deerfield loamy sand	6.0	Moderately well drained
Narragansett silt loam	5.3	Well drained
Birdsall mucky silt loam	4.4	Very poorly drained
Scituate fine sandy loam	4.4	Moderately well drained
Scarboro mucky fine sandy loam	2.9	Very poorly drained
Merrimac fine sandy loam	2.8	Somewhat excessively drained
Swansea muck	2.8	Very poorly drained
Water	2.6	N/A
Ridgebury fine sandy loam	2.4	Poorly drained
Whitman fine sandy loam	1.6	Very poorly drained
Wareham loamy fine sand	1.4	Poorly drained
Windsor loamy sand	1.1	Excessively drained
Paxton fine sandy loam	1.0	Well drained
Tisbury silt loam	0.8	Moderately well drained
Sudbury fine sandy loam	0.5	Moderately well drained
Hinckley loamy sand	0.2	Excessively drained
Woodbridge fine sandy loam	0.2	Moderately well drained
Merrimac-Urban land complex	0.0	Somewhat excessively drained

Water Resources

Ponds. There is only one named pond in Lowell-Dracut-Tyngsborough State Forest; it serves as a portion of the property's northeastern boundary (see Figure 2). Althea Lake is a relatively small, 43-acre pond with a maximum depth of 15 feet (MassWildlife 1993*a* and MassGIS 2009). The DCR owns approximately 1,735 feet of the shoreline; the remaining portion is lightly developed. Emergent

Placeholder for Figure 2.

aquatic vegetation has historically been very heavy at Althea Lake, making it difficult to fish (MassWildlife 1993*a*).

There are approximately 33 acres of other smaller, unnamed pools and ponds within the forest.

A second named pond abuts the DCR's Conservation Restriction in Tyngsborough (see Figure 2). Long Pond is a 158-acre interstate pond with a maximum depth of 25 feet (MassWildlife 1993*b* and MassGIS 2009). The DCR has an interest in approximately 1,200 feet of the shoreline; the remaining portion is heavily developed. Long Pond is an infertile body of water; it contains very little aquatic vegetation or sizeable fish (MassWildlife 1993*b*).

Wetlands. Wetlands account for nearly one-quarter of the forest's acreage (approximately 244 acres or 22%). Spruce Swamp is the largest wetland within the forest (approximately 107 acres; see Figure 2). It contains areas of deep marsh, shrub swamp and wooded swamp, as well as acidic shrub fen, a rare Priority Natural Community. Before the construction of Carney Road (Dracut and Lowell), which dammed a small stream, Spruce Swamp was known as Indian Head Lake.

Vernal Pools. There are 31 certified and 15 potential vernal pools within the state forest, several of which are Civilian Conservation Corps (CCC) water holes (see Cultural Resources, below, for more information).

Streams. There are three named streams within the forest, all of which flow into the Merrimack River (see Figure 2). Scarlet Brook flows out of a wetland southeast of Althea Lake, towards Sherburne Avenue in Lowell, and enters the Merrimack River near Greater Lowell Technical High School. Claypit Brook originates from a wetland south of Spruce Swamp. The stream flows south towards Varnum Avenue in Lowell, where it turns east and enters the Merrimack River near Pawtucket Falls. Flagg Meadow Brook is located in the easternmost portion of the forest and flows south towards Lowell General Hospital before entering the Merrimack River downstream of Claypit Brook.

Groundwater. There are no aquifers beneath the state forest.

Flood Zones. The 100-year flood zone overlaps with the wetland immediately east of Althea Lake (18 acres), the western edge of Spruce Swamp (22 acres) and portions of Scarlet Brook (29 acres). The 500-year flood zone overlaps with the northern edge of Spruce Swamp, near Forest Park Road in Dracut (six acres).

Rare Species

Lowell-Dracut-Tyngsborough State Forest is home to three state-listed species. One of these species is susceptible to collection and is not identified in this plan.

Table 3.2. State-listed Species of Lowell-Dracut-Tyngsborough State Forest, as identified by the Natural Heritage & Endangered Species Program (NHESP)

Species	Type	MESA[a]
Blanding's turtle	Reptile	T
Blue-spotted salamander[b]	Amphibian	SC
Data sensitive species[c]	Insect	T

Source: Harper 2013

a. Status of species listed under the Massachusetts Endangered Species Act (MESA): SC = Special Concern and T = Threatened.

b. Blue-spotted salamander has not been re-observed at the state forest since 1989 and will be considered to be historic at this location at the end of 2014.

c. This species is not identified in accordance with the NHESP's policy of withholding, in site-specific documents, the name or location of rare species susceptible to collection.

Blanding's turtles use a variety of habitats, including vernal pools, marshes, scrub-shrub wetlands and open uplands, during their life cycle (NHESP 2007*a*). Blue-spotted salamanders, on the other hand, rely solely on moist, moderately shaded habitats and vernal pools, in particular, for breeding (NHESP 2007*b*). The data sensitive species can be found in the forest's wetlands and nearby wooded areas.

Nearly 90% of the forest (995 acres) has been designated as Priority Habitat under the Massachusetts Endangered Species Act (321 CMR 10.00; see Appendix F). Approximately 79% of the lands on which the DCR holds a Conservation Restriction are also designated as Priority Habitat (56 acres). These same areas have been identified as Core Habitat in the MassWildlife and The Nature Conservancy publication "BioMap 2: Conserving the Biodiversity of Massachusetts in a Changing World" (MassWildlife and TNC 2010).

BioMap2 highlights two types of areas important for conservation: Core Habitat and Critical Natural Landscape. The first is crucial for the long-term persistence of rare species and other species of conservation concern. The second provides habitat for wide-ranging native wildlife, supports intact ecological processes, maintains connectivity among habitats, enhances ecological resilience and buffers aquatic Core Habitats to help ensure their long-term integrity. Protection of both areas, which may overlap, is "important to conserve the full suite of biodiversity" in Massachusetts (MassWildlife and TNC 2010).

Within Lowell-Dracut-Tyngsborough State Forest, there are also 260 acres (23%) of Critical Natural Landscape, which encompass Spruce Swamp and adjacent wetlands to the north and west.

Vegetation

Forest Types. In 2003, the James W. Sewall Company developed a forest inventory/land cover classification dataset for the state forests and parks. The dataset is primarily based on the interpretation of infrared aerial photography, a process that identified nine forest sub-types within Lowell-Dracut-Tyngsborough State Forest.

Table 3.3. Forest Sub-types of Lowell-Dracut-Tyngsborough State Forest

Forest Sub-type	Acres	% of Forest
Mixed oak	299.2	27.0
Eastern white pine-oak	274.9	24.8
Eastern white pine	72.1	6.5
Oak-hardwoods	64.3	5.8
Eastern white pine-hardwoods	36	3.2
Red maple-swamp hardwoods	33.9	3.1
Red pine plantation	30.8	2.8
Grey birch-red maple	10.8	1.0
Eastern hemlock-hardwoods	6.8	0.6
Total	*828.8*[a]	*74.8*

a. The difference in total acreage is due to the exclusion of wetlands and areas of open water, as well as changes in the forest's boundaries since 2003.

More recently (2010-2011), specific areas within the forest were visited by DCR Management Foresters as part of the Massachusetts Continuous Forestry Inventory (CFI). The CFI is a network of permanent, one-fifth-acre plots on state forest lands that are routinely monitored for sivicultural purposes. The measurements and observations made within each CFI plot are recorded in a database that dates back to 1960, when the CFI was created. Approximately 10% of the state's CFI plots are inventoried each year, on an on-going basis. As of 2010, there were 1,768 CFI plots statewide (Goodwin 2014).

There are seven CFI plots within Lowell-Dracut-Tyngsborough State Forest. They range in age from approximately 70 to 100 years and are comprised of mostly white or red pine, pitch pine, oak or swamp hardwoods. As part of the CFI process, DCR Management Foresters also look for signs of disturbances that affect the development of vegetation in the vicinity of each CFI plot. Since 2010, four disturbance agents have been observed in the forest's CFI plots. These agents, in decreasing order of occurrence, are: fire, clearing for pasture, insects and beavers.

Priority Natural Communities. One Priority Natural Community, acidic shrub fen, has been identified within Lowell-Dracut-Tyngsborough State Forest. Acidic shrub fens are typically found along wet pond margins in the eastern half of Massachusetts and consist primarily of low-growing, interwoven shrubs, with patches of Sphagnum moss growing at the shrub bases (Swain and Kearsley 2001). Acidic shrub fens have a state ranking of S3, which means that they are neither rare (S1) nor common (S5), however their conservation is encouraged. The biggest threats to this natural community are hydrological alterations that affect either water quality or quantity (Swain and Kearsley 2001).

Invasive Species. Since 2010, five invasive species have been observed by DCR Management Foresters in the forest's CFI plots. These invasive species are: common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Frangula alnus*), garlic mustard (*Alliaria petiolata*), oriental bittersweet (*Celastrus orbiculatus*) and black locust (*Robinia pseudoacacia*). Japanese knotweed (*Fallopia japonica*) was also observed in the former headquarters site while conducting fieldwork for this plan.

Pests and Disease. Since 2010, DCR Management Foresters have observed, as part of the CFI process, several biological agents responsible for tree loss. These agents are: heart rot, black knot of cherry (*Apiosporina morbosa*), white pine weevil (*Pissodes strobe*), borers, gypsy moth (*Lymantria dispar*) and other unknown insects and biological agents.

It is also worth noting that Emerald Ash Borer, an invasive wood boring insect that was first identified in Massachusetts in 2012 and adversely affects all genera of ash trees, has recently been discovered in the neighboring town of Methuen (Church 2014).

Wildlife

Birds. Approximately 150 species of birds have been recorded on, or over, the state forest in recent years (see Appendix G). Of these species, 23 are classified as Species in Greatest Need of Conservation (MassWildlife 2006).

Mammals. There is little current information on the forest's mammals. Sixteen species confirmed to occur within the forest and an additional 26 species that may possibly occur within the forest are identified in Appendix G.

Reptiles. There is little current information on the forest's reptiles. Seven species confirmed to occur within the forest, three of which are classified as Species in Greatest Need of Conservation, and an additional nine species that may possibly occur within the forest are identified in Appendix G (MassWildlife 2006).

Amphibians. There is little current information on the forest's amphibians. Eight species confirmed to occur within the forest, one of which is classified as a Species in Greatest Need of Conservation, and an additional 10 species that may possibly occur within the forest are identified in Appendix G (MassWildlife 2006).

Fish. There is no current information on the forest's fish. Surveys conducted by MassWildlife in 1978 at Althea Lake identified the following seven species: largemouth bass (*Micropterus salmoides*), chain pickerel (*Esox niger*), yellow perch (*Perca flavescens*), pumpkinseed (*Lepomis gibbosus*), bluegill (*Lepomis macrochirus*), yellow bullhead (*Ameiurus natalis*) and brown bullhead (*Ameiurus nebulosus*; MassWildlife 1993*a*). A separate MassWildlife survey at Long Pond in 1981 found these same seven species, plus white sucker (*Catostomus commersonii*) and golden shiner (*Notemigonus crysoleucas*; MassWildlife 1993*b*).

Cultural Resources

Pre-Contact Archaeological Sites

Two pre-Contact sites are documented within the state forest. During an archaeological survey, a camp site was uncovered on an upland terrace in Dracut dating to the Early Archaic Period (10,000-7,500 B.P.; Before Present). Many stone tools were recorded, as well as a unique feature unlike any other documented in the northeast. A small pit containing 1,200 fragments of calcined (burned) deer bone was located on a steep slope making this site potentially eligible for listing on the National Register of Historic Places. In another area of the forest (Lowell), a Late Archaic Period (5,000-3,000 B.P.) camp site was recorded. No archaeological sites have been recorded in the Tyngsborough section of the forest, however it has not been systematically surveyed. The physical characteristics, regional setting and known pre-Contact occupation in the area all confer a high archaeological potential for the state forest.

Historic Archaeological Resources

Timothy Coburn reportedly operated one of the earliest mills in Lowell (Richardson 1978). The remnants of this mill site may fall within the southern portion of the forest, along Claypit Brook. The remnants of a dam (see Structures, below) suggest that there was also some small scale industrial activity located along the brook. However, more research is needed to determine the nature and extent of the site, to identify any additional features, and to confirm its association with one of the six men named Timothy Coburn who resided in the area in the 18th and 19th centuries (Richardson 1978).

A spring water bottling company was established at the former headquarters site in the late 19th century, operating until c1920. When the state forest was established in the 1930s, at least one building from the former bottling plant, a pump house, was renovated for forest use. The site was utilized as the forest headquarters until the 1970s, and then left vacant until the buildings were removed in 1996. A concrete pad, the foundation from the former headquarters building and a depression with stones that is likely the cellar hole of the former pump house, are still present on site. The pump house cellar hole is currently filled with branch debris. A trash pile that contains glass bottle debris, as well as

a terra cotta pipe sticking out of the ground (possibly a part of the former bottling works), was also located nearby.

Earlier research on the history of the state forest indicates that there are at least two additional cellar holes that are expected to exist on the property (Richardson 1978). These resources were sought during the fieldwork for this plan, but could not be confidently located; additional research is needed.

Historic Resources

Buildings. There are no historic buildings within the state forest.

Structures. There are five Civilian Conservation Corps (CCC) water holes within the state forest. These water holes, typically small, stone lined ponds, were developed by the CCC in larger state forests and used as a source of water for forest fire control purposes. Two of the water holes within Lowell-Dracut-Tyngsborough State Forest are adjacent to Trotting Park Road (Lowell): one is near the former headquarters site and the other is on the edge of Spruce Swamp. A third water hole is just north of Trotting Park Road (Tyngsborough), adjacent to an unnamed administrative road and Spruce Swamp. The fourth is adjacent to Totman Road (Dracut) and is notable for being encircled by a pathway, providing more access to the resource than is typical. The fifth water hole is located north of Totman Road (Dracut) and is notable for being rectangular in shape, where the others within the forest are round. In general, the water holes are all in fair to poor condition, with some of the side walls settling and vegetation creeping in from the edges. All have drainage issues.

CCC Water Hole (DCR)

There are three stone slab bridges of unknown age located in the forest. This simple bridge type utilizes a single large, relatively flat stone, supported on either side by earth or stone abutments, to cross a small stream or brook. Two of the bridges are located in the southern portion of the forest, not far from the former headquarters site, and serve as part of the current trail system. One bridge is small, while the other is larger and covered by earth that has been held in place by wooden side rails, making the slab construction only visible from the side view. Both are in good condition. The third stone slab bridge is located off-rail, near intersection D3 on Carney Road (Dracut). This bridge is in fair condition and has some vegetative growth on it.

Stone Slab Bridge (DCR)

Four stone culverts were located during the fieldwork for this plan. One is located beneath Trotting Park Road (Lowell), adjacent to Spruce Swamp; another is located beneath the unnamed administrative road in Tyngsborough; a third culvert is located on Carney Road (Dracut), near intersection D3; and the fourth culvert is located on the former headquarter site's entrance loop road, adjacent to the CCC water hole. These culverts, which facilitate the flow of water beneath a roadway, were constructed utilizing small stones. The culvert beneath the former entrance loop road is also lined with a metal pipe, while the others are all stone. They may have been constructed as part of the Works Progress Administration improvements to the forest. All of the culverts are in poor condition, with some blockage and/or minor collapse impeding full flow.

The remnants of a dam, constructed of stone, can be found in the southern portion of the property, along

Claypit Brook. This dam may be associated with the Timothy Coburn mill site. See Historic Archaeological Resources, above, for more information on this resource.

Objects. There are four stone markers located within the state forest, identifying property and/or town boundaries.

- Located near an entrance to the forest on Trotting Park Road in Tyngsborough, this stone is leaning significantly and has some paint remnants on the top. The stone is inscribed with:

  T
  ARD
  1822

- A small property boundary marker inscribed with a "C," located in the southern portion of the forest.
- A town boundary marker with a "T" inscribed on one side and an "L" inscribed on the other. This stone is located at intersection of all three towns; it is leaning and covered in lichen.
- A town boundary marker with an "L" inscribed on one side and a "D" inscribed on the other. This stone is located just off of Trotting Park Road, near the boundary of all three towns. Despite some remnants of paint, it is in the best condition of any boundary marker in the forest.


Stone Boundary Marker (DCR)

Sheep Rock is located in the southern portion of the forest, not far from the former headquarters site. It is a large glacial erratic, approximately 10 feet long, 6 feet wide and 12 feet tall. A large split cuts through the rock and lichen is growing on some of the surface. The north face of Sheep Rock has been vandalized by graffiti and the south face contains the following inscription, in block letters:

SHEEP ROCK
IN MEMORY OF GEORGE J. CARNEY
BORN JUNE 13, 1835
DIED APRIL 24, 1906

Local legend states that Sheep Rock saved a flock of sheep owned by William Parham, a local farmer. During a blizzard, the flock found shelter under an overhang of the boulder. There, they were able to survive for several days until being rescued. The land where Sheep Rock lies was formerly owned by George Carney.


Sheep Rock (DCR)

Stone walls can be found throughout the state forest; they are remnants of the historic land use and ownership in the area, and also reflect the geology of the region. The walls are all dry laid, rubble walls that are generally in fair to poor condition. The walls were not mapped as part of this plan.

Several of the roads in the forest pre-date the establishment of the state forest itself, including Trotting Park Road (Lowell and Tyngsborough) and Totman Road (Dracut). Totman Road, in particular, has been identified as being an older road that may have been laid out along an established Native American pathway. Today it is a typical wide, unpaved forest road that is enjoyed by hikers and mountain bikers.

Landscapes. Remnants of quarrying activity dot the forested landscape, where early settlers took advantage of both the underlying geology of the area and the large collection of glacial erratics. It is a fascinating collection that ties the natural and cultural history of the forest together, and provides a connection to the industrial heritage of Lowell, as stone from the forest was reportedly utilized as building material for Lowell's canal system and textile mills (Ali and Hudon n.d.).

Most of the quarrying activity that was located during the fieldwork for this plan appears to be very small scale; five areas were identified where one or two stones retain visual evidence, in the form of drill scars, of past use for quarrying. Three of these sites are located in the northern portion of the forest, near Trotting Park Road (Tyngsborough) and an unnamed administrative road (Dracut), while the other two are located in the southern portion of the forest, not far from the former headquarters site.

Two other areas were identified where larger scale quarrying took place. One of these quarries is located on the eastern edge of the forest, not far from Gumpus Road in Dracut, and is the only area where a quarry pit, now filled with water, was observed. The other area has evidence of quarrying from exposed ledge. This area, near Sheep Rock, includes a collection of ledge rock and boulders that display drill scars and drill holes.

A boulder that has been worked for quarrying stone. (DCR)

There is undoubtedly evidence of other quarrying activity elsewhere in the forest that was not captured during the fieldwork for this plan. Richardson (1978) noted that he located 73 individual quarry works, the extent of which is unclear, between the former headquarters site and Carney Road (Dracut and Lowell), an area that is popular for mountain biking. However, only one quarry site is recorded on an MHC Inventory form (MHC #LOW.30).

The former entrance loop road that leads to the old headquarters site is a U-shaped drive located in the southern portion of the forest. It is defined by the placement of medium-sized rocks set on either side of the roadbed, approximately five feet apart. It is not known if these rocks were placed during the development of a spring water company in the late 19th century or during the transformation of the area into the state forest headquarters by the Works Progress Administration in 1936-1937.

Recreation Resources

Lowell-Dracut-Tyngsborough State Forest is primarily accessed via motor vehicle. Individuals who live nearby may also choose to walk or ride their bicycle to any one of the trailheads. The Lowell Regional Transit Authority offers an additional, likely underutilized, means of accessing the forest. There are two bus routes, 7 and 10, that run along Varnum Avenue (Lowell) and Tyngsboro Road (Dracut), respectively, and serve downtown Lowell, local high schools and universities, and suburban shopping centers. However, there are no bus stops adjacent to the forest on either bus route.

Recreation at the state forest includes trail-based activities such as hiking and running, horseback riding, mountain biking, snowmobiling and cross-country skiing. Geocaching also occurs throughout the forest, with participants both on and off trails. As of May 2013, there were 13 known geocaches at Lowell-Dracut-Tyngsborough State Forest and two geocaches on the DCR's Tyngsborough Conservation Restriction. Evidence of off-highway vehicle (OHV) use, paintball games, alcohol consumption and campfires, which are in violation of DCR regulations, have also been found along the forest's trails.

Hunting is permitted at the state forest; however there are two designated "No Hunting Areas" (see Figure 2). The first area (approximately 173 acres) is located in the western half of the forest, south of Althea Lake, and overlaps with the portion of the forest that was formerly under agreement with the Greater Lowell Indian Cultural Association (see Section 3.4. Management Resources and Practices). The second area (approximately 36 acres) is located east of Totman Road (Dracut) and south of the

Dracut town line. Neither area is clearly marked in the field.

The Greater Lowell Indian Cultural Association (GLICA) holds several annual recreation events at the state forest each year. The events range from seasonal cleanups to traditional ceremonies that are educational in nature. Each event is open to the public and held within a designated area of the forest, south of Althea Lake in Tyngsborough. Portable sanitary facilities are routinely rented by the GLICA for these events and, in the past, were permitted through a Memorandum of Understanding (MOU) with the DCR; that MOU has expired. Open fires, cooking and camping occasionally take place at GLICA-sponsored events; these activities were also permitted per the expired MOU with the DCR. For more information on the expired MOU, see Section 3.4. Management Resources and Practices.

The Merrimack Valley Chapter of the New England Mountain Bike Association (MV-NEMBA) devotes most of its resources to trail construction and maintenance in the Greater Lowell area. The primary focus of the MV-NEMBA is Lowell-Dracut-Tyngsborough State Forest, but the group is also active at other properties within the Lowell/Great Brook Planning Unit. In addition to their trail work, the MV-NEMBA organizes several group riding and cleanup events within the state forest each year. The majority of the group's activities are approved and permitted, via a Recreational Use Permit, by the Forest and Parks Supervisor.

Infrastructure

Property Boundary

Fee Interest Land. The 1,109-acre state forest is situated northeast of the Merrimack River, between Route 113 in Lowell and Mammoth Road in Dracut, where the City of Lowell and towns of Dracut and Tyngsborough meet. The forest can be reached by car in less than 15 minutes from Lowell, MA and less than 30 minutes from Nashua, NH.

Conservation Restrictions. There are three Conservation Restrictions (CRs) associated with the forest; one each in the towns of Tyngsborough and Dracut, and one in the City of Lowell (see Figure 2).

A 47-acre CR is located off of Autumn and Alden streets in the Town of Tyngsborough. The fee interest is held by the town and its Conservation Commission is responsible for the care and control of the property. The purpose of the CR is "…to retain the premises predominantly in its natural, scenic and open condition; to protect and promote the conservation of forests, wetlands, soils, natural watercourses, ponds, water supplies and wildlife thereon; to allow public access to Long Pond (a Great Pond) for fresh-water recreation and to the premises for the enjoyment of wildlife, natural resources, and passive recreation." Activities that are detrimental to the property's water and soil resources, including the use of motorized vehicles, are prohibited. The construction of two public parking areas, one on Alden Street for not more than 10 cars and one on Autumn Street for not more than five cars, is permitted.

A nine-acre CR is located off of Lakeview Terrace in the Town of Dracut. The fee interest is held by the Boisvert family. The purpose of the CR is "to retain the premises predominantly in its natural, scenic and open condition; to protect and promote the conservation of forests, wetlands, soils, natural watercourses, ponds, water supplies and wildlife thereon; to protect the horticultural resources of the premises; to protect and enhance the value of the abutting conservation areas; and to allow public access for enjoyment of wildlife and open space resources of the premises as specifically provided for herein." Activities that are detrimental to the property's water and soil resources, including the use of motorized vehicles, are prohibited.

A 17-acre CR is located off of Totman Road in the City of Lowell. The fee interest is held by Northeast Radio, Inc. There are existing structures, including four towers for radio transmission, on the property. The purpose of the CR is to allow the DCR to inspect the property on foot; to selectively cut and/or prune trees and erect signs interpreting or regulating access to the land; and to enter and pass through on foot to access the state forest. The property is not open to the public. In addition, activities that are detrimental to the property's water and soil resources are prohibited.

Buildings and Structures

On November 29, 1935, the Town of Dracut granted the Dracut Water Supply District (DWSD), an independent entity, the right to construct and maintain water supply infrastructure on its land. According to the deed, the exact location of the

infrastructure was to be determined by the Commissioners of the DWSD at the time of construction (Middlesex County Registry of Deeds, Northern District, Book 872, Page 85). However, the next day, November 30, 1935, the town conveyed approximately 335 acres to the Commonwealth, reserving the "…rights of the Dracut Water Supply District to construct and maintain a reservoir or standpipe on parcel four (4)…together with all rights necessary and incidental thereto" (Middlesex County Registry of Deeds, Northern District, Book 876, Page 228).

Parcel four includes most of Whortleberry Hill; the reservoir and related infrastructure described below are located on the eastern side of Gage Hill (or parcel five, as described in the deed; see Figure 2). To date, neither the DWSD nor the DCR have found any correspondence regarding the construction of a reservoir, or related infrastructure, on parcel five instead of parcel four. There is also no Memorandum of Agreement, or similar document, between the DWSD and DCR that guides access to and maintenance of the infrastructure on parcel five.

Reservoir. The one million gallon water supply reservoir, constructed in 1939, is located on the eastern side of Gage Hill, near the summit (Riopelle 2013*a*). It is covered by a 93-foot square concrete slab and surrounded by a six-foot tall chain-link fence topped with barbed wire. The fence features two gates that are secured with padlocks and one sign that reads: "Public Water Supply No Trespassing." The DCR is currently reviewing a proposal by the DWSD to replace the reservoir, due to the fact that it is undersized and nearly 75 years old.

Pump House. Down slope of the reservoir is a 15- by 24-foot windowless, single-story, masonry block building with a wood framed roof and asphalt shingles. The building, which was constructed within the last 10 years, serves as a pump house; it has electricity and is serviced by propane gas and fuel oil providers (Riopelle 2013*b*). A single, double-wide, locking metal door secures the building. Next to the entrance, and affixed to the exterior of the building, is a secure propane tank storage area.

At the rear of the building are one of two fire hydrants on site and a raised, circular concrete slab, approximately six feet in diameter. On top of the concrete slab is a secure access panel. Before the pump house was built, this structure was used to access and maintain critical water supply infrastructure. In the future, this structure will be removed and the area resurfaced to match the material and grade of the surrounding access road (Riopelle 2013*b*).

On the north side of the pump house are the second fire hydrant and a four- by five-foot secure, metal electrical transformer box, which is owned by National Grid. The transformer box sits on a five- by six-foot concrete slab and is surrounded by three, four-foot tall concrete bollards for safety and security purposes.

Dam. An illegal dam is located on the northeast side of Trotting Park Road (Tyngsborough), approximately 200 feet southeast of a DCR gate that separates the public and private portions of the road. The dam limits the flow of water from a wetland into Scarlet Brook through a culvert under Trotting Park Road (Tyngsborough). The dam primarily consists of logs greater than 12 inches in diameter and over 10 feet in length. It is not known when the dam was constructed or by whom.

Over time, water and sediment have collected behind the dam, creating a pond-like environment and promoting the growth of leafy vegetation on the dam itself. Water frequently overflows the dam, which floods and erodes portions of Trotting Park Road (Tyngsborough). At times, the erosion is significant enough to prevent DCR staff and emergency vehicles from entering the forest through the nearby DCR gate.

Trash Dumpsters. In the southern portion of the forest, within the former headquarters site, there are four large trash dumpsters that are in fair to poor condition. The dumpsters are primarily used by DCR staff to dispose of trash and larger debris collected at the state forest and nearby Lowell Heritage State Park.

Roads

Althea Avenue (Tyngsborough) is the only public road that runs through Lowell-Dracut-Tyngsborough State Forest; approximately 0.3 miles of the dead end, residential street are located within the northern section of the forest.

Trotting Park Road is the forest's primary administrative road (0.8 miles; see Figure 2). It is oriented in a north-south direction and connects the public portions of Trotting Park Road in Lowell and Tyngsborough. The paved portion of this road (0.6 miles) runs from the main entrance (Trotting Park Road, Lowell) to the northwest corner of Spruce Swamp. From Spruce Swamp to Trotting Park Road in Tyngsborough, the road surface is bank run gravel (0.2 miles).

The paved portion of Trotting Park Road continues north from Spruce Swamp to Dexter Avenue (Dracut) as an unnamed administrative road (0.5 miles; see Figure 2). An additional unnamed administrative road, located off of Tyngsboro Road (Dracut), provides access to the Dracut Water Supply District reservoir and related infrastructure (paved 0.2 miles; processed gravel 0.1 miles).

Parking

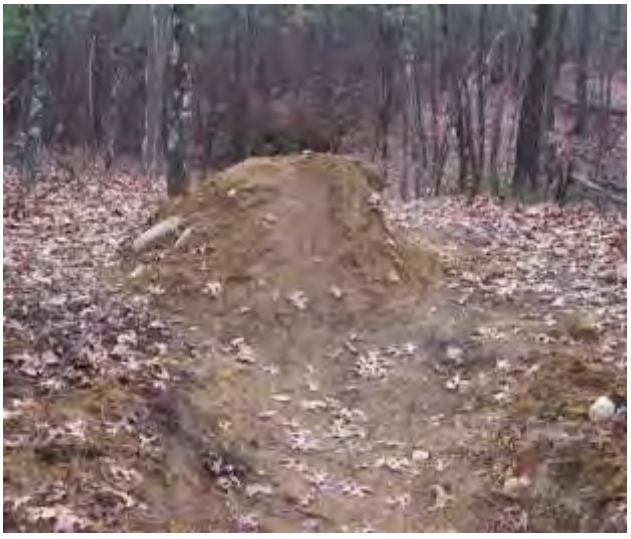
The forest has two small parking areas (see Figure 2). The first is located at the main entrance on Trotting Park Road in Lowell. It is a paved lot with a shared entrance and exit, and can accommodate approximately six vehicles. Individual spaces are not marked and there are no designated accessible spaces.

This parking area is the most popular with visitors. Vehicles are routinely parked on either end of the paved portion of the lot when there are no other spaces available. Further south on Trotting Park Road (Lowell), approximately 40 feet from the designated parking area, an "overflow" lot has been created. This unofficial parking area can accommodate three or four vehicles.

The second parking area, as indicated on the current state forest trail map, is located at the end of Trotting Park Road in Tyngsborough. It is unclear where to park when visiting this area of the forest. The most obvious location is in front of a forest gate on the west side of the road; however, this prevents DCR staff and first responders from being able to enter the forest in the event of an emergency.

Trails

There are approximately 27 miles of trails within the state forest, nearly all of which are official. An assessment of trail condition, conducted in 2009, indicated that 95% of the official trails were in good or fair condition and only 1.3 miles (5%) were in poor condition. Several official trails include technical features (e.g., banked or bermed corners, jumps and ramps), which are constructed to increase the technical challenge for mountain bike riders. It is unclear whether these features were subject to all applicable regulatory reviews and approved by the reviewing authorities and the DCR.



A mountain bike jump constructed in the forest. (DCR)

There is one, 1.5-mile long Healthy Heart Trail within the forest; it is located between the main entrance in Lowell and Spruce Swamp. Healthy Heart Trails are pathways used for hiking or walking that are easy to moderate in activity level and promoted by the DCR as a way to improve health through routine use.

The current version of the state forest trail map indicates four other named trails within the state forest (Thompson Lane, Totman Road, Carney Road and Gumpus Road), as well as "Public Safety Markers," or trail intersection numbers, that correspond to the town in which they are located (e.g., "L1" in Lowell, "D1" in Dracut, "T1" in Tyngsborough, etc.). Signs for these features are largely missing from the trail network. There are also more trails in the network than indicated on the current version of the state forest trail map.

Signs and Kiosks

There is one Main Identification Sign for the state forest. It is set back from, and parallel to, the north side of Varnum Avenue (Lowell), near the intersection of Trotting Park Road (Lowell). The orientation, material and design of this sign do not

meet DCR signage standards (DCR n.d.). There are no Road Marker Signs that lead visitors to the state forest from the surrounding communities.

There are six kiosks located within the state forest; each is constructed of wood framing and has an asphalt shingle roof. Two kiosks are near the forest's parking areas and do not meet DCR signage standards for Welcome Wayside Signs (DCR n.d.). Only one kiosk, at the main entrance on Trotting Park Road in Lowell, features the current state forest trail map. Four of the six kiosks feature information on hunting (e.g., seasons, rules and regulations). The two kiosks closest to the parking area on Trotting Park Road in Tyngsborough are completely blank.

All six kiosks are in fair to good condition. Moss is growing on the roof of the kiosk at the main entrance on Trotting Park Road in Lowell. The two kiosks on Totman Road in Dracut have been vandalized with permanent marker and paint.

Memorials and Markers

Sheep Rock is the only known memorial within the state forest. (See Section 3.3. Existing Conditions, Cultural Resources, for additional information.)

3.4. MANAGEMENT RESOURCES AND PRACTICES

See Section 2, Management Resources and Practices, for a description of the management resources and practices that apply to the entire Lowell/Great Brook Planning Unit.

Natural Resources

Vegetation

The Dracut Water Supply District (DWSD) maintains the vegetation along the access road leading to the summit of Gage Hill, as well as around the water supply infrastructure there. (See Section 3.3. Existing Conditions, Buildings and Structures, for additional information.) The DWSD also maintains an approximately 20-foot-wide vegetated corridor that runs from the pump house north to Tyngsboro Road (Dracut). The purpose of this corridor is to prevent woody or deep-rooted vegetation from disturbing the underground pipelines in the area (Riopelle 2013*c*). There is no Memorandum of Agreement, or similar document, between the DWSD and DCR that guides this maintenance activity.

Wildlife

For the most part, the DCR does not actively manage wildlife at the state forest. However, when beaver activity becomes a problem (e.g., it threatens public health or safety), a wildlife specialist is called upon to install one or more beaver deceivers, or to trap the animal(s). In addition, the hunting of game species is permitted outside of the forest's "No Hunting Areas" (see Section 3.3. Existing Conditions, Recreation Resources).

Cultural Resources

There are no cultural resource management activities that are unique to the state forest.

Recreation Resources

Greater Lowell Indian Cultural Association (GLICA) Memorandum of Understanding (MOU)

The purpose of the expired MOU between the DCR and the GLICA was to "authorize the GLICA to use approximately two hundred and fifty-two (252) acres of the Lowell-Dracut-Tyngsboro [sic] State Forest…for temporary American Indian cultural activities and special events…to promote understanding of American Indian people and customs." The document largely outlined the GLICA's responsibilities related to the use and maintenance of the agreed upon area. Permissible activities, public access to events and circumstances requiring advanced or immediate notification to the DCR were addressed, among other topics.

On April 13, 2012, the GLICA notified the DCR, in writing, of their interest in renewing the MOU that was scheduled to expire on July 1, 2012. The DCR sent a new five-year MOU (valid through July 1, 2017) to the GLICA for their signature on July 6, 2012, but that document was never signed and returned to the DCR.

Camping

There are no permanent campsites or cabins at Lowell-Dracut-Tyngsborough State Forest; however, temporary campsites have been designated in the past, by the Forest and Parks Supervisor, for events sponsored by the Greater Lowell Indian Cultural Association.

Hunting and Fishing

Hunting is not permitted in two separate areas of Lowell-Dracut-Tyngsborough State Forest (see Section 3.3. Existing Conditions, Recreation Resources). The Greater Lowell Indian Cultural Association was responsible for posting and maintaining DCR approved "No Hunting" signs within the portion of the forest that was under agreement.

Trail Use

Snowmobiles may be used on any unplowed forest road or way at Lowell-Dracut-Tyngsborough State Forest, provided that: the vehicle is registered; sub-surface soil is "solidly frozen and completely covered with a minimum of four inches of hard packed snow or ice;" and the vehicle is carrying a spare spark plug, flashlight, drive belt and "sufficient tools to effect minor repairs." Snow vehicles may operate on frozen waters when there are five or more inches of frozen ice and in "fields, gravel banks or similar open areas where such use is permitted by appropriate signage." (See 304 CMR 12.29; Appendix F.)

Infrastructure

Buildings and Structures

The Dracut Water Supply District (DWSD) manages the majority of the infrastructure near the summit of Gage Hill; National Grid is responsible for the maintenance of the electrical transformer box (see Section 3.3. Existing Conditions, Buildings and Structures). There is no Memorandum of Agreement, or similar document, between the DWSD and DCR that guides this management activity.

DCR staff maintain the culvert and leafy vegetation associated with the illegal dam on Trotting Park Road in Tyngsborough (see Infrastructure, above, for more information). Staff have also added a layer of course gravel to the surface of the road, however flooding remains an issue.

The four large trash dumpsters located within the former headquarters site are routinely serviced by a disposal company that is under contract with the DCR.

Roads

The DCR's Forest Fire Control District 6 provides forest road maintenance (e.g., roadside mowing, tree removal and road repairs) on an annual basis.

The Dracut Water Supply District (DWSD) plows the access road leading to the summit of Gage Hill. (See Section 3.3. Existing Conditions, Roads, for additional information.) There is no Memorandum of Agreement, or similar document, between the DWSD and DCR that guides this maintenance activity.

Trails

The Merrimack Valley Chapter of the New England Mountain Bike Association performs volunteer trail work, including trail maintenance, repair and construction, and bridge building for trails, within the state forest. In the past, this work has primarily been done in consultation with the Forest and Parks Supervisor; a more formal agreement for this work is needed to ensure compliance with any required regulatory reviews. All trail work, whether performed by DCR employees or others, must be performed in accordance with general regulations and policies identified in Section 2.

Interpretive Services

Interpretive service programming is not offered at the state forest, nor is any other interpretive information provided.

Operational Resources

DCR Staffing

The state forest is operated as a satellite of Lowell Heritage State Park and does not have any dedicated on site staff.

Supplemental Staffing

Members of the Greater Lowell Indian Cultural Association and Merrimack Valley Chapter of the New England Mountain Bike Association routinely volunteer their time at the state forest for various general cleanup and trail maintenance activities. The potential exists for members of the Friends of the Forest, a group that has been inactive for several years, and students at the Greater Lowell Regional Technical High School to become more involved in organized activities at the state forest.

Public Safety

Local emergency response and law enforcement support within the state forest is complicated by the fact that the forest occurs in three municipalities. Recent efforts to improve communication between the DCR, local responders and visitors include: adopting a town-specific trail intersection numbering system (see Section 3.3. Existing Conditions, Trails) and distributing a "safety map" of the forest to pertinent DCR staff and local officials. The safety map includes information on the forest's trails, fire roads, major trail intersections and access gates, as well as neighboring access roads and municipal boundaries.

DCR Rangers issue citations for violations of various forest and park rules. A summary of incident reports recorded in the state forest during 2013 is provided below.

Table 3.4. Lowell-Dracut-Tyngsborough State Forest Incident Reports, January 1 through December 31, 2013

Incident	Number
Illegal dumping	1
Property damage	1
Violation of DCR regulations[a]	2
Total	*4*

a. These violations were related to off-highway vehicle (OHV) use and a campsite/fire within the state forest.

Vandenberg Esplanade (Peter E. Lee; CC BY-NC 2.0; cropped from original)

SECTION 4. LOWELL HERITAGE STATE PARK

4.1. INTRODUCTION

Forty years ago, the Department of Natural Resources proposed the Commonwealth's first heritage state park in Lowell. The purpose of the park was twofold: to preserve the cultural heritage of the city and surrounding region, and to increase public appreciation and enjoyment of the area's natural and cultural resources. Through an ambitious plan of acquisition, conservation and development, the agency and its partners were able to bring their vision of urban recreation and a revitalized industrial city to life.

Lowell Heritage State Park (87 acres) is comprised of linear greenways along the Merrimack River and Lowell Canal System, and a collection of historic buildings and structures related to the industrial development of the city. The park provides much needed open space in the city's downtown; showcases the city's history, with a focus on the canal system and associated mills; and serves as an important venue for a variety of civic and social functions.

4.2. HISTORY OF PROPERTY

The story of Lowell Heritage State Park is closely tied to that of the Merrimack River. The river originates in Franklin, New Hampshire and runs southward for 116 miles, reaching the Atlantic Ocean in Newburyport, Massachusetts. Although the Merrimack descends "a modest average of 2.6 feet per mile," there are several waterfalls where the river drops more rapidly in elevation (Steinberg 1991, 50). Prior to the construction of dams, a total of 14 waterfalls existed along the course of the Merrimack. Both Native Americans and European colonists established settlements near many of these falls.

Native Americans were drawn to Lowell because of its natural resources and strategic location. Pawtucket Falls slowed the progress of migrating Atlantic salmon, American shad, lamprey and alewife, allowing them to be caught in large numbers (Stolte 1981). This abundant and predictable seasonal food supply, along with easy access to coastal and forest resources, attracted the Pennacook Tribe, who established a populous settlement downstream of the falls. In 1653, the Massachusetts General Court authorized John Elliot

to establish Wamesit, a praying village for the Pennacook, at the confluence of the Merrimack and Concord rivers (Hudon 2004). Twenty-three years later, however, the Pennacook abandoned Wamesit due to King Phillip's War.

As European settlements expanded, colonists sought ways to move timber and crops to coastal cities, and imported goods inland. However, Pawtucket Falls impeded the flow of river traffic, requiring goods to be shipped over land around the falls. In 1792, a group of wealthy Newburyport businessmen, known as the Proprietors of Locks and Canals on the Merrimack River (the Proprietors), constructed the Pawtucket Canal to solve this problem. The canal, which ran from upstream of the falls to the confluence of the Merrimack and Concord rivers, bypassed both the falls and a near 90-degree bend in the Merrimack. In 1801, five years after the Pawtucket Canal opened, work began on a competing canal. Beginning in 1803, the Middlesex Canal, which connected Chelmsford to Charlestown, moved raw materials and goods to the port of Boston. Although the Middlesex Canal outcompeted the Pawtucket Canal, its success was short-lived due to the arrival of the railroad in the 1830s.

The industrial development of Lowell began in 1821 when a second group of businessmen visited Pawtucket Falls to assess its potential for industrial water power (Hudon 2004). Within a month they had purchased over 350 acres of land between the bend in the river and the Pawtucket Canal, in what was then East Chelmsford. In 1822, they purchased water power rights from the Proprietors, the company that constructed the Pawtucket Canal 30 years earlier. This established the Proprietors as the developer and power broker of the city, selling land and leasing mill power to textile manufacturers for years to come (Hudon 2004).

In 1825, the Merrimack Canal, the city's first power canal, was completed. Four additional power canals were constructed between 1826 and 1835; by 1840 these canals were distributing power to 32 mills (Hudon 2004). One additional canal and an underground connector between canals were built in the late 1840s. A permanent dam across the Merrimack, constructed in 1830 and increased in height in 1833, created an 18-mile stretch of river as a water holding area to ensure an adequate supply of water for the mills. In 1845, the Proprietors bought outlets to several bays and lakes in New Hampshire to further ensure sufficient water to power the mills.

As the mills grew, so too did the city. In 1826, the site of the mills in East Chelmsford became the town of Lowell. Ten years later, Lowell was given a city charter and in three short years, it was the third largest city in Massachusetts. This rapid population growth was driven by the arrival of mill workers. Initially, most mill workers were single, young females from the Merrimack Valley who lived in boarding houses owned by the mills. However, immigration soon changed the demographics of mill workers.

A massive influx of immigrants, from Ireland and other parts of Europe, took place in the 1840s. By 1850, the population of Lowell was 33,000. According to the 1915 state census, one-third of Merrimack Valley residents were foreign born (Hudon 2004). These immigrants remained the major source of labor until the 1920s (Forrant and Strobel 2011). Fewer immigrants made their way to Lowell between the mid-1920s and mid-1960s due to changes in immigration laws and the closing of mills. It was at the end of this period of decline, amid a 13% unemployment rate and a surplus of abandoned, deteriorating infrastructure, that an interest in revitalizing the city first took hold.

In 1974, the Department of Natural Resources (DNR) developed a nine million dollar proposal for Lowell Heritage State Park, the first of its kind in the state system. The following year, the Department of Environmental Management (DEM), a successor to the DNR, announced the completion of a Memorandum of Understanding with the City of Lowell and an accelerated development schedule for two "nodes" within the park: Francis Gate and Pawtucket Boulevard. A few years later, in 1978, President Carter signed legislation dedicating $40 million to the creation of Lowell National Historical Park, which spurred a unique preservation partnership between local, state and federal governments, and later, the private sector.

By the mid-1980s, the DEM had exceeded its original acquisition, conservation and development goals for the park. It also created an ambitious and successful year-round interpretive program, including a living history component, which was fully integrated with the efforts of the National Park Service. At its peak in 1987, Lowell Heritage State

Park employed 16 full-time and 17 seasonal staff, and had an annual operating budget of $480,000.

Over the next five years, the DEM's budget was greatly reduced and the agency was forced to cut personnel and park budgets. Lowell Heritage State Park presented a particular challenge, since it served as the model for the heritage park concept, and was the largest and most complex heritage park in the state system. At the request of then Commissioner Peter Webber, an intradivisional task force was convened to review the status of the park and develop recommendations for its future. The task force's report concluded that the DEM should "concentrate on maximizing the riverfront component and minimizing, but not eliminating, [its] position in the downtown" (DEM 1993, ES).

Today, the Department of Conservation and Recreation (DCR), successor to the DEM, retains an ownership interest in most of the land that once comprised Lowell Heritage State Park. However, under even greater budget constraints, the DCR continues to focus its resources on the riverfront portion of the park and uses legal agreements with its original partners, the City of Lowell and National Park Service, to operate and maintain facilities park-wide.

4.3. EXISTING CONDITIONS

In this section and the following, 4.4. Management Resources and Practices, the park's resources are presented in order, from west to east. In other words, under each heading (e.g., Natural Resources), resources related to the Vandenberg esplanade are presented first, followed by resources related to the downtown portion of the park. The descriptions of the downtown resources are further organized by the flow of water. In general, resources related to the Pawtucket and Northern canals are present first, followed by resources related to the remaining canals, in the same order as the water flows through the system today.

Natural Resources

Physical Features

Topography. The Merrimack and Concord rivers are the defining features of Lowell Heritage State Park (see Figure 3). The Merrimack River flows easterly through the northern portion of Lowell, dropping approximately 60 feet in its eight-mile course through the city. The Concord River flows northerly through the eastern half of the city and enters the Merrimack near Bridge Street. In general, the Concord River is fairly level and its floodplain is mostly broad. However, within the city, the Concord River drops rapidly, due to three sets of falls, and has a relatively narrow floodplain.

Geology. The City of Lowell is located within the northern portion of the Nashoba terrane, a rock formation that consists of interlayered gneisses and schists. The Clinton-Newbury fault zone forms the northern boundary of the Nashoba terrane and is believed to have played a role in changing the course of the Merrimack River at the western limits of the city. The river originally flowed southeast through Woburn and into Boston Harbor. The buried bedrock valley from this original course provides valuable resources for the region. For example, wells that supply Lowell, Winchester and Woburn with abundant groundwater are situated along the former course of the river. In addition, glacial outwash deposits within the buried valley are mined for concrete aggregate and other building purposes.

Soils. Soils within Lowell Heritage State Park vary based on the topography and level of development near the Merrimack River. Very poorly to excessively drained silt and sandy loams are associated with the wide floodplain and limited development between the river and Varnum Avenue. These soils are considered severely limited for playgrounds and moderately limited for picnic areas, paths and trails (Peragallo 2009). Well to excessively drained glacial deposits, most of which have been disturbed by heavy development, dominate the remaining portion of the park. These soils range from being moderately to slightly limited for picnic areas, playgrounds, paths and trails (Peragallo 2009).

Table 4.1. Soils of Lowell Heritage State Park[a]

Soil Series	% of Park	Drainage Class
Udorthents	17.1	N/A
Urban land	16.1	N/A
Suncook loamy sand	12.8	Excessively drained
Merrimac-Urban land complex	10.8	Somewhat excessively drained
Occum very fine sandy loam	9.9	Well drained
Limerick silt loam	8.5	Poorly drained
Water	7.0	N/A
Winooski very fine sandy loam	7.8	Moderately well drained
Scio very fine sandy loam	3.6	Moderately well drained
Birdsall mucky silt loam	3.5	Very poorly drained
Windsor loamy sand	1.7	Excessively drained
Scio-Urban land complex	0.8	Moderately well drained
Canton-Charlton-Urban land complex	0.3	Well drained

a. Excluding the Lord swimming pool and Janas skating rink.

Water Resources

Ponds. There are no ponds within the park.

Wetlands. There are approximately 11 acres of wetlands along the Vandenberg esplanade, immediately upstream of the Rourke Bridge and north of regatta field. In addition, there is a small (0.5 acres) wetland in between the Janas skating rink and Douglas Road. (See Figure 3.)

Vernal Pools. There are no certified or potential vernal pools within the park.

Streams. There are three named streams or rivers within Lowell Heritage State Park (see Figure 3). Claypit Brook, the smallest of the water bodies, originates in Lowell-Dracut-Tyngsborough State Forest. The stream flows south from the forest towards Varnum Avenue in Lowell, where it turns east and runs near regatta field before entering the Merrimack River.

The next water body is the heart of the park and the city. Once considered one of the most polluted rivers in the country, the Merrimack River's water quality has improved greatly in the last 40 years. However, it is still considered "impaired" by the United States Environmental Protection Agency (EPA), due to a variety of chemical and biological contaminants that are routinely detected in present day water quality assessments.

Table 4.2. Causes of Impairment for Select Segments of the Merrimack River, Reporting Year 2012

Segment Location	Cause of Impairment
NH/MA State Line to Pawtucket Dam, Lowell	Fecal coliform, mercury in fish tissue
Pawtucket Dam, Lowell to Duck Island, Lowell	E. Coli, mercury in fish tissue, total phosphorus
Duck Island, Lowell to Essex Dam, Lawrence	E. Coli, mercury and PCBs in fish tissue, total phosphorus

Source: EPA 2014

The remaining water body, located on the easternmost side of the park, is the Concord River. It originates at the confluence of the Sudbury and Assabet rivers and flows north, approximately 16 miles, through Concord, Carlisle, Bedford and Billerica before entering the Merrimack River in Lowell. The EPA also considers a portion of the Concord River in Lowell, from the Rogers Street Bridge to the Merrimack River, to be "impaired." The causes of impairment are: excess algal growth, fecal coliform, mercury in fish tissue and total phosphorus (EPA 2014).

Groundwater. A portion of two medium-yield aquifers and one high-yield aquifer occur beneath two sections of the park (see Figure 3). Near the Rourke brothers boat ramp, approximately 16 acres of the park overlap with both a high- and medium-yield aquifer that follows Stony Brook and Black Brook south, past Route 3 in Chelmsford. Further east, at the bend in the Merrimack River, between Pawtucket Falls and Aiken Street, a medium-yield aquifer extends south from Pleasant Street, along Beaver Brook, to the northern shoreline of the river. Approximately two acres of the park overlap with this aquifer.

Flood Zones. The 100-year flood zone covers 64 acres (73%) of the park; its boundary approximately parallels the Merrimack River and each of the canals, where the DCR has an ownership interest. All of the developed areas along the Vandenberg esplanade are included in the 100-year flood zone. In addition, many of the historic buildings within downtown Lowell are included in the 100-year flood zone. However, it should be noted that water levels

Placeholder for Figure 3 (front).

Placeholder for Figure 3 (back).

within the canal system are regulated to reduce the likelihood of flooding in this portion of the park.

The 500-year flood zone covers an additional nine acres (10%) of the park, including the majority of the Rynne bathhouse and its parking area. In downtown Lowell, the Gatekeeper's Barn is the only historic building included in the 500-year flood zone. Further east, the 500-year flood zone also extends across the Janas skating rink parcel, impacting approximately 22% of the property (one acre), but not the skating rink itself.

Rare Species

Lowell Heritage State Park is home to three state-listed species.

Table 4.3. State-listed Species of Lowell Heritage State Park, as identified by the Natural Heritage & Endangered Species Program (NHESP)

Species	Type	MESA[a]
Bald eagle	Bird	T
Cobra clubtail	Insect	SC
Umber shadowdragon	Insect	SC

Source: Harper 2013

a. Status of species listed under the Massachusetts Endangered Species Act (MESA): SC = Special Concern and T = Threatened.

While occasionally spotted over the park, bald eagles are more common near the mouth of the Merrimack River, where there is more suitable nesting and wintering habitat (NHESP 2012). The cobra clubtail and umber shadowdragon can also be found in the park, on occasion, primarily along the Merrimack River. Both species of dragonflies prefer large, unvegetated rivers and lakes for breeding, and the surrounding upland borders for feeding, resting and maturing (NHESP 2008*a* and NHESP 2008*b*).

Nearly half of Lowell Heritage State Park (42 riverfront acres) has been designated as Priority Habitat under the Massachusetts Endangered Species Act (321 CMR 10.00; see Appendix F). Most of this same area (39 riverfront acres) has also been identified as Core Habitat in the MassWildlife and The Nature Conservancy publication "BioMap 2: Conserving the Biodiversity of Massachusetts in a Changing World" (MassWildlife and TNC 2010).

BioMap2 highlights two types of areas important for conservation: Core Habitat and Critical Natural Landscape. The first is crucial for the long-term persistence of rare species and other species of conservation concern. The second provides habitat for wide-ranging native wildlife, supports intact ecological processes, maintains connectivity among habitats, enhances ecological resilience and buffers aquatic Core Habitats to help ensure their long-term integrity. Protection of both areas, which may overlap, is "important to conserve the full suite of biodiversity" in Massachusetts (MassWildlife and TNC 2010).

Within the park, there are also 35 acres (40%) of Critical Natural Landscape adjacent to the Merrimack River.

Vegetation

Forest Types. In 2003, the James W. Sewall Company developed a forest inventory/land cover classification dataset for the state forests and parks. The dataset is primarily based on the interpretation of infrared aerial photography, a process that identified three forest sub-types along the Vandenberg esplanade.

Table 4.4. Forest Sub-types of Lowell Heritage State Park[a]

Forest Sub-type	Acres	% of Park
Oak-hardwoods	3.3	3.8
Mixed oak	3.2	3.7
Scots pine plantation	2.7	3.1
Total	*9.2*[b]	*10.6*

a. Excluding the Lord swimming pool and Janas skating rink.

b. Only the park's riverfront acres were included in the analysis. Of those acres, wetlands, areas of open water and day use and administrative areas were removed from the total.

There is also one Continuous Forest Inventory (CFI) plot within the park. The CFI is a network of permanent, one-fifth-acre plots on state forest lands that are routinely monitored for sivicultural purposes. The measurements and observations made within each CFI plot are recorded in a database that dates back to 1960, when the CFI was created. Approximately 10% of the state's CFI plots are inventoried each year, on an on-going basis. As of 2010, there were 1,768 CFI plots statewide (Goodwin 2014).

Unfortunately, the plot within Lowell Heritage State Park is located within a grassy area of the Vandenberg esplanade, so it does not provide any additional information about the health of the park's limited forest.

Priority Natural Communities. There are no Priority Natural Communities within the park.

Invasive Species. Japanese knotweed (*Fallopia japonica*) was observed along the western half of the Vandenberg esplanade, between the river and the retaining wall, while conducting fieldwork for this plan.

Pests and Disease. None has been identified at the park.

Wildlife

Birds. There is little current information on the park's birds. Five species confirmed to occur within the park are identified in Appendix G. Of these species, one is classified as a Species in Greatest Need of Conservation (MassWildlife 2006).

Mammals. There is little current information on the park's mammals. Fourteen species that may possibly occur within the park are identified in Appendix G.

Reptiles. There is little current information on the park's reptiles. One species confirmed to occur within the park and an additional four species that may possibly occur within the park are identified in Appendix G.

Amphibians. There is little current information on the park's amphibians. Five species confirmed to occur within the park and an additional three species that may possibly occur within the park are identified in Appendix G.

Fish. The Massachusetts Office of Fishing & Boating Access lists largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), northern pike (*Esox lucius*), white perch (*Morone americana*), chain pickerel (*Esox niger*), black crappie (*Pomoxis nigromaculatus*) and walleye (*Sander vitreus*) as fish species that are typically caught in the Merrimack River (OFBA 2014).

In addition, the Department of Public Health lists American eel (*Anguilla rostrata*) and white sucker (*Catostomus commersonii*) as part of the public health fish consumption advisories for the Merrimack River and canal system (DPH 2014). (See Recreation Resources, below, for more information about the advisories.)

Finally, the United States Fish & Wildlife Service, through its Central New England Fishery Resources Office, monitors migratory fish populations in the Merrimack River. Fish passage data for the Pawtucket Dam indicate American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*) and sea lamprey (*Petromyzon marinus*) also occur in the park (USFWS 2014).

Cultural Resources

Pre-Contact Archaeological Site

Although only three pre-Contact sites are recorded in the park, many more exist along the Merrimack River both downstream and up. Many Archaic Period village sites, camp sites and fishing grounds are documented nearby along the banks of the river. Archaeological testing along the river clearly revealed it has been reconfigured and straightened. Above Pawtucket Dam, which was constructed at the naturally occurring Pawtucket Falls, the shoreline had to be raised and straightened and Pawtucket Boulevard was constructed on the fill afterwards. Despite land modification and filling, there is a moderate potential for the complex.

Historic Archaeological Resources

The Tremont Mills powerhouse, formerly located in Tremont Yard, on the Western Canal where it meets Father Morissette Boulevard, was partially demolished when it became a part of Lowell Heritage State Park. The single-story ruin was in a state of serious deterioration when it was completely demolished in 2008, as part of a lease for redevelopment (see Infrastructure, below, for more information). The stipulations for redevelopment included preserving the historically significant below grade features, such as the original turbine pits dating from 1847-1854. It was within this powerhouse that James B. Francis, chief engineer for the Proprietors of Locks and Canals on the Merrimack River, conducted experiments that allowed for the development of a more powerful and efficient turbine technology. The original turbine pits are viewable within the office building that is now located on the site and interpretive information is provided.

Historic Resources

This section provides information on Lowell Heritage State Park's historic buildings, structures, objects and landscapes (see Figure 3). See Infrastructure, below, for information on the park's non-historic buildings and structures.

Designations

With the exception of the Rynne bathhouse, all of the resources within Lowell Heritage State Park fall within the Downtown Lowell Local Historic District. This district, initially established on December 13, 1983, and later expanded in 1986 and 2004, "…seeks to ensure that development activities within the district are consistent with the preservation of its 19th century setting" (City of Lowell 2014). More protective than a National Register of Historic Places designation, the local historic district requires review of alterations to any exterior feature by the Lowell Historic Board for compliance with the design review standards and policies that have been established for this district. The DCR has a seat on the Lowell Historic Board.

There are also three National Register Districts, with some overlaps, and a National Historic Landmark designation that apply to the DCR properties within Lowell Heritage State Park:

- The City Hall District, of which only the Mack building is a part, was listed on the National Register on April 21, 1975.
- The Locks and Canals Historic District was listed on the National Register on August 13, 1976 and became a National Historic Landmark on December 22, 1977. With the exception of the Rynne bathhouse, all of Lowell Heritage State Park falls within this district.
- The Lowell National Historical Park and Preservation District was listed on the National Register on June 5, 1978. This much larger district includes all of Lowell Heritage State Park.

The Lowell Canal System has also been recognized for its significance within the field of engineering. The American Society of Civil Engineers designated the "Lowell Waterpower System" as a Historic Civil Engineering Landmark in 1984, and the American Society of Mechanical Engineers (ASME) designated the "Lowell Power Canal System and Pawtucket Gatehouse" as a Historic Mechanical Engineering Landmark in 1985 (Reese 2014; ASME 2014).

Buildings

The ***Michael Rynne Bathhouse*** is the lone historic building on the Vandenberg esplanade. Located at 160 Pawtucket Boulevard, the building was constructed sometime between 1906 and 1924. It is named for Mike Rynne, a former Lowell police officer and highly regarded athlete that excelled in swimming. The bathhouse is a brick building with a flat roofed, square central core, flanked by two gable roofed wings, each three bays in length. Architectural details include brick piers on the wings, round headed door and window openings in the central core and a small, low parapet on the center of the street façade of the building. The wings of the building have wood trim, an asphalt shingle roof and the upper portion of the gable ends are sheathed in unpainted clapboard. Some of the former openings have been filled in with brick and some of the wood trim is exhibiting signs of deterioration or missing. Water damage to the roof framing is also evident on the interior of the building.

The bathhouse is open year-round. The central core contains public restrooms that are not universally accessible, and each wing is used for office and storage space. DCR staff use one wing and the City of Lowell uses the other for their seasonal lifeguards and waterfront equipment (see Recreation Resources, below, for more information). The building has electricity, a phone line, domestic water and waste water disposal; it is in fair condition.

Rynne Bathhouse (DCR)

The majority of the park's historic buildings are located in downtown Lowell and associated with the city's canal system (see Figure 3). The National Park Service maintains these resources as part of an expired Memorandum of Understanding with the Department of Environmental Management, Boott Hydropower, Inc. and the Proprietors of Locks and Canals on the Merrimack River (see Section 4.4. Management Resources and Practices for more information). The Gatekeeper's House and barn are excluded from this arrangement, as the buildings are

part of the DCR's Historic Curatorship Program. The Mack building is also excluded because it is not directly associated with the canal system.

The ***Pawtucket Gatehouse***, located at the eastern edge of the Pawtucket Dam and the head of the Northern Canal, was constructed in 1847. The gatehouse contains the machinery designed by James B. Francis to operate 10 sluice gates via a turbine and hoisting screws. Constructed of brick, on top of the granite dam, and extending 11 bays long, the Italianate style gatehouse has a gabled slate roof. Architectural details include denticulated cornices, pediment returns, round headed door openings and recessed, round headed, six-over-six double-hung sash windows. Twin end interior chimneys complete the picture. One corner of the building is rounded, a detail that is seemingly part of the original design, but the purpose is unclear. A navigational lock, not used since 1871, is located next to the gates. One end wall of the gatehouse has experienced some cracking, but it is otherwise in good condition. The building has electricity.

Pawtucket Gatehouse (DCR)

Next to the Pawtucket Gatehouse, at 23 School Street, is the ***Gatekeeper's House***, historically home to the operator of the Pawtucket Gate. The Gatekeeper's House is a two-story, side gabled, wood frame house built in 1847, in the Italianate style. It is three bays wide by two bays deep, with a hipped roof section at the rear and a one-story kitchen ell. The projecting center entrance with enclosed pediment is an addition made sometime before 1890, and the front façade windows have round arched trim. The house is clad in wooden clapboards, has a stone foundation, asphalt shingled roof, two interior brick chimneys and wood cornerboards with a boxed cornice. The building has electricity, a phone line, domestic water and waste water disposal; it is in good condition.

Gatekeeper's House (DCR)

Behind, and perpendicular to, the Gatekeeper's House is the ***Gatekeeper's Barn***. Constructed in three separate phases (dates unknown), the barn has two gable roofed sections with a smaller, shed roofed component. Clad in a combination of clapboards and vertical board sheathing, the barn has an asphalt shingle roof and is in good condition. The building also has electricity. The oldest section of the barn, located in the center, is set up as a one car garage. Due to the slope of the surrounding land, the rear façade of the building is a full story higher than the front, which provides storage space below the garage.

Gatekeeper's Barn (DCR)

The gatekeeper's property was acquired by the DCR in 1977 and housed a staff interpreter until 1986. After being vacant for 15 years, it was included in the DCR's Historic Curatorship Program and leased by curators from 2001 through 2011. The house and barn are once again vacant and available for curatorship; proposals are currently being solicited.

Located beyond the Gatekeeper's Barn is the ***Blacksmith Shop***. Primarily utilized by the Proprietors of Locks and Canals on the Merrimack River as a boathouse and blacksmith shop, to fix and

maintain flashboard hardware, this building was brought or built on site in 1884. Clad in vertical board sheathing and clapboards, the Blacksmith Shop has a hipped roof covered with cedar shingles and a brick chimney that pierces the roof line. A large exterior sliding door provides access. The building has electricity and is in fair condition.

Blacksmith Shop (DCR)

Francis Gate Park is located on the Pawtucket Canal near Broadway Street and includes a series of resources associated with the Guard Locks. The first navigational lock was built in 1796-1798, with the development of the canal. This lock was subsequently rebuilt and several other features were added to the site over the course of the 19th century, including a dam, power canal, second navigational lock and flood gate. A manmade island separates the dam and sluice gates from the navigational locks and flood gate.

The oldest extant resource within Francis Gate Park is the ***Great Gate***, also known as the Francis Gate or Francis' Folly. Constructed in 1848-1850, this Portcullis gate was designed by James B. Francis for flood control purposes. The gate itself is made of wood, constructed of 17-inch-wide southern pine timbers that are held together with vertical iron rods; it is in excellent condition. The gate protected the city from serious flood damage in 1852, and again in 1936. The Great Gate is sheltered by the ***Guard Locks Great Gate Gatehouse***; a tall, narrow, wood frame building sheathed in clapboard with a cedar shingle roof. Buttresses support the building, tying it to the granite abutments. The gatehouse has electrical service, and is also in excellent condition.

Great Gate and Gatehouse (DCR)

The ***Guard Locks Gatehouse*** contains the hydraulic machinery for operating the sluice gates located at the dam, in the easternmost section of Francis Gate Park. Constructed in 1870, predominantly of brick with a single wood frame wall, this one-story building has a full height basement level on the upstream side of the dam. The gatehouse is sheathed in brick and clapboard, and has a slate roof. Italianate details include denticulated cornices; pediment returns; round headed, recessed, four-over-four, double-hung sash windows; and round headed door openings. Twin end interior chimneys complete the picture. The gatehouse has electricity, and it is in excellent condition.

Guard Locks Gatehouse (DCR)

The ***Guard Locks Lock House*** is located just north of the Guard Locks Great Gate Gatehouse, where it shelters the equipment that mechanically assists with opening the gates of the lock. Constructed in 1881, this single-story, seven-bay-long building is sheathed in clapboard and has a two stage hipped roof sheathed with slate; it is in excellent condition. Italianate architectural details include round headed,

four-over-four, double-hung sash windows; round headed door openings; projecting wooden lintels; and paneled trim along the lower portion of the building, where some of the projecting lock mechanisms are accommodated. The lock house also has electricity.

Guard Locks Gatehouse, left, and Guard Locks Lock House, right (DCR)

The ***Hadley House***, located at 719 Broadway Street, was originally located in Middlesex Village. In 1990, the Federal style home was moved from 1708 Middlesex Street by the Jaycees of Lowell in an effort to save it from demolition and restore it, possibly for housing. The building has been vacant since the move and is presumably owned by the Jaycees, who may now be incorporated as the Lowell Jaycees Housing Corporation, Jaycee-Lowell Limited Partnership, or Jaycee-Lowell, LLC. There is no Memorandum of Agreement, or similar document, between the Jaycees and the DCR that describe the terms under which the Hadley House was moved to, and remains at, Francis Gate Park.

Hadley House (DCR)

The ***Northern Canal Wasteway Gatehouse*** was constructed in 1872, when the waste gates that are part of the Northern Canal Great Wall dam were modified to be mechanically operated by a turbine. It is the only gatehouse without electricity. Accessed by a walkway, the building sits on top of the Great River Wall and was built to shelter the mechanical equipment. The gatehouse is a rectangular, two-story timber frame building with a very low pitched shed roof. Four window bays are located on the river side of the building. The gatehouse is sheathed in clapboard and has a membrane roof.

The gatehouse is in poor condition. Regular overtopping of the dam wall has led to structural damage, most notably loss of much of the sill on the river side of the building. The National Park Service has undertaken emergency stabilization measures, but a more permanent solution is needed.

Northern Canal Wasteway Gatehouse (DCR)

The ***Tremont Gatehouse*** is located at the intersection of the Northern and Western canals; it controls the flow of water from the Northern Canal into the lower Western Canal by a pair of offset sluice gates. These gates are operated electrically, but the manual operation equipment is still located in the building. Constructed c1855, this gatehouse is in excellent condition, reflecting maintenance work that was done to remove the extensive ivy growth that covered the building in the 1970s. Recent work performed in 2010-2011 by the National Park Service includes repointing brick, applying a graffiti preventive coating and repairing the doors and windows.

This single story, gable roofed gatehouse has a granite foundation, walls constructed of brick and a slate roof. Italianate details include denticulated cornices; pediment returns; round headed, recessed, six-over-four, double-hung sash windows; and round

headed doors. Twin end interior chimneys complete the picture. One corner of the building has an unusual taper, where the corner itself has been removed in what appears to be a modification of the original design.

Tremont Gatehouse (DCR)

The ***Swamp Locks Gatehouse*** was first constructed on the crest of the Swamp Locks dam and south sluice gate in 1859, to provide some shelter and protection for the dam. The gatehouse, a wood framed, single-story, interlocking gable roofed structure, has walls sheathed in a combination of clapboard and vertical boards, and an asphalt shingle roof. The wood windows are six-over-six, double-hung sash. The gatehouse has electricity.

Four different sections currently connect across the length of the dam. The longest section, located above the flashboard crest of the dam, is present in a historic photo from 1922, but was removed years later, as it is not present in DCR file photos from 1979. This section was reconstructed sometime after 1994, as it was not present when the National Park Service documented the site in the List of Classified Structures at that time. The National Park Service made some repairs to the clapboard and repainted the building in 2013. The gatehouse is in excellent condition.

Swamp Locks Gatehouse (DCR)

The ***Hamilton Wasteway Gatehouse***, located at the head of the Hamilton Wasteway, was constructed in 1872 when the wasteway itself was rebuilt, replacing an earlier gatehouse and wasteway dating from 1850. The purpose of the wasteway was to remove ice from the Hamilton Canal and divert it into the Pawtucket Canal. The gatehouse was manually operated until an electric motor drive was installed in the early 20th century. The small, single-story hipped roof building has rolled asphalt roofing and is clad with metal panels that have been pressed to resemble brick. The three windows that overlook the visible portion of the wasteway have four-over-four, double-hung sash windows; the remaining openings are boarded up. Vegetation is encroaching on the building, some of the cladding has been peeled away and a few pieces of the simple wood trim are missing. Unlike the other gatehouses in the park, this building is in very poor condition and lacks interpretive information.

Hamilton Wasteway Gatehouse (DCR)

Two buildings have been in place at the Lower Locks Dam since the mid-19th century; they provide shelter for the dam and house some of its mechanical components. The ***Lower Locks Gatehouse***, a one-by-one-bay building clad in clapboards with a cedar shingle roof, is located at the edge of the dam, at the upstream entry to the lock. An enclosed pediment on the gable end and a diamond pane, double-hung, sash window adorn the building.

A larger, single-story, wood framed, gabled roof building is located on top of the dam. A cross gabled component of this building, known as the ***Watch House***, shields the deep gate control housing. A gabled cupola sits atop the Watch House. The walls of this building are clad with vertical board siding, the windows are fixed 12-light windows and the roof is sheathed with cedar shingles.

Both of these buildings have electricity and are in excellent condition.

Lower Locks Gatehouse and Watch House (DCR)

The ***Massachusetts Wasteway Gatehouse*** is located at the turn in the Eastern Canal and sits slightly below Bridge Street. Built in 1862, in conjunction with the wasteway, the gatehouse protects the flashboard controls that direct water through the wasteway. The wasteway connects the Eastern Canal to the Merrimack River and assisted with ice removal in the canal.

The gatehouse is a single-story, five-by-one-bay building with a gabled roof and an inaccessible center entrance that faces the canal. Clad in clapboards, the roof is sheathed with cedar shingles and the windows are four-over-four, double-hung sash with hood moldings. The roof of the building has changed over time. Photographs from 1979 show a flat roof with a slight pitch, possibly a modification of an original gabled roof that was then rebuilt sometime between 1979 and 1994 to reflect its presumably historic appearance. The gatehouse has electricity and is in excellent condition.

Massachusetts Wasteway Gatehouse (DCR)

The ***Boott Dam Gatehouse***, built above the Boott Dam in 1892 as part of a rebuilding effort, provides shelter for the dam and houses hydraulic equipment to lift the sluice gate, which controls the level of water in the Eastern Canal. The gatehouse, which has electricity, is composed of two single-story, gable roofed sections that are situated at a slight angle to each other, probably to accommodate the infrastructure below. One section, attached to the sidewall of the Boott Mills, is slightly wider and taller than the other section. The building is clad in corrugated metal sheathing and it has a rolled asphalt roof. The only architectural detailing includes a plain vergeboard made of corrugated metal. A set of seven, six-over-six, vinyl windows stretch across the side of the building facing the canal. A brick chimney extends from the center of the building. Boston ivy has started to drape itself over part of the roof of the smaller section. The building is otherwise in good condition.

Boott Dam Gatehouse (DCR)

The ***W.A. Mack & Company Building***, located at 25 Shattuck Street, is the current home of the National Streetcar Museum (first and second floors) and DCR's North Region Headquarters (third and fourth floors). The museum utilizes space within the building through an expired Memorandum of Understanding with the DCR (see Section 4.4. Management Resources and Practices for more information).

The Mack building was constructed in 1886 by Sewall Mack for the W. A. Mack & Company on land they originally leased, and later purchased, from the Proprietors of Locks and Canals on the Merrimack River. The Queen Anne style brick building, with a cast iron storefront, served as the retail arm for their ironworks. Originally a three-story building, with decorative panel brick details on the second and third floors, a fourth story was added sometime between 1890 and 1905. Four-over-two, double-hung sash windows are located in the upper

stories of the façade; all 38 of the building's double-hung windows are scheduled to be replaced in the fall of 2014 (see Section 2 for more information).

A full height brick and glass, stair and elevator tower was added to the north side of the building in 1979, when it was being renovated to serve as the visitor center for Lowell Heritage State Park. The building has electricity, telephone and internet service, domestic water and waste water disposal; it is in good condition.

The Mack building, prior to the window replacement project. (DCR)

Structures

The ***Lowell Canal System*** evolved steadily from 1821, when the old Pawtucket transportation canal was purchased and, a few years later, used to channel water into a series of new power canals. These virtually unaltered waterways, together with the remaining mills and their machinery, form what is "the most historically significant extant aggregation of early 19th century industrial structures and artifacts in the United States" (NPS 2014*b*).

Table 4.5. Power Canals within Lowell Heritage State Park[a]

Name	Date(s) of Construction
Merrimack Canal	1821-1823
Hamilton Canal	1825-1826
Lowell Canal[b]	1828
Western Canal	1831-1832
Lawrence Canal[c]	1831-1832
Eastern Canal	1835
Northern Canal	1846-1847

a. See Infrastructure, below, for more information on the DCR's ownership interest in the power canals.
b. The Lowell Canal was covered in 1880 (NPS 2014*b*).
c. Most of the Lawrence Canal is covered; sections of the canal have also been filled in (Herlihy 2014).

Each canal is unique, from the Pawtucket Canal, which follows the features of the surrounding landscape, to the Northern Canal, which is the deepest and widest canal, and perfectly straight. The canals are generally eight to 20 feet deep and 30 to 100 feet wide (NPS 2014*b*). The canal walls are constructed of natural materials, ranging from earth to granite, and the canal bottoms are mostly wood (Lowell Canalwaters Cleaners 2014). The canals are generally in good condition, however some vegetative growth and localized deterioration was observed in the canal walls while conducting fieldwork for this plan. The National Park Service has provided funding for selective vegetation removal over the past four years, but no longer has the funding to provide this assistance.

The ***Brick Vault*** is a 32-foot-wide, by 200-foot-long brick arch spanning the Merrimack Canal between Merrimack and Market streets. It provided a passageway for repair boats on the canal below, while supporting a portion of the foundation of the Merrimack Street Depot above. It is in fair condition.

Table 4.6. Dams within Lowell Heritage State Park, by the DCR's Ownership Interest[a]

Dam	Class[b]	Last Inspection[c]	Condition	DCR Interest
Northern Canal Great Wall	S	6/18/2012	Satisfactory	Fee and Ease
Guard Locks	S	6/18/2012	Satisfactory	Ease
Swamp Locks	S	6/18/2012	Fair	Ease
Lower Locks	L	6/1/2006	Satisfactory	Ease
Boott[d]	N/A	N/A	N/A	Ease
Rolling[d]	N/A	N/A	N/A	Ease

a. See Infrastructure, below, for more information on the DCR's ownership interest in the dams. In this table, ownership is summarized as: Fee = fee interest; Ease = easement interest.
b. Hazard Class: Low (L) = the dam is located where failure may cause minimal property damage to others and the loss of life is not expected; Significant (S) = the dam is located where a failure may cause the loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads, or cause interruption of use or service of relatively important facilities (MassGIS 2012).
c. Low hazard potential dams are inspected every 10 years; significant hazard potential dams are inspected every 5 years.
d. The DCR's Office of Dam Safety defines the Boott and Rolling dams as canal gates, which are not classified or inspected.

Northern Canal Great Wall Dam. The Northern Canal Great Wall Dam (MA-00833), also known as the Great River Wall, is an approximately 2,000-foot-long earthen island and stone wall that runs along the south side of the Merrimack River, near Pawtucket Falls. The DCR holds a fee interest in approximately 1,000 feet of the upstream portion of the dam, which consists of a naturally deposited earthen and bedrock island, as well as some man placed earth. Downstream of the island, the dam transitions into a cut granite stone wall for a length of about 1,000 feet; the DCR holds an easement interest in this portion of the structure.

The dam was constructed in 1846-1847 to provide additional water power to downstream mills and the canal system in Lowell. Today, it continues to supply water to the canals, as well as a hydroelectric power plant owned by Boott Hydropower, Inc. Sudden gate closures at the power plant can cause the water in the Northern Canal to rise rapidly and overtop the Great River Wall. Due to this threat, the walkway along the wall and island is generally closed to the public; however the National Park Service does offer periodic guided tours along the walkway.

The most recent inspection of the dam determined that the structure was in good condition, identifying excessive vegetation on the great wall and island, and voids in between the cut granite stones along the crest of the great wall. An estimated $204,000 in additional analysis, maintenance and repairs is needed to correct these issues (Haley & Aldrich, Inc. 2012*a*).

Guard Locks Dam. The Guard Locks Dam (MA-00834) includes a lock, earthen embankment, gatehouse and spillway with hydroelectric power mechanisms. The dam and lock system was constructed in 1848 to regulate water levels in the Pawtucket Canal for mills in the center of Lowell. Today, the locks are used by the National Park Service for tourism and the dam is used to regulate water levels in the canal for hydroelectric power and flood control purposes.

While the dam is in good condition, the following issues were identified during a recent inspection of the structure: vegetation in the walls and downstream earthen embankment, debris in the spillway area, and voids in between the granite stones. The total estimated repair cost for the Guard Locks dam is $120,000 (Haley & Aldrich, Inc. 2012*b*).

Swamp Locks Dam. The Swamp Locks Dam (MA-00836) was originally constructed as part of the development of the Pawtucket Canal in the 1790s. The 1822-1823 reconstruction of the Pawtucket Canal reworked the lock system from a navigational system to a power system, creating a two-tiered power canal network and placing the Swamp Locks Dam centrally within this system. This configuration was retained through several subsequent rebuilding efforts. Many of the existing components of the dam (e.g. the lock, gates, spillway and weirs) date back to those reconstruction periods in 1839-1841, 1859, 1892, 1928, 1942 and 1946. The original purpose of the dam was to regulate the flow of water as a power source for downstream mills. Today the structure is used to impound water for boat tours of the canal system and flood control purposes.

The most recent inspection of the dam identified areas of broken and missing concrete, vegetation in the stone block walls, leakage and wear on the broad crested weir and gatehouse structure. An estimated $665,000 in additional analysis, maintenance and

repairs is needed to correct these issues (Haley & Aldrich, Inc. 2012*c*).

Lower Locks Dam. The Lower Locks Dam (MA-00835) was constructed in the late 18th century as part of the Pawtucket transportation canal, which allowed boat access around Pawtucket Falls. It was rebuilt in 1822-1823 and consists of two gatehouses, a primary spillway, low level outlet (deep gate), two-bay lock chamber, canal drain pipe and valve, and a culvert system that drains excess flow from the adjacent Eastern Canal into the discharge channel downstream of the dam. Today, the dam is primarily used for flood control purposes.

During a 2006 inspection of the dam, vegetation and debris were identified as minor deficiencies. The canal drain valve control platform upstream of the dam was also noted as being potentially unstable. An estimated $27,000 to $42,000 in additional analysis, maintenance and repairs was needed to correct these deficiencies (Weston & Sampson 2006).

Since the inspection, the vegetation on the spillway has been removed and the canal drain valve control platform has been stabilized with guy wires; it is unclear whether this is a temporary or permanent solution.

Objects

Boston & Maine (B&M) Railroad No. 410, a steam locomotive built in 1911 by the American Locomotive Company's Manchester, NH works, is on permanent display at the corner of Merrimack and Dutton streets in downtown Lowell. Engines like No. 410 were used by the B&M Railroad to move freight cars around train yards throughout New England; in Lowell, the engine shuttled cars between textile mills for nearly 40 years.

In 1950, No. 410 was sold to H.E. Fletcher Company, where it was used in a quarry for approximately 30 years before being retired. In 1993, the engine was moved to its current location and is part of the interpretive components of the park. No. 410 is in excellent condition due to over 20 years of restorative work and routine annual maintenance by volunteers (see Section 4.4. Management Resources and Practices for more information). A restored 1907 Pullman Coach, owned by the National Park Service, is on display with No. 410.

Landscapes

The Lowell Canal System and its associated buildings and structures, while discussed individually in this section for inventory and management documentation purposes, collectively form a historic landscape that needs to be considered as a whole. These resources shaped the historic development and growth of the city, and continue to do so today. The canal system defines the character of downtown Lowell, and together with the remaining mills, provides a physical connection to the city's illustrious industrial past.

The parcel known as Tremont Yard, located on the Western Canal between Hall Street and Father Morissette Boulevard, is the site of the former Tremont Mills. Now predominantly paved over for parking, with remnants of the tailraces below it, the only above ground feature remaining is a one-story segment of brick wall with a concrete cap that runs along the north and east edges of the property. This wall, containing arched window openings that have been bricked in, serves as an important landscape feature and a reminder of what was once located on the site. By the late 1990s, the northern section of the wall, adjacent to Hall Street, had become a serious safety hazard, so it was dismantled by hand and partially rebuilt with the salvaged brick. The eastern section of the wall has a significant amount of vegetation growth.

The eastern section of the wall in Tremont Yard. (DCR)

Recreation Resources

Visitors to Lowell Heritage State Park can drive, bike or walk to the various facilities and points of interest within the park. In addition, the Lowell Regional Transit Authority operates buses that circulate through downtown. However, there are only three bus routes (1, 7 and 8) that cross the

Merrimack River and provide indirect access to the Vandenberg esplanade. The closest bus stop to the concentration of recreation resources on the western half of the esplanade is located in front of Lowell General Hospital on Varnum Avenue.

There are a variety of active and passive recreational opportunities within Lowell Heritage State Park, including:

- Bicycling
- Boating, motorized and non-motorized
- Events (e.g., concerts, movies)
- Field sports (e.g., soccer, flag football)
- Fishing
- Geocaching
- Interpretive displays and programs
- Nature study
- Pet walking
- Photography
- Picnicking
- Swimming
- Walking/jogging/running

Boating takes place in the Merrimack and Concord rivers and, to a limited extent, in the canal system (see Figure 3). Motorized and non-motorized boats are launched into the Merrimack River from the Rourke brothers boat ramp; there are no fees charged at this facility. Non-motorized boats are also launched into the Merrimack at the Bellegarde boathouse. The Merrimac River Rowing Association (MRRA) and University of Massachusetts Lowell offer a variety of kayaking and rowing programs to the public at the boathouse; some of these programs are free of charge, while others require a fee. On a much larger scale, the MRRA also hosts two regattas, the Festival Regatta and the Textile River Regatta, at the boathouse each year.

Motorized and non-motorized boats can also be found on the Concord River. Every spring, the Lowell Parks & Conservation Trust, in partnership with Zoar Outdoor, offers a unique whitewater rafting opportunity on the Concord River, for a fee. Each trip concludes with passing through the Lower Locks Lock Chambers. Finally, the National Park Service offers motorized boat tours on the Pawtucket Canal from the Lower Locks to the Merrimack River for a nominal fee; each tour includes a locking demonstration. The canal system is not open to the public for boating, aside from these two opportunities.

Fishing takes place in the rivers and canal system too. The Department of Public Health alerts the general public to the possible dangers of eating fish caught in Massachusetts waters through a public health fish consumption advisory. There are several advisories for the Merrimack River and canal system; there are no advisories for the Concord River in Lowell.

Table 4.7. Fish Consumption Advisories for the Merrimack River and Lowell Canals

Water Body	Hazard	Advisory[a]	Fish Species
Merrimack River	Mercury	P1, P3	Largemouth bass, white sucker
Canals[b]	Mercury, lead, PCBs, DDT	P1	All fish
Canals[b]	Mercury, lead, PCBs, DDT	P2, P4	American eel

Source: DPH 2014

a. P1 = Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not consume the affected fish species; P2 = The general public should not consume the affected fish species; P3 = The general public should limit consumption of the affected fish species to two meals per month; P4 = The general public should limit consumption of non-affected fish species to two meals per month (DPH 2014).

b. For the canals, the general public is advised to consume only the fillet of non-affected fish species (DPH 2014).

Special events, such as carnivals, and athletic events take place at the Anne Dean Welcome Regatta Field (see Figure 3). The City of Lowell sells permits for the use of the field through an expired Memorandum of Understanding with the DCR (see Section 4.4. Management Resources and Practices for more information). In 2013, the city issued 46 permits; the months of May and September were the most popular for events (Faticanti 2014).

Walks for charity, large cultural events, like the Southeast Asian Water Festival, and DCR-sponsored programming also take place along the Vandenberg esplanade. In a typical year, there is a special event on the esplanade every weekend from April through October. Many of these events are coordinated from the Sampas pavilion; there are fees to use the lawn in front of the stage and the stage itself. Permits for the esplanade are issued by the Forest and Parks

Supervisor or the DCR's Office of Special Events, for a fee.

Guarded, freshwater swimming is available at the Rynne beach in July and August, every year, free of charge. The City of Lowell manages the beach through an expired Special Use Permit that was issued by the Department of Environmental Management (see Section 4.4. Management Resources and Practices for more information). During the swimming season, water quality is tested weekly; if poor water quality becomes a problem, tests are conducted daily until the results indicate improved water quality (Faticanti 2014).

Table 4.8. Water Quality Results for the Rynne Beach, May 2013-August 2013

Sample Date	*E. coli* per 100ml[a]	Days Since Last Rainfall	Amount of Last Rainfall (inches)
5/31/13	30	1	0.6
6/6/13	0	2	0.4
6/12/13	60	1	1.0
6/20/13	50	3	0.3
6/25/13	10	8	0.3
7/2/13	210	1	0.9
7/4/13	150	3	0.9
7/9/13	80	1	0.3
7/15/13	30	6	0.1
7/22/13	110	11	0.1
7/29/13	30	8	0.5
8/6/13	50	5	0.5
8/12/13	100	2	1.0
8/19/13	60	6	0.1

a. Limit = 235 *E. coli* per 100 ml.

The Merrimack River Watershed Council (MRWC) also monitors the river's water quality through its Safe Beaches Project. The closest sampling location to the Rynne beach is upstream, at the Bellegarde boathouse. The MRWC did not sample in 2013, due to a lack of volunteers (O'Mara 2013).

The Lord pool is another location within the park for visitors to enjoy guarded swimming (see Figure 3). The pool is open from June through August, every year; there are no fees charged at the facility. DCR staff are responsible for managing the pool and testing its water quality during the swimming season. In addition, the Department of Public Health (DPH) inspects the pool once each year as part of a Memorandum of Agreement with the DCR (see Section 4.4. Management Resources and Practices for more information). The DPH provides a brief report on the water quality, health and safety, and general sanitation conditions of the pool to DCR staff after the inspection.

Table 4.9. DPH Water Quality Results for the Lord Pool, August 8, 2013

Test	Allowable Result[a]	Test Result[a]
pH	7.2-7.8	7.6
Alkalinity	50-150	70
Calcium Hardness	150-1,000	210
Free Chlorine	1.0-3.0	4.2[b]
Combined Chlorine	0.0-0.2	0.0
Secchi Disk	Clearly visible	Clearly visible

a. Results are reported in parts per million (ppm), except for the pH and Secchi disk tests.
b. Additional testing was conducted 45 minutes later, after corrective actions were taken. The second test result, 3.8ppm, exceeded the allowable range, and the pool was closed until the free chlorine reading was brought into compliance.

The following health and safety, and general sanitation violations were also noted as part of the 2013 DPH inspection:

- The water depth is not marked at or above the water surface on the pool wall.
- A gap in the outside fence of greater than three inches.
- A broken step on the ladder in the deep end.
- An insufficient emergency communication system in the first aid room.
- The log book indicated the pool was not closed with free chlorine reading of 13.8ppm.
- The paint on the pool floor is peeling.
- A portion of the cement deck is raised, creating a tripping hazard.

Many of these violations, such as the broken step ladder, were addressed during the 2013 season and the remaining items, such the raised cement deck, will be addressed as part of the fall 2014 modernization project (see Infrastructure, below for more information).

Visitors to the Lord pool enjoy biking to the property; however there are no bike racks available for storing and securing their bikes. Social gatherings are also popular on the lawn and at the picnic tables that surround the pool. Two mature trees, near the corner of Cross and Fletcher streets, are the only source of shade in this open space.

The National Park Service (NPS) provides most of the interpretive programming within the downtown portion of the park. Visitors can participate in a free ranger-guided walking or trolley tour of the historic sites. A variety of indoor exhibits are open to the public too, including the NPS's visitor center at Market Mills, the Boott Cotton Mills Museum (fees apply), the Patrick J. Mogan Cultural Center and the Wannalancit Mill. The NPS also co-sponsors one of the largest, free folk festivals in the world; the Lowell Folk Festival is held each summer and over 100,000 people come to Lowell and the park to celebrate traditional music, ethnic foods and crafts (NPS 2014*c*).

Geocaching also occurs in the park. As of March 2014, there were three known geocaches along the Vandenberg esplanade and two known geocaches in the downtown portion of the park.

Infrastructure

Property Boundary

Fee Interest. Lowell Heritage State Park (87 acres) is situated in the northern half of Lowell, adjacent to the Merrimack River and the city's historic power canals. The majority of the parcels that comprise the park are linear in nature, and most were acquired between 1976 and 1986.

By 1980, the Department of Environmental Management (DEM) purchased a fee interest in a portion of the Vandenberg esplanade, from the Rourke Bridge to the intersection of Pawtucket Boulevard and Varnum Avenue; a portion of Francis Gate Park, north of Broadway Street; the gatekeeper's property; Tremont Yard; and the Mack building. Over the next five years, the agency added a few more parcels to the Vandenberg esplanade, near the intersection of Pawtucket Boulevard and Varnum Avenue, and Francis Gate Park, south of Broadway Street.

In 1986, the DEM obtained a fee interest in the park's remaining parcels through a complicated and lengthy Order of Taking, recorded in the Middlesex County Registry of Deeds, Northern District, Book 3830, Page 70. This legal action completed the Vandenberg esplanade, from the intersection of Pawtucket Boulevard and Varnum Avenue to Pawtucket Falls, and further east, along VFW Highway. It also created a network of protected land, in combination with property owned by the National Park Service and City of Lowell, along each of the city's canals. Finally, it established the DEM's ownership interest in 13 buildings associated with the canal system (see below). Only one of these buildings, the Rolling Dam Gatehouse, has been demolished.

1. Pawtucket Gatehouse
2. Blacksmith Shop
3. Guard Locks Great Gate Gatehouse
4. Guard Locks Gatehouse
5. Guard Locks Lock House
6. Northern Canal Wasteway Gatehouse
7. Tremont Gatehouse
8. Swamp Locks Gatehouse
9. Hamilton Wasteway Gatehouse
10. Lower Locks Gatehouse
11. Massachusetts Wasteway Gatehouse
12. Boott Dam Gatehouse
13. Rolling Dam Gatehouse (demolished)

The Janas rink and Lord pool parcels were acquired before the 10-year effort to establish Lowell Heritage State Park. In 1972, the Department of Natural Resources (DNR) purchased the two-acre Lord pool parcel from the City of Lowell; the deed is recorded in the Middlesex County Registry of Deeds, Northern District, Book 2211, Page 558. The following year, the city sold the Janas rink parcel (4.5 acres) to the DNR; the deed is recorded in the Middlesex County Registry of Deeds, Northern District, Book 2091, Page 58.

Other Legal Interests. The DEM also obtained a number of other legal interests through its 1986 Order of Taking (see Middlesex County Registry of Deeds, Northern District, Book 3830, Page 70). These easements and other rights are the most complicated, and confusing, parts of the taking.

With respect to the 13 canal system buildings, the DCR holds a permanent easement in the canal walls and beds or bottoms that support each building, and the associated structures and fixtures. The Proprietors of Locks and Canals on the Merrimack River (the Proprietors), and their successors and assigns, retain the right to access the buildings in order to maintain and operate the gates and canals for hydroelectric power production. In addition, the

Proprietors, their successors and assigns reserve an easement for access and the right to use the Blacksmith Shop for maintaining and operating the Pawtucket Dam for hydroelectric power production.

The DCR also holds a permanent easement in the following structures, which are specifically named in the taking:

- Pawtucket Gatehouse Wall and Lock Chamber;
- Guard Locks Lock Chambers;
- Northern Canal Walkway;
- Swamp Locks Dam;
- Swamp Locks Chamber;
- Lower Locks Dam;
- Lower Locks Lock Chambers;
- Boott Dam;
- Rolling Dam; and
- YMCA Gates.

The permanent easement is for the following purposes, provided that the Proprietors, their successors and assigns are able to use, maintain and operate the structures and surrounding property for hydroelectric power production without interference.

- Support of all fixtures or structures of the Commonwealth;
- Preservation and conservation;
- Supplemental maintenance in addition to that performed by the Proprietors, their successors and assigns;
- Landscaping and erection of exhibits and structures;
- Placement of barriers and fences;
- Placement and attachment of docks, wharves, walls and boat ramps of a temporary or permanent nature;
- Placement of lighting and other utilities;
- Operation and maintenance of boat locking chambers, if any, for any and all purposes; and
- Any and all other uses consistent with the operation of the canal system as a park.

In addition to the permanent easements described above, the DCR has an interest in the following:

1. An overarching "…permanent and exclusive easement in all canal walls and beds or bottoms and in all dams and boat lock chambers located in said canals and not otherwise referred to in [the taking]…" (Book 3830, Page 102). This permanent easement is for the same purposes as described immediately above.
2. "All air rights over the canals, including the canal walls and any dams thereon, to the extent not already lawfully obstructed or occupied, for so long as such lawful obstruction or occupation continues uninterrupted in its present form" (Book 3830, Page 103).
3. "The exclusive right to use the water in the entire canal system and the Merrimack River for recreational, educational and navigational purposes, which use shall be nonconsumptive with respect to hydroelectric power generation, except for reasonable amounts to operate locking gates" (Book 3830, Page 103).

In 2001, the Highway Department (MassHighway) granted the DEM possession, care, custody and control of Anne Dean Welcome Regatta Field through a license agreement (see Section 4.4. Management Resources and Practices for more information). The DCR's use of the property is restricted to passive recreation. MassHighway, now MassDOT, reserved the right to utilize the property, in whole or in part, for highway purposes.

Pocket Parks

The two smaller "pocket parks" within the downtown portion of Lowell Heritage State Park, the Mack plaza and Victorian garden, were designed by Carr, Lynch Associates, Inc. in 1982. The firm received multiple awards for their work, including a:

- Citation for Excellence in Urban Design from the American Institute of Architects (1990);
- Mayoral Proclamation for the Preservation of Lowell's Historic Architecture (1990);
- Citation from the American Society of Landscape Architects (1987); and
- Massachusetts Governor's Design Award (1986).

Mack Plaza. The Mack plaza is located next to the Mack building, on the corner of Shattuck and Market streets. Nineteen linden trees and 20 new benches enhance the brick plaza as a relaxing oasis in an otherwise busy section of the city. (See Section 2 for more information on the bench replacement project.) The fountain component of "The Worker"

sculpture, when functioning, adds to the ambiance of the space (see Buildings and Structures, below, for more information).

An approximately three-foot-tall steel rail and granite post fence encloses the plaza along Market Street. For several decades, the condition of the granite posts has been deteriorating. Today, 11 of the 13 posts are badly cracked; several posts are being held in place by a temporary wooden support structure. In 2007, a close inspection of the fence identified the pin mounting system and temperature changes in the steel as the likely causes of cracking (DCR 2007*c*).

A cracked granite post and temporary wooden support structure in the Mack plaza. (DCR)

Mary J. Bacigalupo Victorian Garden. The Victorian garden is also located next to the Mack building, at the intersection of Shattuck and Middle streets. Raised beds dominate the space and support a variety of mature evergreen and deciduous trees, as well as smaller, shade-tolerant perennial and annual plantings, some of which stray from the original design of the garden. Seven benches situated along the garden's brick pathways offer a welcoming respite from city life. An approximately seven-foot-tall fence, identical to the one in the Mack plaza, surrounds the entire garden. There are 25 granite posts in this fence and 22 are badly cracked. One post that supported the garden's western gates was recently removed for public safety reasons (DCR 2007*c*).

In 2005, the garden was dedicated to Mary Bacigalupo, a Lowell citizen who was instrumental in the beautification of the City of Lowell (see Appendix H). A large granite marker bearing Mary's name is located within the garden (see Memorials and Markers, below, for more information).

Victorian Garden (DCR)

Buildings and Structures

This section provides information on Lowell Heritage State Park's non-historic buildings and structures. See Cultural Resources, above, for information on the park's historic infrastructure.

Rourke Brothers Memorial Boat Ramp. The Rourke brothers boat ramp is located at the western end of the Vandenberg esplanade, upstream of the Rourke Bridge (see Figure 3). The concrete ramp, which is approximately 45 feet wide, leads from an access road and parking area off of Pawtucket Boulevard into the Merrimack River. The ramp was constructed by the Office of Fishing and Boating Access (OFBA) in 2002 and is in good condition (Sheppard 2013). Extensive regulations govern the use of OFBA sites; see Section 4.4. Management Resources and Practices for more information.

Vandenberg Esplanade Benches. There are 50-75 metal and wood benches located on the Vandenberg esplanade, primarily along the Scott Finneral Memorial Riverwalk (see Trails, below). The benches provide a place to enjoy the scenic, and sometimes busy, Merrimack River. While an inventory of the benches has not been updated in several years, a few benches were observed to be in poor condition while conducting fieldwork for this plan.

Edmund A. Bellegarde Boathouse. The Bellegarde boathouse, situated on a parcel of land between Pawtucket Boulevard and the Merrimack River, was once the headquarters for Lowell Heritage State Park between 1993 and 2002, but is now under the care and control of the University of Massachusetts Lowell (see Section 4.4. Management Resources and Practices for more information).

Charles G. Sampas Pavilion. The Sampas pavilion is located on the Vandenberg esplanade, near the intersection of Pawtucket Boulevard and Delaware Avenue (see Figure 3). The 30- by 50-foot open-air, poured concrete and steel frame structure has functioned as the park's performing arts stage for 37 years. The stage is equipped with electricity and limited performance lighting; it is in good condition.

Merrimack River Retaining Wall. A riprap and poured concrete retaining wall is located along the Vandenberg esplanade, from the Rourke Bridge to the Sampas pavilion. It is not known when the wall was constructed. Woody vegetation, some of which is an invasive species, is growing in the riprap portion of the wall. Many sections of the poured concrete wall are also misaligned. Overall, the retaining wall is in fair condition.

Raymond J. Lord Memorial Swimming Pool. The Lord swimming pool, located at 81 Cross Street, is a complex of one pool, one spray deck (formerly a wading pool), one bathhouse and one outbuilding, constructed in 1972 (see Figure 3). The pool has a maximum depth of 12 feet; a set of stairs provides access to the shallow end of the pool. In 2010, the wading pool was converted into a spray deck with one centrally located spray feature. Both the pool and the spray deck are in good condition. Pending approval and funding, plans are in place to modernize the structures in the fall of 2014 by reducing the maximum depth of the pool to five feet; replacing the stairs in the shallow end of the pool with a "zero entry" ramp; adding more spray features to the spray deck; and constructing a shade shelter.

The bathhouse, approximately 3,300 square feet, is a single-story, masonry block building with a wood framed gabled roof clad with asphalt shingles. The 983-square-foot outbuilding, which houses pool equipment (e.g., pumps, filters and chemicals), a first aid station and staff restroom, is constructed of similar materials; however it has a flat, tar and gravel roof. Both the bathhouse and outbuilding received new roofs in 2009, and new epoxy floors and fresh interior and exterior paint in 2012. The pool's filtration system was also replaced 2012. Both buildings have electricity, domestic water and waste water disposal. In addition, the outbuilding has a phone line. Both buildings are in good condition.

Tremont Yard. For many years, the predominant feature on the Tremont Yard parcel, located at 257 Father Morissette Boulevard, was the one-story ruin of a brick powerhouse with below grade water power features (see Cultural Resources, above, for more information). In 2003, the Legislature authorized the DCR to lease the property (see Appendix H) and two years later, a Request for Proposals (RFP) was issued. In 2008, a 25-year lease was signed by Tremont Yard, LLC (see Section 4.4. Management Resources and Practices for more information). That same year, construction began on a modern, five-story office building; the ruin was demolished as part of that process, but the historic power system features were preserved. Today, the site is the headquarters for the Jeanne D'Arc Credit Union, which includes a first-floor interpretive display (see Figure 3). Although this preservation effort is open to the public, there is little promotion of the space.

Trolley Tracks. The National Park Service (NPS) operates a free trolley service for visitors to Lowell National Historical Park. The trolleys run on approximately one-mile of track that is laid out in a "T" shape within downtown Lowell. The western terminus of the track is located on the DCR's Tremont Yard parcel. The Department of Environmental Management granted the United States of America, through the Lowell Historic Preservation Commission, an easement for the construction of the tracks and associated fixtures. The easement is recorded in the Middlesex County Registry of Deeds, Northern District, Book 6249, Page 209.

Lowell Public Art Collection. From 1984 to 1995, former U.S. Senator and Lowell resident Paul Tsongas, along with staff from the Lowell Historic Preservation Commission, led the development of the Lowell Public Art Collection (Marion 2014). During that time, a series of permanent sculptures were placed throughout the downtown area, but

generally within sight of the National Park Service's canalway walking path. Each work of art addresses a theme of the federal and state park systems: the industrial city, labor, machines, power and capital.

While a few of the sculptures are located on DCR property, e.g., "The Worker" in the Mack plaza, the collection is owned by the City of Lowell, through its Cultural Affairs and Special Events Department, and the National Park Service, both of whom are responsible for its ongoing maintenance. However, oversight of the collection is limited, due to a lack of resources at the municipal and federal levels (Marion 2014).

John J. Janas Memorial Skating Rink. The Janas skating rink, located at 382 Douglas Road, is managed and operated by the North Shore Rink Management Associates, Inc. through a 25-year lease (see Section 4.4. Management Resources and Practices for more information).

Roads

Public roads, which are owned and maintained either by the City of Lowell or Department of Transportation, surround the park. Pawtucket Boulevard, or Route 113, and VFW Highway border, and provide primary access to, the riverfront portion of the park. In downtown Lowell, Broadway Street and Fletcher Street provide access to the DCR's westernmost historic resources and Lord pool, respectively. Dutton Street and Father Morissette Boulevard are the highest-capacity roads that lead to the concentration of the DCR's historic resources.

Parking

Along the Vandenberg esplanade, there are five DCR-owned parking areas (see Figure 3). The first is a paved lot, with a shared entrance and exit, located next to the Rourke brothers boat ramp. It can accommodate 64 vehicles; 44 spaces are reserved for vehicles with trailers, while the remaining 20 spaces are reserved for vehicles with car-top boats. All of the spaces are well marked, including the lot's four accessible spaces. The parking area is signed as being DCR property and gated.

The second parking area is located next to the Bellegarde boathouse; it is not under the care and control of the University of Massachusetts Lowell (see Section 4.4. Management Resources and Practices for more information). Forty-one vehicles can park in this paved lot, which has a separate entrance and exit. All of the spaces are well marked, including the four accessible spaces. The parking area is not signed as being DCR property or gated.

A third, unpaved parking area is located next to the regatta field. This unlined lot, with a shared entrance and exit, is heavily used during events and is showing serious signs of wear and tear. Vehicles, up to 40 at one time, are sometimes forced to park haphazardly due to deep ruts that fill with rain water and small patches of shrub-like vegetation. While the regatta field itself is signed as being DCR property, the parking area is not signed. The lot is also not gated.

The remaining two parking areas are located near the Sampas pavilion. Both lots are paved and marked, and utilize shared entrances and exits. The lot upstream of the pavilion has 22 spaces, including two accessible spaces. The lot downstream of the pavilion has 14 spaces, two of which are designated as accessible. Neither lot is signed or gated.

Visitors to the downtown portion of Lowell Heritage State Park most likely utilize the National Park Service's (NPS) visitor center parking lot, located near the intersection of Broadway and Dutton streets, or municipal parking options throughout the city (see Figure 3). The NPS's visitor center parking lot was formerly owned by the Department of Environmental Management (DEM). Upon selling a portion of the property to the NPS, the DEM established a Memorandum of Understanding (MOU) with the NPS regarding the use of the parking lot (see Section 4.4. Management Resources and Practices for more information). The remaining portion of the property was sold to the City of Lowell; there is no record of an MOU, or similar document, between the city and the DEM.

The DCR leases one parking area within Tremont Yard to the University of Massachusetts Lowell (see Section 4.4. Management Resources and Practices for more information). The other three DCR-owned parking areas within downtown Lowell are located outside of the concentration of historic resources (see Figure 3).

The first of these parking areas is located on Cross Street, next to the Lord pool. It is a paved lot, with a shared entrance and exit, and can accommodate

approximately 40 vehicles. The majority of the individual spaces are not marked, however there are two accessible spaces that are well marked. The parking area is not signed as being DCR property or gated and, as a result, it is heavily used by residents and visitors in the immediate area.

The second downtown parking area is located on Broadway Street, near the Pawtucket Canal. Approximately 15 vehicles can park in this gravel lot, which has a separate entrance and exit. Individual spaces are not marked and there are no designated accessible spaces. Like the parking area at the Lord pool, this lot is not signed or gated and is routinely used by students, residents and visitors in the immediate area.

The final parking area is associated with the Janas skating rink, which is under the care and control of the North Shore Rink Management Associates, Inc. as part of a 25-year lease (see Section 4.4. Management Resources and Practices for more information). This lot is paved and can accommodate 80 to 90 vehicles. Individual spaces are well marked, including two designated accessible spaces. The lot's shared entrance and exit features a large DCR sign, as well as a gate.

Trails

There is one trail within Lowell Heritage State Park; it is a 10-foot-wide paved path located along the northern shoreline of the Merrimack River. The first section of the path, designated as the Scott Finneral Memorial Riverwalk, is approximately one mile long (see Appendix H). It runs from the Rourke Bridge to the Sampas pavilion on the Vandenberg esplanade. Portions of this path have been damaged by tree roots lifting and cracking the pavement. Sinkholes also appear along the path on occasion, due to water undermining the Merrimack River retaining wall (see Buildings and Structures, above, for more information).

The second, unnamed section of the path is approximately two miles long. It runs from Beaver Brook to near the Duck Island Wastewater Treatment Facility. Only the upstream portion, ending near the Hunts Falls Bridge, is on DCR property (approximately one mile of path). Small sections of this path can become overgrown, due to the dense vegetation that grows on both sides.

Currently, the only connection between these two sections of path is the public sidewalk along Pawtucket Boulevard and VFW Highway. However, the National Park Service, in conjunction with the DCR, City of Lowell, Northern Middlesex Council of Governments and Massachusetts Department of Transportation (MassDOT), has developed plans for an extension of the paved path from the Sampas pavilion to School Street. Additional improvements will include viewing areas that overlook the Pawtucket Falls, plants, benches, lighting and a pedestrian bridge across the mouth of Claypit Brook. MassDOT has committed approximately three million dollars for the construction of the project.

Signs and Kiosks

There are very few DCR signs within Lowell Heritage State Park and there are no kiosks. Five separate Site/Facility Identification Signs exist for the Rourke brothers boat ramp, regatta field, Vandenberg esplanade, Francis Gate Park and Lord pool.

- The sign for the boat ramp, located at the ramp's main entrance, does not meet DCR signage standards (DCR n.d.).
- The regatta field sign, located on the north side of Pawtucket Boulevard near the sidewalk, within the larger of the two playing fields, meets all DCR signage standards (DCR n.d.).
- The sign for the Vandenberg esplanade, which is located on the south side of Pawtucket Boulevard near the intersection of Varnum Avenue, should be double-sided in order to meet DCR signage standards (DCR n.d.).
- The Francis Gate Park sign, located near the Guard Locks Lock House, does not meet DCR signage standards (DCR n.d.).
- The sign for the Lord pool meets all DCR signage standards (DCR n.d.).

A standard Rink Identification Sign is located at the main entrance of the Janas rink (DCR n.d.).

There is one Road Marker Sign that leads visitors to Lowell Heritage State Park from the Lowell Connector. The sign reads: "Lowell National and State Parks Exit 5B;" it does not meet DCR signage standards.

A small identification sign is attached to each of the DCR-owned buildings that the National Park

Service maintains (see Section 4.4. Management Resources and Practices for more information). Although these signs do not meet DCR signage standards, they are consistent in appearance and placement, and thus easily recognizable as a component of Lowell National Historical Park.

National Park Service Identification Sign (DCR)

Within the last 10 years, Lowell General Hospital constructed a three-sided directional sign on DCR property located on the corner of Pawtucket Boulevard and Varnum Avenue. There is no record of a legal document (e.g., permit, Memorandum of Understanding, etc.) being issued or a bill being passed that authorized the construction of this sign.

Memorials and Markers

There are five known memorials within Lowell Heritage State Park. The first, a large granite marker, is located at the entrance to the Rourke brothers boat ramp. It is inscribed with the names of three Rourke brothers, Steve, Cliff and Bud, all of whom served in World War II.

The second memorial is dedicated to Charles G. Sampas, a former columnist for the Lowell Sun. An approximately four-foot-tall, one-foot-square granite post, topped with a bronze plaque, is located near the Sampas pavilion. The plaque includes the names of the state and national parks.

Another bronze plaque, the third memorial, is mounted directly to the front of the Rynne bathhouse. It pays tribute to Michael Rynne, a former Lowell policeman and athlete, and also includes the names of the state and national parks.

The fourth memorial, located at the eastern end of the Vandenberg esplanade, is dedicated to George Scott Finneral, who was killed in action during the Persian Gulf War. It, too, is a bronze plaque mounted atop an approximately four-foot-tall, one-foot-square granite post. However, the plaque does not match the design of the other memorials.

The fifth and final memorial is small granite marker located within the Victorian garden. It is inscribed with Mary J. Bacigalupo's name and reads, in part: IN RECOGNITION FOR HER LEADERSHIP AND DEDICATION TO THE PEOPLE AND CITY OF LOWELL.

There are at least nine other bronze plaque markers, either mounted on a granite post or directly to a building, placed throughout the park. These markers provide information about the nearby buildings and objects. Each marker includes the name of the state and national parks. The plaque for the brick vault, located near the Victorian garden, was stolen and has not been replaced.

Bronze Plaque and Granite Post Marker (DCR)

Surprisingly, there is no marker for Hoyt S. Vandenberg (1899-1954), the presumed namesake of the esplanade and Lowell's highest ranking general.

4.4. MANAGEMENT RESOURCES AND PRACTICES

See Section 2, Management Resources and Practices, for a description of the management resources and practices that apply to the entire Lowell/Great Brook Planning Unit.

512 Agreements

Chapter 512 of the Acts of 1980 authorized the Department of Environmental Management (DEM) to enter into agreements with municipalities and redevelopment authorities for the purposes of land acquisition, development and associated costs in connection with establishing urban heritage state parks. While Lowell was not specifically mentioned in this act, Chapter 723 of the Acts of 1983 did mention the city and disbursed over 30 million dollars to the DEM for the continuation of the Urban Heritage State Park Program, provided that the funds were expended pursuant to Chapter 512 of the Acts of 1980.

Since 1984, the DEM (now DCR) has entered into four agreements with the City of Lowell, the most recent of which was executed on November 7, 1990. This agreement has been amended four times since 1990, and the majority of the amendments expanded the scope of the project, which now includes all of Lowell Heritage State Park. The agreement is "in full force and effect until all project activities…have been completed, all obligations…have been fulfilled and all [funds] have been expended, revoked or returned to the Commonwealth." It is unclear whether any of these conditions have been met.

Natural Resources

Vegetation management within the park consists primarily of mowing and trimming. DCR staff maintain the lawn and landscaping at the Rourke brothers boat ramp and along the Vandenberg esplanade. The city maintains regatta field (see Recreation Resources, below for more information).

Within downtown Lowell, the National Park Service maintains the grounds around the canal system resources (see Cultural Resources, below). The maintenance of the lawn and landscaping within the Gatekeeper's property falls to the curator or DCR staff, when a curator is not present. DCR staff also maintain the grounds at the Lord pool and the plantings at the Victorian garden. The lawn and landscaping at Tremont Yard and the Janas rink are maintained by Tremont Yard, LLC and North Shore Rink Management Associates, Inc., respectively (see Infrastructure, below).

Cultural Resources

Buildings and Structures

Michael Rynne Bathhouse. In 1996, the Department of Environmental Management (DEM) issued the City of Lowell a three-year Special Use Permit "to use and occupy the [beach] adjacent to the Rynne [bathhouse] on the Merrimack River for the purpose of providing a safe, clean and accessible swimming area for the general public."

As part of this permit, the city was given one room in the bathhouse, "as designated by the Park Supervisor, for the purpose of a First Aid and storage area." In addition, the DEM agreed, "subject to appropriation and available personnel, to make major repairs to the [bathhouse] such as, roof replacement, exterior painting, heating system replacement, etc." The shared use of the bathhouse has continued, under agreeable terms, for the last 15 years without a Memorandum of Agreement or similar document in place.

Buildings and Structures Associated with the Canal System. In 1991, the four major stakeholders in downtown Lowell's historic properties – the Department of Environmental Management (DEM), Boott Hydropower, Inc. (Boott), the Proprietors of Locks and Canals on the Merrimack River (Proprietors) and the National Park Service (NPS) – signed a five-year Memorandum of Understanding (MOU) for the purpose of "maintaining and operating the Lowell Canal System for the benefit and enjoyment of the general public and for the private production of hydroelectricity and for other private uses of its waters." The agreement divided the critical tasks related to maintaining and operating the canal system, including the associated buildings and structures, among the four major stakeholders with the understanding that each held a slightly different ownership, and general, interest in the various components of the system.

In general, maintenance of the canal walls and bottoms, dams and control apparatuses fell to Boott and the Proprietors. Boott was also responsible for maintaining, and providing access to, the Eldred L. Field Power Station for interpretive tours, as well as

managing the water levels and flow rates in the canal system. The cost of utilities for the associated buildings was split between the DEM and Boott, while the DEM and NPS worked together to maintain and secure the buildings and grounds. The DEM and NPS also agreed to meet each year in order to develop building maintenance, destructive vegetation clearing, canal water surface cleanup, and long term capital improvement programs.

Despite evidence that one or more of the stakeholders attempted to renew this MOU after it expired in 1996, the maintenance and operation of the canal system continues today, under somewhat agreeable, if not confusing, terms, in the absence of any legally binding document.

W.A. Mack & Company Building. In 2007, the DCR and New England Electric Railway Historical Society / Seashore Trolley Museum signed a five-year Memorandum of Understanding (MOU), which authorized the group to utilize space on the first and second floors, including the window displays, of the Mack building for the purpose of operating the National Streetcar Museum. As part of this MOU, the group is responsible for:

- Any and all utility services and costs;
- Notifying the DCR's Regional Director of any fees under consideration or charged for using and/or accessing the museum;
- Scheduling and attending an annual in-person meeting with the Regional Director;
- Receiving the approval of the Regional Director prior to making any changes or improvements to the building; and
- Notifying the Regional Director of any injuries, closures, property damage or related incidents associated with the use of the building.

Even though this MOU expired on June 30, 2012, the museum has continued to utilize the Mack building, under agreeable terms, for the last two years.

Objects

Boston & Maine (B&M) Railroad No. 410. The historic steam locomotive is maintained and cleaned, at least twice a year, by the Boston & Maine Railroad Historical Society (B&MRRHS), a non-profit historical and educational organization comprised of volunteers who share a common interest in the history and operations of the B&M Railroad. There is no Memorandum of Agreement, or similar document, between the B&MRRHS and DCR that guides this management activity.

Recreation Resources

Anne Dean Welcome Regatta Field. In 2007, the DCR and City of Lowell signed a five-year Memorandum of Understanding (MOU), which authorized the city to "…manage, maintain, and schedule events and programs consistent with the recreational missions of both parties at the [field]…." As part of this agreement, the city:

- Retains the funds it generates through permitting fees;
- Schedules an annual meeting with the DCR's Regional Director to discuss the previous year's programs and compliance with the MOU;
- Receives approval from the Regional Director before making any changes or improvements to the property;
- Does not cut, remove or interfere in any manner with any natural vegetation or store equipment or property without approval from the Regional Director; and
- Notifies the Regional Director of any injuries, closures, property damage or related incidents associated with the use of the property.

Despite the fact that this MOU has expired, the management and maintenance of the field, as well as communications between the city and park staff, have seamlessly continued for the last two years.

Rynne Beach. In 1996, the Department of Environmental Management (DEM) issued the City of Lowell a three-year Special Use Permit "to use and occupy the [beach] adjacent to the Rynne [bathhouse] on the Merrimack River for the purpose of providing a safe, clean and accessible swimming area for the general public." As part of this permit, the city agreed, at its own expense, to:

- Assume complete management responsibility of the waterfront area, including daily maintenance of the public restrooms;
- Provide qualified personnel to staff and manage the beach from June 1st through Labor Day of each year;

- Notify the DEM of incidents, such as vandalism, accidents, serious injuries, etc.; and
- Provide the park supervisor with a weekly report that includes a summary of incidents and attendance figures.

The management and maintenance of the beach, as well as communications between the city and park staff, have seamlessly continued for the last 15 years without a Memorandum of Agreement or similar document in place. Today, the beach is generally open from July 1st through mid- to late-August; a schedule that is dependent on the availability of students to fill the lifeguard positions and the timing of the Southeast Asian Water Festival, a popular event that is held on the Vandenberg esplanade each summer (Faticanti 2014).

The lack of a small, motorized boat presents the biggest management challenge for the city (Faticanti 2014). Every year, staff must borrow a boat to place and remove moorings, or swimming area markers, in and from the river. In addition, the city borrows a boat, or more, if available, to guard the non-motorized, dragon boat races that are an integral part of the Southeast Asian Water Festival. Finally, staff are routinely called upon to assist individuals who are swimming outside of the designated area, sometimes up to a mile away.

Raymond J. Lord Memorial Swimming Pool. In 2011, the DCR and Department of Public Health (DPH) signed a Memorandum of Agreement in order facilitate compliance with the State Sanitary Code (105 CMR 435.00, see Appendix F). As part of this agreement, the two agencies meet a minimum of twice per year to discuss pool inspections and compliance issues; share seasonal information regarding the operation of each pool; and jointly inspect each pool at least once per season. The agreement is in effect until terminated by either agency, upon 60 days written notice.

Infrastructure

Property Boundary

Anne Dean Welcome Regatta Field. Under the terms of the license agreement, signed by the Department of Environmental Management (DEM) and Highway Department (MassHighway) in 2001, the DEM must obtain written approval from MassHighway before altering the property and before transferring or assigning the license, in part or in whole. In addition, the DEM is responsible for maintaining the property, as well as any existing or additional utilities needed to utilize the property. This license is in effect until terminated by MassHighway, now MassDOT, or the DEM, now DCR.

Buildings and Structures

Rourke Brothers Memorial Boat Ramp. Extensive regulations govern the use of the Office of Fishing and Boating Access (OFBA) sites, such as the Rourke brothers boat ramp (320 CMR 2.00; Appendix F). Use of these sites is restricted to the launching of watercraft and the parking of associated vehicles. No other parking or recreational uses are allowed. Special Use Permits are required for events (e.g., fishing tournaments) at OFBA sites. Permits are issued by the OFBA, following DCR review.

Edmund A. Bellegarde Boathouse. Chapter 238 of the Acts of 2006 authorized the transfer of the boathouse from the DCR to the University of Massachusetts Lowell (UMass). Sections seven through nine of the Act describe the terms and conditions of the transfer, including the requirements for public access and consequences regarding a change in use. The following additional items were also agreed upon, in order to execute and deliver a "care, custody, management and control" agreement between the DCR and UMass:

- Any document transferring the property shall include a reversionary clause, stating that care, custody, management and control reverts back to the DCR if the property ceases to be used as a public boathouse and park land.
- The Division of Capital Asset Management (DCAM), in consultation with the DCR, shall survey and provide a legal description of the property to be transferred.
- UMass shall prepare and submit, at its own expense, an Environmental Notification Form (ENF) regarding a land transfer of Article 97 protected lands.
- The transfer shall not be completed until the Secretary issues a certificate stating that no Environmental Impact Report (EIR) is needed, or that the EIR is adequate until the expiration of the legal challenge period.

- UMass shall comply with all requirements of the National Park Service and shall seek and obtain any required approvals.

The boathouse was officially transferred by the DCAM in 2006 (a signed Transfer Request 1, or TR1, form was located during this planning process); however the care, custody, management and control agreement has yet to be finalized. Several items from the list above, including the property survey and ENF, could not be located during this planning process.

The area including the parking lot to the west of the boathouse and the boathouse itself was estimated to be 1.15 acres, which exceeds the agreed upon land transfer estimate of one-third of an acre. Based on the estimate of 1.15 acres, it is presumed that the parking lot was not included in the land transfer.

Tremont Yard. The 25-year lease signed by Tremont Yard, LLC is a lengthy and detailed document that guides the management and operation of the DCR's property located at 257 Father Morissette Boulevard, excluding the parking area (see Parking, below). Permitted uses, rent, insurance, maintenance and subletting, among other topics, are addressed in the agreement. The DCR's Long-term Permit and Lease Program staff, within the Office of the General Counsel, ensure that the terms of the lease are being met. This lease is scheduled to expire on May 21, 2033, however it may also be extended for seven additional 10-year periods.

On October 31, 2008, Tremont Yard, LLC entered into a 15-year sublease with Jeanne D'Arc Credit Union. The sublease only covers the building that was constructed at 257 Father Morissette Boulevard. The credit union has options to extend the term of the lease, expand the leased premises and to purchase the property from Tremont Yard, LLC. For this sublease, Tremont Yard, LLC is the landlord and responsible for ensuring that the terms of the sublease are being met.

John J. Janas Memorial Skating Rink. The 25-year lease signed by the North Shore Rink Management Associates, Inc. is a lengthy and detailed document that guides the management and operation of the DCR's property located at 382 Douglas Road. Permitted uses, rent, insurance, maintenance and subletting, among other topics, are addressed in the agreement. The DCR's Long-term Permit and Lease Program staff, within the Office of the General Counsel, ensure that the terms of the lease are being met. This lease is scheduled to expire on June 20, 2027.

Parking

National Park Service's Visitor Center Parking Lot. In 1982, the Department of Environmental Management (DEM) and National Park Service (NPS) signed a Memorandum of Understanding (MOU) regarding the use of the parking lot located near the intersection of Broadway and Dutton streets in downtown Lowell. As part of this MOU, the two entities agreed:

- The NPS would be solely responsible for the operation and maintenance of the property, including staffing, daily operation, trash and snow removal, and repairs;
- The DEM would maintain a continuing role in the development of management policy relative to property;
- The obligations assumed by the NPS would not be transferred, assigned or modified without written approval by the DEM;
- The NPS would maintain a sign at the entrance of property, indicating that it may be used by visitors of both state and federal parks; and
- That a reasonable number of official spaces would be reserved for use by state or federal vehicles.

The MOU acknowledged that the DEM was authorized and intended to convey a portion of the property to the NPS and to that end, stated, "This agreement shall remain in full force and effect and shall not be defeated by the execution and delivery of a deed from [the] DEM to [the] NPS in connection therewith."

Tremont Yard. On January 10, 1985 the Trustees of Wannalancit Office and Technology Center Trust (Trustees) signed a 99-year lease with the Department of Environmental Management for the parking area located in the rear of 257 Father Morissette Boulevard. On September 27, 1996, the Trustees assigned the lease to the University of Massachusetts Lowell (UMass), who remains the tenant today. UMass is responsible for maintaining and, when it deems necessary, improving the parking area. Any construction on the property must

be approved by the DCR. This lease is set to expire in 2084.

Interpretive Services

The National Park Service provides all of the interpretive programming related to the historic resources in downtown Lowell, due to the lack of DCR interpretive staff assigned to Lowell Heritage State Park and the overlap between the state and federal parks.

Lowell Heritage State Park is a participant in the Park Passport Program; the passport box is located next to the Rynne bathhouse.

Operational Resources

Supplemental Staffing

The supplemental staff at Lowell Heritage State Park are truly invaluable. Without the help of the City of Lowell and National Park Service, many of the DCR's most significant resources would certainly be in a state of disrepair, inaccessible to the public, or safety hazards requiring demolition. Other important partners include the Office of Fishing and Boating Access, University of Massachusetts Lowell, Merrimac River Rowing Association and Merrimack River Watershed Council, all of whom play a role in providing quality, safe access to the Merrimack River. Finally, the many volunteers in downtown Lowell – from the Lowell Canalwaters Cleaners, to the Boston & Maine Railroad Historical Society, to Park Serve Day attendees – help preserve and enhance the park's individual resources, as well as the visitor experience overall.

Public Safety

DCR Rangers issue citations for violations of various forest and park rules. A summary of incident reports recorded in the park during 2013 is provided below.

Table 4.10. Lowell Heritage State Park Incident Reports, January 1 through December 31, 2013

Incident	Number
Vandalism	1
Violation of DCR regulations[a]	1
Total	*2*

a. This violation was related to alcohol consumption on state property and, in turn, a suspected drunk driver. The incident was relayed to the Lowell Police Department, as the individual drove their vehicle onto a city-owned road after leaving the park.

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Dairy cows at Great Brook Farm State Park. (DCR)

SECTION 5. GREAT BROOK FARM STATE PARK

5.1. INTRODUCTION

Great Brook Farm State Park is a large property – 929 acres – located in the northern section of the rural community of Carlisle, with a few acres falling over the town border to the north, in Chelmsford. Main access points to the property are located off of Curve Street, North Road and Lowell Street. This is a diverse property with a variety of resources, uses and issues, including an active dairy farm; multiple historic buildings; acres of wetlands, forests and agricultural fields; miles of trails popular with walkers, equestrians and mountain bikers; and home to a cross-country ski concession.

Great Brook Farm is the largest active farm remaining in Carlisle, and is touted as the only active dairy farm within a state park in the country. The farm complex boasts a robotic milking system, the first one to be installed in Massachusetts.

5.2. HISTORY OF PROPERTY

The Concord River Valley area has a long history of human occupation, with a Native American presence that stems back thousands of years. Known archaeological sites within Great Brook Farm State Park confirm pre-contact use of this property.

European settlement of the Carlisle area took place in the mid 17th century, with the establishment of three separate small settlements, one of which, Chelmsford South End, began sometime after 1655 and was located in the area of the present day park (MHC 1980*d*). River Meadow Brook provided serviceable waterpower, and mills and dwellings began appearing along its banks in the 17th century, including the area known as "The City," a small milling community with multiple homes and even a possible garrison (Markey 2002). A fulling mill was established in 1691 by John Barrett. Saw, grist and hoop mills were also located along River Meadow Brook, operated by the Adams and Robbins families through the early 18th century. A blacksmith shop was located in the area, and small scale quarrying also took place on land that is now within the park. A hoop mill continued to operate into the late 19th century.

By the early 18th century, the Spaulding and Adams families settled in the area and established small farms. The first North District schoolhouse was authorized in 1788, and the brick school building, the second one on this site, was constructed by Benjamin Barret in 1828. Small scale agriculture continued into the early to mid 20th century.

In 1939, Farnham Smith purchased eight acres off of North Road and built himself a cabin on a small pond as a summer retreat. Attracted to the area, he began purchasing additional property – the Adams farm in 1943, the home at 886 Lowell Street in 1953, and the purchase of the Hart property, including the barn and the schoolhouse shortly thereafter (Miller 1998). He ultimately purchased 29 individual parcels, owning more than 900 acres, eight houses, the former schoolhouse, and five barns (Markey 2002). Smith began dairy farming and some breeding, and in 1948 he hired a farm manager, embarking fully into the breeding of Holsteins. Great Brook Farm became one of the largest dairy farm operations in New England and a highly respected breeder of Holsteins.

In September 1974, Smith sold Great Brook Farm to the Commonwealth of Massachusetts for $4.3 million, for the establishment of a state park. Smith retained the rights to: operate the farm for an additional three years, use and lease the North Farm house for an additional five years, use the log cabin and the East Farm house for an additional eight years, and life tenancy use of the schoolhouse. Smith decided to cease farm operations just one year later, selling off equipment and animals in 1975.

A cross-country ski concession has been operating on site (weather permitting) since December 1977, when it began as a pilot program for the 1977-1978 ski season. The current concession has been operated by the same family since the 1982-1983 ski season.

Legislation was passed in 1982 for the establishment of an interpretive farm. Applicants were sought to operate the farm in 1986, and Mark and Tamma Duffy have been operating the dairy farm component of the park under lease agreements since 1987. The ice cream stand opened in 1988.

5.3. EXISTING CONDITIONS

Natural Resources

Physical Features

Topography. The topography within Great Brook Farm State Park is composed of lowlands in the south and gently rolling hills in the north. Elevation ranges from 170 to 300 feet above sea level.

Geology. Located within the Nashoba terrane, Great Brook Farm State Park lies primarily within the Nashoba formation. This formation is composed of metamorphosed volcanic rocks and includes schist, gneiss and biotite gneiss as well as an abundance of mica and sillimanite (Skehan 2001). Glacial eskers and erratics can be seen throughout the park.

Soils. The soils at Great Brook Farm State Park include large areas that are well suited to agricultural and pasture use, although there are some issues with droughtiness that limits crop production and pasture usage (Peragallo 2009). The wetlands present on the property are reflected in the high percentage of acres characterized as muck type soils.

Table 5.1. Soils of Great Brook Farm State Park

Soil Series	% of Park	Drainage Class
Canton fine sandy loam	20.7	Well drained
Freetown muck	14.4	Very poorly drained
Hinckley loamy sand	10.5	Excessively drained
Charlton-Hollis-Rock outcrop complex	7.6	Well drained to somewhat excessively drained
Merrimac fine sandy loam	5.7	Somewhat excessively drained
Swansea muck	5.2	Very poorly drained
Woodbridge fine sandy loam	4.6	Moderately well drained
Scarboro mucky fine sandy loam	4.4	Very poorly drained
Saco mucky silt loam	2.7	Very poorly drained
Freetown muck, ponded	2.3	Very poorly drained
Carver loamy coarse sand	2.3	Excessively drained
Windsor loamy sand	2.2	Excessively drained
Scituate fine sandy loam	2.2	Moderately well drained
Haven silt loam	2.1	Well drained
Hollis-Rock outcrop-Charlton complex	2.1	Somewhat excessively drained to well drained
Deerfield loamy sand	2.0	Moderately well drained
Raypol silt loam	1.7	Poorly drained
Narragansett silt loam	1.7	Well drained
Water	1.2	N/A
Wareham loamy fine sand	1.1	Poorly drained
Raynham silt loam	0.8	Poorly drained
Rock outcrop-Hollis complex	0.6	Somewhat excessively drained
Udorthents	0.5	Variable
Whitman fine sandy loam	0.3	Very poorly drained
Tisbury silt loam	0.2	Moderately well drained

There are slight to moderate limitations on path and trail development in dry areas, depending on slope, and some limitations on picnic and playground development, based on slope and the stoniness of the soils (Peragallo 2009).

Water Resources

Great Brook Farm State Park is rich in water resources – almost a quarter of the park's total acreage is made up of either ponds or wetlands.

Ponds. Meadow Pond, centrally located in the park, is the largest body of water in Great Brook Farm State Park (see Figure 4). Meadow Pond has an abundant amount of water chestnut (*Trapa natans*) that is impacting the chemistry and habitat of this body of water. Beaver activity, weather, and water releases from nearby cranberry bogs impact the water level, and have led to flooding on nearby trails.

There are two smaller ponds on the property. One is the farm pond located adjacent to the farm complex and the second is located north of North Road, in the eastern portion of the park, near the site of Farnham Smith's cabin retreat (see Figure 4). There are almost 12 acres of water that are encompassed by these three ponds.

Wetlands. The southern portion of the park is dominated by Tophet Swamp, a 76 acre wooded wetland area consisting primarily of mixed trees (see Figure 4), along with two blocks of coniferous wooded swamp. A smaller (28 acre) coniferous wooded swamp can be found in the northern section of the park. Shrub swamps (approximately 33 acres) and deciduous wooded swamps (57 acres) can be found spread throughout the property. All combined, swamp areas cover almost 21% of the park.

Some shallow marsh meadow lands encompassing 10 acres are found north of Meadow Pond, in the area known as "The Meadows". Small pockets of deep marsh can be found scattered nearby, totaling almost nine acres. The largest of these deep marshes is located directly northeast of Meadow Pond.

A small bog area, just over one acre in size, is located within the southern section of Tophet Swamp.

Vernal Pools. There are seven certified vernal pools and 12 potential vernal pools located in the park.

Streams. River Meadow Brook, also locally known as Great Brook, is situated roughly west-east through the park, starting in a cranberry bog west of the park and running just south of Curve Street and North Road until it enters Meadow Pond (see Figure 4). Exiting the north end of Meadow Pond, River Meadow Brook heads northward out of the park into a series of mill ponds in Chelmsford and into the Concord River in Lowell.

Two small, unnamed streams flow into River Meadow Brook from the north, on either side of Lowell Road, while a third stream swings through a small portion of the southern border of the park, ultimately connecting to Pages Brook south of the park.

Groundwater. A small portion of a medium-yield aquifer lies beneath nine acres in the northern part of the park, extending from Meadow Pond north to the park boundary.

There are two drinking water wells located at Great Brook Farm State Park. One well (#3051017-01G) is located just east of the Main Farm house, and serves the farm and the ice cream stand. The second well (#3051017-02G) is located north of the Nature Center Pavilion, in the field just southeast of the North Farm House Barn, along the Litchfield Loop trail, and serves the Nature Center Pavilion. Both are categorized as Transient Non-Community Groundwater Sources by the Department of Environmental Protection.

Flood Zones. The 100-year flood zone covers 84 acres that fall within Great Brook Farm State Park. This zone roughly corresponds to lands adjacent to River Meadow Brook and Meadow Pond, and extends north from Meadow Pond into The Meadows. The 500-year flood zone incorporates 162 acres of land, concentrated in the Tophet Swamp area in the southern half of the park.

Rare Species

A very small component of Great Brook Farm State Park, just 33 acres, has been designated as Priority Habitat under the Massachusetts Endangered Species Act (321 CMR 10.00). Located in the westernmost parcel of the park, the Priority Habitat is located on a non-contiguous piece of land located south of Curve Street and west of Old Morse Road, and extends into nearby municipal conservation land and private lands.

Placeholder for Figure 4.

Two rare species, both reptiles, can be found in this Priority Habitat: Blanding's turtle and eastern box turtle (NHESP 2007*a*; NHESP 2007*c*). These two species are similar in appearance and have similar nesting habitats, and thus are often confused with each other.

Table 5.2. State-listed Species of Great Brook Farm State Park, as identified by the Natural Heritage & Endangered Species Program (NHESP)

Species	Type	MESA[a]
Blanding's turtle	Reptile	T
Eastern box turtle	Reptile	SC

Source: Harper 2013

a. Status of species listed under the Massachusetts Endangered Species Act (MESA): SC = Special Concern and T = Threatened.

Blanding's turtles use a variety of habitats, including vernal pools, marshes, scrub-shrub wetlands and open uplands, during their life cycle, and travel long distances during their active season (NHESP 2007*a*). Eastern box turtles are more of a terrestrial turtle and inhabit a variety of habitat types (NHESP 2007*c*).

In 2010, MassWildlife and The Nature Conservancy (TNC) issued "BioMap 2: Conserving the Biodiversity of Massachusetts in a Changing World" (MassWildlife and TNC 2010). This guide identified two types of areas important for conservation: Core Habitat and Critical Natural Landscape. The first is crucial for the long-term persistence of rare species and other species of conservation concern. The second provides habitat for wide-ranging native wildlife, supports intact ecological processes, maintains connectivity among habitats, enhances ecological resilience, and buffers aquatic Core Habitats to help ensure their long-term integrity. Protection of both areas, which may overlap, is "important to conserve the full suite of biodiversity" in Massachusetts (MassWildlife and TNC 2010). At Great Brook Farm State Park, 490 acres (54% of the park) has been designated Core Habitat, a much larger area than the MESA designated Priority Habitat, but no Critical Natural Landscape areas have been designated.

Vegetation

Forest Types. In 2003, the James W. Sewall Company developed a forest inventory/land cover classification dataset for the state forests and parks. The dataset is primarily based on the interpretation of infrared aerial photography, a process that identified seven forest sub-types within Great Brook Farm State Park (Table 5.3).

Table 5.3. Forest Sub-types of Great Brook Farm State Park

Forest Sub-type	Acres	% of Park
Eastern white pine - oak	209.3	22.5
Eastern white pine	123.8	13.3
Eastern white pine - hardwoods	83.2	9.0
Mixed oak	76.6	8.2
Oak – hardwoods	33.9	3.6
Eastern white pine - eastern hemlock	8.8	0.9
Red maple - swamp hardwood	3.6	0.4
Total	*539.2*[a]	*57.9*

a. The difference in total acreage is due to the exclusion of wetlands and areas of open water, as well as changes in the park's boundaries since 2003.

More recently (2010-2011), specific areas within the forest were visited by DCR Management Foresters as part of the Massachusetts Continuous Forestry Inventory (CFI). The CFI is a network of permanent, one-fifth-acre plots on state park and forest lands that are routinely monitored for sivicultural purposes, and help to gage forest health. The measurements and observations made within each CFI plot are recorded in a database that dates back to 1960, when the CFI was created. Approximately 10% of the state's CFI plots are inventoried each year, on an on-going basis. As of 2010, there were 1,768 CFI plots statewide (Goodwin 2014).

There are seven CFI plots at Great Brook Farm State Park. These even aged stands range in age from 70 to 100 years and are comprised mostly of white or red pine, red maple, and white, black or scarlet oak.

Some disturbance agents have been noted in these stands, including pasturing (1900 to the present); insects (1981) and wind (1985). Harvesting also occurred in these stands in 1960.

Priority Natural Communities. There are no Priority Natural Communities within the park.

Invasive Species. A number of invasive species have been observed and identified by foresters and visitors to Great Brook Farm State Park. These species include:

- Common buckthorn (*Rhamnus cathartica*), a deciduous small tree or coarse shrub that threatens wetlands, where it can suppress other species, and field edges.

- Garlic mustard (*Alliaria petiolata*), a biennial herb that can spread rapidly, displacing native vegetation and in turn altering habitat. Garlic mustard is very difficult to eradicate.
- Bittersweet, a deciduous woody vine that has the capacity to grow over 60 feet long, girdles trees and smothers other plants. Bittersweet has been observed by the ice cream stand, along the Acorn Trail, and at the small parking area at the intersection of Lowell Street and North Road.
- Purple loosestrife (*Lythrum salicaria*), an herbaceous perennial, can suppress native populations, alter wetland structure and function, and impede water flow. Dense stands can form that are unsuitable for use by wetland habitat animals. Purple loosestrife has been found in wetland areas and along the brook.
- Water chestnut (*Trapa natans*), a fast growing aquatic plant, can crowd out native species and choke waterways. Water chestnut damages habitat and can impede recreational access. This is particularly present at Meadow Pond, and has been one of the contributing factors to the decrease in recreational boating in this pond.
- Multiflora rose (*Rosa multiflora*), is a densely spreading shrub that forms thickets that crowd out native species.
- Japanese knotweed (*Polygonum cuspidatum*), a shrub-like herbaceous plant that forms dense thickets that crowd out native species and reduce wildlife habitat, posing significant threats in riparian areas in particular.
- Catalpa (*Catalpa bignonioides* or *Catalpa speciosa)*, a fast growing tree that can reach a height of 50 feet and crowd out native trees in the process.
- Winged burning bush (*Euonymus alatus*), also known as winged euonymus or burning bush, is a deciduous shrub that forms dense thickets that crowd out native species.
- Japanese barberry (*Berberis thunbergii*), a spiny shrub that forms dense stands that can displace native plants and reduce wildlife habitat and forage. Barberry also harbors deer ticks that have the potential to carry the Lyme disease bacteria, functioning as a nursery of sorts for juvenile ticks (Benson 2011).
- Privet, a rapidly maturing semi-evergreen shrub that forms dense thickets that crowd out native species.

Pests and Disease. White pine weevil (*Pissodes strobe*) has been identified in Great Brook Farm State Park. While tree mortality from this pest is low, damage does impact tree health and reduce wood quality. Leaf feeders have also been identified here as well, although to a much lesser degree than the weevils. Leaf feeders encompass a broad category of insects that are all defoliators, impacting trees and other plants.

Wildlife

Birds. Great Brook Farm State Park is popular with birders, and over 150 wild species have been recorded in or over the park in recent years (see Appendix G). Of these species, 22 are classified as Species in Greatest Need of Conservation (MassWildlife 2006). As part of the farming operation, the farmers also maintain a flock of domesticated chickens.

Mammals. There is little current information on the park's mammals. Nine species confirmed to occur within the park and an additional 34 species that may possibly occur within the park are identified in Appendix G. Of the confirmed species, one of them, the Eastern red bat, is classified as a Species in Greatest Need of Conservation (MassWildlife 2006).

As part of the farming operation, the farmers also maintain a herd of dairy cows for milk production, as well as some goats, sheep, pigs, rabbits and a horse. Some are family pets, while others are kept for visitor enjoyment and farm income.

Reptiles. There is little current information on the park's reptiles. Seven species confirmed to occur within the park and an additional nine species that may possibly occur within the park are identified in Appendix G. Of the confirmed species, two are classified as Species in Greatest Need of Conservation (MassWildlife 2006). These are the Blanding's turtle and the Eastern box turtle.

Amphibians. There is little current information on the park's amphibians. Ten species confirmed to occur within the park and an additional eight species that may possibly occur within the park are identified in Appendix G.

Fish. There is no current information on the park's fish. A survey of River Meadow Brook in 1979 yielded an American eel (*Anguilla rostrata*), a brown bullhead (*Ameiurus nebulosus*), 12 bluegill (*Lepomis macrochirus*), four pumkinseed (*Lepomis gibbosus*), and four largemouth bass (*Micropterus salmoides*) (Wineman 1980).

Cultural Resources

There is a wide range of cultural resources within Great Brook Farm State Park. Some are associated with Farnham Smith's use of the property, while others predate his acquisition of these lands. Many of the cultural resources have been documented on Massachusetts Historical Commission (MHC) inventory forms. The park was evaluated by the MHC in the late 1990s and determined at that time to be eligible for listing in the National Register of Historic Places.

Pre-Contact Archaeological Sites

Four pre-Contact sites have been recorded in the park. One site is a stone tool making workshop that dates to the Middle Archaic Period (7,500-5,000 B.P.). The remaining sites are identified as "find spots" with little more than locational information provided. Despite the low number of sites, the physical characteristics, regional setting, and the known patterns of pre-Contact occupation in the area, all confer a high archaeological potential for this park.

Historic Archaeological Resources

Remnants of the 18th – 19th century mill site operated by the Adams family are located on River Meadow Brook, adjacent to Farnham Smith's cabin. (See MHC inventory form # CAR.902.) The Adams mill site includes a dam, two sluiceways, an impoundment, and the foundation of a mill. The dam and the sluiceways were originally constructed of dry laid stone, which helped to control water and create the impoundment area. The dam, also known as Cabin Pond Dam in agency records (MA02506), has an earthen core and sluiceways with concrete reinforcing. This dam is considered non-jurisdictional, meaning it is not under the regulation or jurisdiction of the DCR Office of Dam Safety and has not been assigned a hazard code. This dam was last inspected in 2007. A gate mechanism was added in the 20th century, probably to manage the water levels in the impoundment area. The mill foundation is located just north of the dam. According to research, this building once functioned as a grist, hoop, and saw mill (Dwyer 1995).

Not far from the Adams mill site, off of the Garrison Loop Trail, is the area locally known as "The City," also known as Chelmsford South End. This area, a collection of cellar holes likely dating from the 18th century, was potentially affiliated with the nearby mill, possibly as an area of mill worker housing. An archaeological survey of the area in 1995 identified five visible cellar holes in this area (Dwyer 1995); only two definite cellar holes and a possible third cellar hole were located during the RMP fieldwork. Archaeological work revealed a low density of artifacts, suggesting the area was not inhabited for a sustained period of time.

One of the cellar holes that is still visible is locally known as the Garrison House site. Although archival research points to a garrison located in the Great Brook area in the 17th century, the archaeological investigation yielded domestic artifacts, and cannot confirm its use as a garrison (Dwyer 1995).

Another cellar hole is located next to three pieces of quarried stone. A third, possible cellar hole is located north of these other two, near the northern intersection of Garrison Loop with the Woodchuck Trail. Lots of leaf and brush debris were noted in the cellar holes during the RMP fieldwork.

Other cellar holes that may or may not be affiliated with the settlement of "The City" can be found within the park. One of these, located across the street from the Litchfield House, consists of a dry laid stone foundation in an I-shape, with a large chimney base. This was also researched and tested during the 1995 archaeological survey of the park, at which time it was determined to have been the site of a mid to late 18th century residential structure (Dwyer 1995). This particular cellar hole is currently filled with brush.

Another cellar hole is located northeast of "The City," alongside the Woodchuck Trail. This one is small and square, with a smaller cellar hole next to it, suggesting an outbuilding. Of note are some stone walls that make some unusual turns in the immediate vicinity of this cellar hole.

The stonework remnants of John Barrett's Mill, located on River Meadow Brook near the

intersection of Lowell Street and North Road, on the west side of Lowell Street, are still somewhat visible. Local historians suggest that this was established in 1691 as one of the first fulling mill sites in the U.S., and later used as a hoop mill until the late 19th century (Lapham 1970). A stone dam that may have been affiliated with this mill site is located near this same intersection, on the east side of Lowell Street, and is known as the Lowell Road dam (MA02508). This dam is considered non-jurisdictional, meaning it is not under the regulation or jurisdiction of the DCR Office of Dam Safety and has not been assigned a hazard code. This dam was last inspected in 2006.

Two historic wells were located in the park during the RMP fieldwork. One of them, located south of North Road, once serviced the Main Farm House. A small well house covered this well until relatively recently, when it was removed for safety reasons and replaced by wooden decking. The other well, which is located southeast of the Litchfield House, is an open well located just off the trail.

Historic Resources

Buildings. In the process of acquiring the acreage for his large farm, Farnham Smith acquired several nearby farms – and their buildings – over the course of about 20 years. Since the establishment of the park, some were able to be put to use for park purposes or through long-term lease agreements. However, several of them no longer function for park purposes, or are residences that in the recent past have housed DCR staff, but with the disbandment of the staff housing program are no longer utilized. The buildings are presented here in three groupings: those that are currently in active use by park staff, long-term leaseholders, or curators; those that are used solely for storage purposes by the park and/or the region; and those that are currently vacant and no longer in active use (see Figure 4).

Buildings in Active Use

North Schoolhouse, located at 984 Lowell Street, is also known as the Park Headquarters building. See MHC inventory form #CAR.7. Constructed in 1828, this single-story, side gabled, three-by-four bay brick building has a granite block foundation and a slate roof. A single-story rear ell, perpendicular to the main block, has another ell added onto the first one, oriented parallel to the main block. Both are clad in clapboard. The building has two interior brick chimneys; one is located in the main block and the other in the rear ell.

Utilized as a grade school until 1906, the former schoolhouse was adapted in the early 20th century for vegetable storage. Farnham Smith purchased the property in 1955, and renovated the schoolhouse into his farm offices in 1959, which may have been when the side entrance was modified to the present-day central recessed entrance under the elliptical arch. The rear ells, clad in clapboard, were added in 1959 and 1969 respectively.

English ivy is growing on the end walls of the main block, and the brick chimney in the rear ell is experiencing major spalling. Other than the issue with the chimney, the building is in good condition.

The North Schoolhouse has been in use as the Park Headquarters since establishment of the park. The building has electrical service, water and septic.

North Schoolhouse/Park Headquarters (DCR)

Hart Barn, located at 1018 Lowell Street. This one-and-one-half story, gambrel roofed barn was once a dairy barn, constructed in the first quarter of the 20th century. With a poured concrete foundation, a concrete block first floor, a clapboard second story, and an asphalt shingle roof, this barn also has an attached milk room and metal stave silo. Aluminum framed fixed sash windows and a metal vent in the roof completes the picture.

Recent mortar repairs efforts between the concrete blocks is evident, and it appears that multiple materials were used in the process. This was done in anticipation of a repainting project scheduled for later in 2014. Asbestos abatement of the window glazing was completed in 2014. The development of a plan for the remaining lead and asbestos inside the building is also anticipated. While the southern side of the roof was replaced in the recent past, the

northern side has not been in some time, and lichen growth is evident. While work has slowly been occurring here to address major issues, the building is still in fair condition. While this building has electrical service, it does not have water or septic.

The Hart Barn has been the home base for the cross-country skiing concession since this activity started here during the l977-1978 ski season.

Hart Barn (DCR)

The ***Main Farm House***, historically known as the Adams House, is located at 247 North Road. See MHC inventory form #CAR.8. The Main Farm House is a two-story, side-gabled, three-by-two bay, central chimney, Georgian style home with a single-story rear ell. A shed roof provides a covered patio area on the rear façade, between the main block and the ell. The main house has a granite block foundation, and the ell has a concrete block foundation. The entire house is clad in clapboards and has an asphalt shingle roof. Windows are primarily six-over-nine double hung sash, with exterior storms. Architectural details include cornice returns on the gable ends, wide and flat window trim with a small projecting cornice, and top lights above the main entrance. Documentation on the MHC inventory form prepared in 1993 notes interior details including original paneling, wide pine flooring, and exposed gunstock posts in one second floor bedroom, however park staff could not confirm if these features still exist. The building has electrical service, water and septic.

The house was constructed in the second half of the 18th century. Local historians differ about the date of construction - Timothy Adams, who purchased the property in 1793, may have constructed a new home on the site or may have remodeled an earlier c1760 home. The main farm complex was acquired by Smith in 1943 and a rear ell was added c1949.

While there is a gutter on the ell, there is no gutter on the main block of the house. This has led to the presence of lichen on the front and rear façades of the house due to splash back, and the doorsill at the main entrance appears to have some moisture damage. Some minor woodpecker damage can be seen on a front corner board. These are easily correctable issues, and this building is in otherwise good condition.

The Main Farm House is now in use as the residence of the farmers that operate Great Brook Farm under a long-term lease.

Main Farm House (DCR)

Garage/Apartment. Located within the core of the farm complex is a two-story, side gabled structure. This building was built for equipment storage and farm staff housing, and is still utilized for these same purposes. Constructed during Smith's ownership of the property, this concrete block and clapboard building has five vehicle bays on the first floor and a two bedroom apartment on the second floor. Park staff has use of two of these vehicle bays for storage purposes. The building has electrical service, water and septic. This building is in good condition.

Garage/Apartment (DCR)

Tie Stall Barn. Constructed in phases, this long building consists of a single-story gable roofed tie stall barn constructed c1910-1920 on the eastern

end; connected to a two-and-one-half-story gambrel roofed barn built in the 1950s; connected to a single-story gable roofed open ended building on the western end. Gabled dormers punctuate the gambrel roofed section, and small single-story additions punctuate the eastern section, one of which links the barn to a wood stave silo that is no longer in use. The foundation is fieldstone on the eastern end and concrete block on the western end. The building is clad in drop board siding and roofed with asphalt shingles. Vinyl replacement windows dot the structure. Exposed rafter tails provide the only adornment on this building. The building has electrical service, water and septic.

Some small sections of siding are in need of repair, due to cracking or pieces missing. There are serious sill and foundation issues in need of attention. The north facing roof has some lichen growth and staining, and may need replacement. The building is in fair condition.

The Tie Stall Barn used to house the dairy herd. A seasonal ice cream stand that is operated by the farmers April through October is now located at the eastern end of the structure. An interior dining and event space was developed by the farmers just behind the pre-existing ice cream stand section, however it was done without prior consultation with the DCR (as stipulated in the farm lease agreement) and without the benefit of a building permit. Authorization of future use of this space for this purpose is still pending, and will not occur until all applicable permits are obtained. The remainder of the barn is currently utilized primarily for storage of hay and sawdust.

Tie Stall Barn (DCR)

Bull Barn. This one-and-one-half-story front gabled building, located just to the east of the Tie Stall Barn, is composed of concrete block on the first floor and clad in drop board above, and has an asphalt shingle roof. Windows are aluminum framed sliding sash, some of which may no longer function. The main entrance is located on the side of the front façade and three more doors are located on the south elevation. A door sized opening is located in the gable end of the upper floor, presumably to access the area for storage. Like the Tie Stall Barn, the only adornment here is exposed rafter tails.

Constructed during Smith's ownership of the property, severe cracking has since occurred in the foundation through the front wall. Due to this issue, the building is in fair condition.

This building is currently used for storage. The sign on the building, "Non-Hazardous Industrial Wastewater," reflects the nearby presence of underground piping associated with the tight tank for the Smart Barn (see the Infrastructure section for more information).

Bull Barn (DCR)

The ***Litchfield House***, historically known as the East Farm, is located at 437 North Road. See MHC inventory form #CAR.6. This c1860 one-and-one-half-story front gabled Greek Revival house is composed of a three-by-three bay main block with a one-story rear ell. The ell connects to a side gabled barn and two car garage through a small shed roofed addition, forming an L-shaped plan. The home has a granite block foundation, clapboard sheathing, and an asphalt roof. Architectural details include a deep eave overhang, sidelights flanking the main entrance, and six-over-six double hung sash windows that have been fitted with exterior storms. The New England style banked barn has large at grade openings on both the front and lower rear facades. Lichen is present on the north side of the roof and some can be seen creeping up the walls. The house has two interior brick chimneys, both of which could use some minor repair work. Extensive

gardens surround the house. This property was purchased by Farnham Smith in the 1940s and served as the home for his head farmer, Lowell Litchfield.

This home is currently in use as a residence under a long-term lease as a part of the DCR's Historic Curatorship Program. The building has electrical service, water and septic. This building is in excellent condition. The curators are currently working on the rear wall of the barn, which is in poor condition.

Litchfield House (DCR)

The ***Hounds House***, historically known as the Woods House, is located at 659 North Road. The Hounds House is a two-story, flat roofed modern home, constructed in c1950 of concrete block, with vertical board wood sheathing on the second floor. With metal casement windows and a deep raking eave with exposed rafters, this home reflects the modernism movement that had a large presence in nearby communities. The building has electrical service, water and septic. This building is in good condition. A small one-story, front gabled wood frame horse barn is located to the rear of the home.

This home is currently used as a residential and non-profit facility. It has been operating under a long-term lease to Old North Bridge Hounds, a non-profit organization that retains a kennel of working foxhounds on site and organizes local equestrian hunts. The building provides the organization with meeting and event space and houses caretakers of the hounds.

Hounds House (DCR)

Buildings Used for Storage Purposes

Hadley House and Garage. Located at 1003 Lowell Street, this small mid-19th century residential building is a one-and-one-half-story, side gabled, two-by-one bay main block with a full width one-story shed roofed component on the rear. The foundation is largely fieldstone, with some concrete block on the southwest corner. The sheathing is clapboard and the roof is asphalt shingle.

The windows are primarily two-over-two double hung sash, and the main entrance is located on the side of the building, on the south facing façade. A centrally located brick chimney pierces the roofline. A wide fascia board and gable returns are the only adornments on this building.

A lilac bush, along with some bittersweet, can be found in the back yard.

The building has no gutters, the paint is failing, and a hose coming from the basement suggests a water problem.

Most recently, the Hadley House had been in use as staff housing. The building had electrical service, water and septic, but this has since all been shut down. Vacated about seven years ago, the house is now used for storage by the region, is in poor condition and is on the agency demolition list. As the timing of demolition is unknown, park staff plans on repainting the building in 2014 to make it less of a potentially attractive nuisance.


Hadley House (DCR)

A well maintained, detached two car garage in good condition is located just south of the Hadley House. Built c1960, the side gabled garage has a concrete slab foundation, clapboard walls and an asphalt shingle roof. A gutter is located on the front wall, but not the rear wall of the garage.

Park staff currently use this garage for snowmobile storage, and do not plan to demolish the building.

Anderson Barn. Located at 360 Curve Street, this one-and-one-half-story, side gabled 19th century barn has a fieldstone foundation, clapboard walls and an asphalt shingle roof. The primary façade has a pair of adjoining entrances, located slightly off center. One is composed of a set of double doors that swing inward; directly next to it is a small entrance that has an intact sliding door that is affixed to the exterior. Built into a bank, an on grade entrance to the basement level is visible on the west side façade, but not accessible due to vegetative overgrowth. Six-over-six, double-hung sash windows are present on the side and rear walls of the building. This barn has several architectural details not always present in such a utilitarian structure, including: corner boards, a full cornice that wraps the building, an overhanging eave, decorative gable end treatments, and wide and flat trim around the windows that includes a small projecting cornice.

The building is in fair condition. Paint is failing on the wall, and some small holes have been addressed by stapling mesh wire over them to prevent access by rodents. Interior evidence suggests some recent insect damage. Lichen is starting to grow on the roof and vegetation is encroaching on the side and rear façades of the building.

This building has electrical service, and is currently utilized for storage by the regional office (including IT equipment and former exhibit materials), as well as the regional foresters and fire control. It abuts private property and is across the street from another private property that maintains horses on site.


Anderson Barn (DCR)

Vacant Buildings

Duck Coop. Located just to the east of the Main Farm House, the Duck Coop is a small shed roofed outbuilding built into a bank, with the lower level providing access to a low, poorly drained area that used to function as a seasonal pond. The building has a concrete foundation, clapboard walls and an asphalt shingle roof.

Moss and lichen are present on the roof, and the foundation has been compromised by the roots of the directly abutting trees. Due to the foundation damage, this building is in poor condition.


Duck Coop (DCR)

Farnham Smith's Cabin. This cross-gabled, L-shaped, single-story cabin was built by Farnham Smith in 1939 as a summer retreat, prior to his establishment of Great Brook Farm. Located adjacent to the Adams Mill site, the cabin provided him with a private spot on a small pond.

Built partially on stone and concrete piers and partially on a fieldstone foundation, the building has a shed roofed front porch and a centrally located

rubblestone chimney. Although at first glance it appears to be a log cabin, the building is actually a wood frame building with half round logs that have been applied as exterior sheathing. Since they are not structural, the log ends are mitered at the corners. Exposed rafter tails complete the rustic look. The building was wired for electrical and phone service, and was also outfitted with a security system by Smith (none of these services are currently live).

The cedar shake roofing has deteriorated to the point where there are a several holes in the roof, coupled with minor vegetation growth. At least one interim repair effort involving tar paper occurred, possibly covering an earlier hole. The porch steps are deteriorating as well. The building is in poor condition.

In the sale of the property, Farnham Smith negotiated use of the log cabin for an additional eight years. After use reverted to the DCR, the cabin was periodically rented out for day use, primarily for corporate retreats. It was then briefly utilized as staff housing in the early 1990s. The building had electrical service, an alarm system, as well as water and a septic that passed a Title V inspection in 1998. The windows are now boarded over, the door is locked, and the building is posted with "No Trespassing" signs.

Farnham Smith's Cabin (DCR)

Farnham Smith's Cabin Shed. A small, one-by-one bay front gabled shed is located adjacent to Farnham Smith's Cabin. Sheathed in cedar shingles, the shed is built on piers, has a tar paper roof, and is in good condition. Park staff does not have a key and do not use the space. Materials stored within the shed appear to date to use of the property by the former resident. A small open lean-to, probably used for protecting firewood, is located directly in front of this shed.

Cabin Shed and Lean-to (DCR)

Boat House. A small, one-story, three-by-one bay front gabled building located on the southwest end of Meadow Pond, the Boat House has a full-width front porch and rear addition. Built on a concrete block foundation, the building has drop board siding and an asphalt shingle roof.

The Boat House, unused since the early 1970s, is currently in extremely poor condition and considered to be in a state of critical failure. It has been posted with "No Trespassing" signs and is marked off with snow fencing to discourage people from exploring the site. Chunks of siding are missing, portions of the roof are caving in, and a section of sill appears to no longer exist.

The building is slated for demolition. As per a Memorandum of Agreement with Massachusetts Historical Commission, documentation on an MHC inventory form is underway.

Boat House (DCR)

The ***District 6 Fire Control Office***, historically known as the South House, is located at 841 Lowell Street. This c1950 traditional Cape Cod style former residence is a one-and-one-half story, side gabled, three-by-two bay building. The house has a concrete block foundation, a clapboard exterior, and an

asphalt shingle roof. The front slope of the roof was replaced in the recent past with architectural style shingles; the rear slope has standard three-tab style shingles.

Two front gabled dormers punctuate the roof line and a single story breezeway connects the main block to a two car garage. Windows are six-over-six and eight-over-twelve double hung wooden sash. A brick chimney pierces the front slope of the roof, slightly off-center.

The exterior siding has some holes, and other minor deterioration, and the paint job is failing. There may be some foundation sill issues and several window sills are deteriorating. The building no longer has gutters and as one result, the front fascia board is deteriorating. The basement has water issues, as evidenced by the pipe leading out from a basement window that connects to a sump pump inside.

This building was utilized as the District 6 Fire Control Office and also housed some regional staff until 2010, when those operations relocated to the new, large garage and office built on site to the rear of this building. (See the Infrastructure section for more information.) At that time, the septic system for this building was retrofitted and re-permitted for use by the new building. The water has been turned off, but the electrical service is still connected to power the sump pump. This house is in poor condition, and is on the agency demolition list.

District 6 Fire Control Office (DCR)

The ***Manseau House***, historically known as the West Farm, is located at 1112 Lowell Street. This three-by-two bay, two-story, central entrance home with a hipped roof, reflects a plan that was popular in the first quarter of the 20thc. A hipped roof entry porch with some scrollwork adorns the façade, and a small single story shed roofed addition has been added to the rear entrance. The home has a fieldstone foundation, late stage aluminum siding, and an asphalt shingle roof. There are no gutters.

Two brick chimneys are present: an exterior one on the south façade and an internal one that pierces the north slope of the roof. Windows are primarily two-over-two double hung sash. Historic photos show a central hipped roof dormer, removed sometime after 1973.

English ivy, growing up the south side and rear walls, appears to have infiltrated the interior of the home. The internal chimney is leaning and the rear entry porch is collapsing.

Most recently, the Manseau House had been in use by regional fire control as storage until about 2008, and prior to that as staff housing. The building had electrical service, water and septic. Vacated by the last residents approximately 10 years ago, the house is in poor condition and is on the agency demolition list.

Manseau House (DCR)

A well maintained, detatched, two car garage in excellent condition is located behind the Manseau House. Built c1960, the hipped roof garage has a concrete slab foundation, clapboard walls that have recently been repainted, and an asphalt shingle roof.

The fire control staff currently use this garage for vehicle and other storage, and there are no plans to demolish this building.

North Farm House and Barn. Located at 107 Old North Road, this well maintained, one-and-one-half-story, cross gabled, five-by-three bay home has a fieldstone foundation, clapboard sheathing and an asphalt shingle roof. The house has two brick chimneys – an exterior one on the south façade and an interior one in the north end of the building. Windows are six-over-six double hung sash. The building is situated on a small rise with nice views of the fields to the south and the barn to the east.

Extensively renovated and added onto in 1961, it appears this was originally a Cape Cod style home that had the front gable added to the north half of the front façade.

This home is in excellent condition as it was utilized for staff housing until March 2014, when it was vacated as part of the discontinuance of the staff housing program. The building has electrical service, water and septic. There are no current plans for its future use, but park staff would like the house to be reused in some capacity, especially since it is located on the edge of the park property. Neighbors have already expressed concerns to park staff, and are worried about vandalism.

North Farm House (DCR)

The North Farm House Barn, just east of the house, is a one-and-one-half-story barn with a gambrel roof. Built into a small bank, the foundation is poured concrete, the sheathing is dropboard and the roof is covered with asphalt shingles. The windows appear to be fixed wooden sash and exposed rafter tails provide the only adornment. The barn has also been well maintained and is in excellent condition.

The lower level of the barn has been used for park storage for many years, while the tenant utilized the upper level of the barn. Park staff has expressed an interest in using the upper level for additional storage, ideally for equipment that cannot stay in the Hart Barn during the winter, but no decisions have been made. The barn has electrical service.

Structures. There are a number of different historic structures located within the park.

Bridges and Culverts

Along the Woodchuck Trail is a small ***bridge*** that is graced on one corner by a short cobblestone pillar with a concrete cap. The pillar appears to have had electrical service to it at some point, possibly to light the bridge. This bridge, constructed of non-historic wooden decking that rests on historic stone and concrete abutments, spans a small stream bed. The abutments appear to have been originally stone, but partially rebuilt through the addition of concrete. A concrete gate is located about 20 feet upstream from the bridge, probably utilized to create a small impoundment and control water flow.

Small bridge on Woodchuck Trail (DCR)

A ***stone arch bridge*** is located on the Pine Point Loop Trail, just north of the Boat House. This at grade crossing consists of a triple arch stone bridge, composed of dressed granite blocks, with low stone curbing for sidewalls, and an earthen pathway. Round holes are visible in the granite curbing, although their original purpose is unclear. While this spans the outlet of Meadow Pond, water seems to be creating problems at either end of the bridge. Debris is visible on the upstream side of the bridge and little headspace is visible through the arched culverts, suggesting that either the water level of the pond has risen over time, or that the openings may be partially blocked and impeding water flow beneath the bridge at the rate needed.

Stone bridge on Pine Point Loop Trail (DCR)

A small stone and earthen ***causeway***, outfitted with a stone culvert, is located just west of the stone bridge. The culvert is composed of rough dry laid fieldstone.

Farm Structures

Pole Barn. This partially enclosed, side gabled barn is actually a post and beam structure with a corrugated metal roof. Where exterior walls exist, they have board and batten siding. Vegetation is encroaching upon the rear (northern) façade of the building.

Pole Barn (DCR)

Bunk Feeder. The Bunk Feeder, an open air pavilion, provides shade for the farmers' cows and is a space used for feeding. This wood frame building has a corrugated metal roof that appears to have some minor damage, including small spots of corrosion.

Bunk Feeder (DCR)

Both the Pole Barn and the Bunk Feeder were constructed during Smith's ownership of the property, and are currently used for Heifers of breeding age. Both structures are in good condition.

Metal Stave Silo. This silo, one of two on the property, is located between the Pole Barn and the Bunk Feeder. It appears to be in good condition, but it is no longer used for silage.

Metal Stave Silo (DCR)

A few additional small farm structures of indeterminate age are located in the core farm area, most notably a chicken coop and a pig shed.

Other Structures

Segments of ***stone walls*** can be seen in many areas throughout the park, both within the woods as well as alongside some of the roadways. These walls, predominantly dry laid loose rubble, vary in condition from failing to being in good condition. These walls show how this land was used and divided over the past three centuries.

A section of ***concrete retaining wall***, poured in stages, is located on the south side of North Road, across the street from the Main Farm House. The function of this retaining wall is not entirely clear. It is almost entirely covered in moss.

A free standing ***stone and brick hearth***, designed for outdoor grilling, is located just south of the Adams Mill remnants, not far from Farnham Smith's Cabin. Designed with two levels for cooking, it has a full chimney to direct smoke away from the cook. The hearth likely dates to Smith's development of this piece of property as his cabin retreat.


Outdoor Stone and Brick Hearth (DCR)

Located outside of Great Brook Farm, proper, is a fire tower, ***Massachusetts State Tower #21***, also known as the Hollis Wilkins Memorial Tower. Situated on a small (.06 acre) parcel at the peak of Robbin Hill, the property at 30 Summit Avenue in Chelmsford was purchased by the Commonwealth for 50 cents in 1918. First used as a site for fire monitoring purposes in 1911, the 60-foot-tall steel tower is the fourth one on the site, dating from 1939. The current cab dates from 1970.

The tower has also served as a host to a number of pieces of telecommunication equipment since 1978, from ham radio antennae to microwave dish antenna and repeaters for state police to commercial users. The following entities currently have equipment on this tower: Nextel, Massachusetts Department of Transportation, Greater Boston Police Council (GBPC), Massachusetts Port Authority, and the Massachusetts State Police.

A structural analysis of the tower undertaken in July, 2009 indicated the tower is in conformance with the requirements of the TIA/EIA-222-F standard (Structural Steel Standard for Steel Antenna Towers and Supporting Structures) for the current and antenna loading. An analysis completed in April, 2013 using the TIA-222-G-2 standard (Structural Standard for Antenna Supporting Structures and Antennas*)*, a more critical standard, found the tower to be overloaded with the existing and proposed antenna load by the GBPC. However, the GBPC chose not to add the proposed antenna systems due to a lack of funding. When and if they obtain the necessary grant funding to proceed with the project, the GBPC will have to reinforce the tower to meet the TIA-222-G-2 standard and their proposed antenna load.

Objects. There are no historic objects within the park.

Landscapes. There are a range of historic landscapes within Great Brook Farm State Park that showcase the history of Carlisle.

The core of ***Great Brook Farm*** and its adjacent fields to the east and northeast collectively form an historic landscape that conveys the agricultural history of the property, and is documented on MHC inventory form #CAR.A. It is through this collection of historic buildings and structures, the farmyard, the adjacent manmade farm pond, and the immediate surrounding fields that visitors can get a sense of what this place is, and see how dairy farming has evolved through the 20th century and into the 21st. The layout of these buildings and structures, as well as the fenced enclosures, provides pathways for visitors and safe spaces for animals and also help visitors understand how the farmyard functions. While the buildings and structures are described separately, the complex as a whole needs to be considered collectively.

Two other historic landscapes, the ***Adams mill site*** and ***"The City,"*** are discussed above, in the Historic Archaeological Resources section. The individual resources within these areas collectively make up larger historic landscapes, and each individual resource within these two sites needs to be considered within the full context of their larger landscape.

Finally, what appears to be a small unmarked family ***cemetery*** can be found off of the Woodchuck Trail, in the part of the park known as "The City." A series of 11 or 12 small stones are lined up, possibly head and foot stones. While there are no inscriptions, and the stones are not formally shaped, their rectilinear layout suggests they were lined up for this purpose, and may have served the mill village community. Additional research is needed.

During the last few decades, stone features and other landscape elements in the park have been the subject of differing research perspectives. Some of the stone features in the park are interpreted as symbolic and having astronomical alignments, or anthropomorphic details, and some have been designated "prayer seats". The public, independent researchers, historians, and archaeologists have all contributed to literature on the interpretation of the stone features

within the park. The interpreted origins range from Precolumbian European exploration, to Native Americans and farmers. Because of the differing backgrounds, beliefs and agendas, a consensus on the debate has not been reached.

Cemetery (DCR)

Recreation Resources

Great Brook Farm State Park is primarily accessed via motor vehicle, although some local residents and regional cyclists do visit by bicycle. There are no public transit options to reach this park.

The primary recreational activities at Great Brook Farm State Park revolve around its extensive network of trails. This network, encompassing over 26 miles of trails, provides a variety of trail experiences that help make this park a popular destination. From wooded areas, to the edges of open fields, to rocky areas with some hills, to low lying areas along wetlands, visitors are not apt to get bored with the scenery.

The trails are routinely used by walkers and hikers, often accompanied by a dog, and according to park staff, the occasional goat. Despite signs at trailheads informing users of on-leash restrictions, many dogs are off-leash.

This park is a popular destination for mountain biking, in part because the trail system provides a range of experiences that can accommodate riders of all skill levels; mountain bikers range from beginners to experienced riders, and biking occurs throughout the park. When surveying park users about their use of the park for this RMP, the majority of survey respondents (65%) indicated that they have biked here in the past year. Technically challenging sections are concentrated in the Stone Row and Indian Hill areas. Riders explore the park individually, as well as through organized club rides and events, including an annual event organized by the New England Mountain Bike Association (NEMBA) as a part of the Kona Bicycles MTB Adventure Series. Park staff reports that some mountain bikers ride some of these trails after dark, despite the park officially closing at dusk.

The park's trails are also utilized by individuals and clubs for orienteering activities. The New England Orienteering Club has held events at Great Brook Farm State Park for several years, developing courses that are on- and off-trails. Other trail user groups include the Carlisle Trails Committee, the Cambridge Sports Union, and the local school system, which holds high school cross-country races as well as a local history search for third graders within the park.

The cross-country ski concession is very popular during the winter months, and serves as a major draw of visitors to the park. Over 10 miles of machine groomed loop trails are open, when there is enough snow to ski. The ski trails are restricted for use by skiers during the winter. Since 2010, more active efforts have been made by the DCR to keep hikers off of the ski trails to help preserve snow conditions for skiers. Steps taken include: new trail maps showing groomed ski trails; additional directional signage; increased ranger presence during the winter to help with enforcement; and efforts to pack snow down on the trails open for hikers to make them easier to use while walking. The Lantern Loop, lit for nighttime skiing on Tuesday and Thursday evenings, provides visitors with a unique and interesting way to experience the park.

The ice cream stand at the main farm is also a big draw for visitors. Located at the eastern end of the Tie Stall Barn, ice cream is available on a seasonal basis. Approximately 10 picnic tables are located here for sitting and dining and checking out the farm animals. The farmers maintain a number of small farm animals in addition to the dairy cows, including goats, pigs, chickens and rabbits, for viewing in enclosures located adjacent to the Tie Stall Barn.

Equestrian use of the trails is also popular at the park. Complimenting the trail use, a series of cross-country horse jumps are located just off-trail in the section of the park south of North Road, most notably in the open fields to the west of Meadow

Pond. These jumps were constructed by the Old North Bridge Hounds and are comprised of wooden fencing often flanked by overgrown cedars. They are in fair condition. Some visitors complain to park staff (and also evident in the user survey for this RMP) about the frequent presence of horse droppings on the trails.

A canoe launch used to be located at the northern end of Meadow Pond, providing access to this body of water for canoeing and kayaking. This launch was removed in 2009 when a new large bridge was constructed nearby; some park users were unhappy about this outcome. While there has been some discussion of designing and installing a new canoe launch area nearby, this has not yet happened. The abundance of water chestnut growth in the pond also poses an impediment to canoeing and kayaking. As a result, the use of the pond by boaters has decreased significantly in recent years.

Infrastructure

Property Boundary

Great Brook Farm State Park is located in the northern part of the Town of Carlisle, roughly in the middle of the triangle formed by state routes 4, 225 and 27. Easily accessible by car from interstates 495 and 95/128 and state routes 3 and 2, Great Brook Farm State Park is a popular destination park within the greater metro Boston region.

Buildings and Structures

In addition to the historic buildings and structures discussed in the Cultural Resources section, there are a few more recent ones that have been constructed since establishment of the park, the two most prominent being the Nature Center Pavilion and the Smart Barn (see Figure 4).

The Nature Center Pavilion, constructed in 2002, provides a sheltered area under which interpretive programs can be held and visitors can relax at the six picnic tables. This pavilion also includes an enclosed portion that contains restrooms and an office for the seasonal interpreter. The building has electrical service, water and septic.

Nature Center Pavilion (DCR)

Designed to reflect the agricultural history of the park, the cross gabled building features a standing seam metal roof, a bank of clerestory windows in the pavilion to help bring natural light into the sheltered portion, and a gable end detail intended to appear as a haymow.

The Smart Barn, constructed in 2010-2011 and located within the farm complex, is equipped with a DeLaval robotic milking system to support the dairy farm operations. This robotic system is touted as the first one to be installed in Massachusetts. The barn, a cross gabled building with a standing seam metal roof, vertical board siding and a clerestory, evokes the history of the farm and blends nicely with the nearby historic barns. The building has electrical service, water and septic.

Smart Barn (DCR)

Also in line with evolving agricultural practices, the silage for the cows is no longer kept in the tall vertical silos, still found on the property. Rather it is stored in a large trench silo, an open trench with large concrete block retaining walls on three sides and a central divider, to facilitate loading and unloading by heavy equipment.

The District 6 Fire Control Office and Garage is located at 841 Lowell Street. It does not have a very

visible presence, as it is set back from the road, behind the vacant Cape Cod house, and is not open to the general public. A non-descript, tall, front gabled building with corrugated metal siding and a standing seam metal roof was constructed in 2010 to house vehicles and equipment utilized for regional fire control purposes. The building has electrical service, water and septic.

There are several non-historic bridges in the park, facilitating trail connections over wet areas and streams. (For a review of historic bridges, see the Cultural Resources section.) The northernmost bridge, noted on the park's trail map, is located near the intersection of Woodchuck Trail and East Farm Trail and crosses River Meadow Brook. This is a wide bridge, to accommodate park vehicles if needed, constructed of preformed concrete abutments and wooden decking.

Two wooden pedestrian bridges are located over the sluiceways at the Adams mill site, located near Farnham Smith's Cabin.

The largest bridge is located next to the parking area at the Pine Point Trail Loop. It is a wide bridge with a metal truss and wooden decking, sturdy enough to accommodate vehicular traffic. Installed in 2009, this bridge provides a connection to the other end of the loop so that trail users can avoid walking on North Road. As a part of the network of groomed ski trails, this safe connection is also important to skiers.

Non-historic culverts can also be found within the park, in an effort to control water flow. Near the northern intersection of the Woodchuck Trail and Garrison Loop is a concrete culvert, bridged by wooden decking on the trail. This culvert, equipped with a small gate controlled by wood boards to control water flow, has been outfitted with a beaver deceiver. A lot of brush debris has collected around the deceiver and the wetland itself has a lot of vegetation.

A culvert at the intersection of Woodchuck Trail and Garrison Loop. (DCR)

Two other smaller pipe culverts can be found along the Woodchuck Trail.

The last category of non-historic structures is a collection of three rock shelters located in the northern portion of the park, off of the Stone Row trail. These three shelters, one with a functioning chimney, are composed of dry laid fieldstone constructed around an existing glacial outcrop, with makeshift roofing composed of branches.

Rock Shelter (DCR)

Due to local lore suggesting that these may have past and present Native American associations, one of these rock shelters was investigated during the 1995 archaeological survey of the park (Dwyer 1995). After a walk over of the site with local Native American representatives, as well as subsurface testing within one of the shelters, it was determined at that time that these are not affiliated with past or present Native American use of this land.

Park staff indicates that these shelters have been created since the development of the property as the state park. The structures reportedly began as the work of a local park user, a mason that was interested in modern druid culture, and have since been altered, rebuilt, or new ones created by others. According to long time park staff, these have only been in place for approximately the last 25 years.

Roads

Curve Street, Lowell Street and North Road are all town-owned, locally designated scenic roads (see Figure 4). These roads provide access to Great Brook Farm State Park. While these roads are not owned by the park, impacts to any stone walls or trees on DCR land that fall in the right of way of these roads must be first seek the written consent of the Carlisle Planning Board.

Parking

The main parking area for the park, located off of North Road, provides easy access to the Nature Center Pavilion, the farm and the ice cream stand (see Figure 4). This paved lot accommodates over 80 vehicles, and has two spots allocated for handicapped parking. A parking fee of $2.00 is charged seasonally (April 1st – December 1st) via a pay and display machine located on site. This parking lot contains over 20 signs, 12 of which concern parking and the use of the pay and display machine. Some of these signs are official looking, while others are laminated paper.

Adjacent to this parking lot is a low impact rain garden that the DCR installed in 2010. The garden is planted with native flowers and shrubs, and it catches and filters the water run-off from the parking lot and the Nature Center Pavillion.

A paved parking lot is also located at the North Schoolhouse that now serves as the Park Headquarters (see Figure 4). This parking area, which primarily serves park staff, is also available for public use. The lot can accommodate approximately seven vehicles and it has one spot that is demarcated for handicapped parking.

A small parking area is located off of North Road at the trail head for Pine Point Loop, adjacent to the former canoe launch location (see Figure 4). This unpaved lot holds four to six vehicles. This location also has a lot of signage and includes four separate signs that address parking and are clustered in one area. None of these signs utilize the actual name of the park.

Signage at the Pine Point Loop parking area. (DCR)

Another small, unpaved lot is located at the intersection of Lowell Street and North Road, and can accommodate parking for approximately four vehicles (see Figure 4). This area is needed for large vehicle turnaround purposes rather than parking, but it is not signed as such.

Parking is also available in the former field directly adjacent to the Hart Barn, and serves the cross-country ski concession (see Figure 4). This unpaved lot can accommodate approximately 120 vehicles. A parking fee of $2.00 is charged seasonally (April 1st – December 1st) via a pay and display machine located on site.

Trails

Great Brook Farm State Park has an extensive and well utilized trail network spread over its 929 acres. This network includes a little over 24 miles of official trails (see Figure 4) and almost two miles worth of additional, unofficial trails.

Of the network of official trails, 0.5 miles are administrative roads, including the entrance to the District 6 Fire Control Office and Garage, as well as the roads within the farm complex. Unpaved forest roads make up 11.5 miles of the network and the remaining 12 miles are trails.

A survey of the trail network within Great Brook Farm State Park was undertaken in 2010. At that time, 19.4 miles were deemed to be in good condition, 4.6 miles were in fair condition, and only 0.3 miles were in poor condition, a fairly low percentage (1.5%) than is typical in other DCR properties, possibly reflecting the presence of the cross-country concession and their use of the trails

and the strong volunteer participation in trail construction and maintenance by the mountain biking community. This survey does not reflect the condition of those trails that were subjected to extensive flooding while conducting fieldwork for this RMP. Some of the trails around Meadow Pond in particular were impassable due to flooding, interrupting the trail network in this area.

A series of short boardwalks are placed throughout the trail system, where necessary, for erosion control or wetland and stream crossings. Some of these structures are in good condition, while others are aging.

Great Brook Farm State Park is unique within the DCR system, as it separates trail users during the winter season. During the winter, 10.5 miles of trails in the eastern section of the park are set aside for the exclusive use of cross-country skiers (Johnstone 2014). These trails are groomed to facilitate use by skiers and all other users are encouraged to use the remaining trails that are open to multi-purpose use, most of which are located on the western side of the park. Some trails in the eastern section of the park are closed to all uses during the winter season, if they connect to the groomed trails, but are not groomed for use by skiers. This practice has helped to reduce user conflicts and maintain a high quality network of groomed trails for use by skiers.

Two trail maps have been developed for Great Brook Farm State Park; one is for summer use, while the other shows the separation of trail uses during the winter. These trail maps are available on the park's webpage, on the DCR's website, as well as at the Hart Barn (during the winter) and in the Park Headquarters at the North Schoolhouse. The Great Brook Ski Touring Center also has a map of the trails set aside for use by skiers available on their website.

Signs and Kiosks

There is one Road Marker Sign that leads visitors to the state park, located in the center of Carlisle. There is one Main Identification Sign for the state park, located at the intersection of North and Lowell roads. The orientation, material and design of this sign meets DCR signage standards (DCR n.d.). The sign is surrounded by ornamental plantings that are starting to get tall enough to obscure the bottom of the sign.

There are two informational kiosks located at the park; one is located at the eastern end of Hart Barn parking area, and the other is located within the farm complex.

Informational signage is also located within the Nature Center Pavilion, where a glass enclosed bulletin board is located on one wall, next to a wildlife sighting white board for use by visitors.

Additional interpretive signage is also located within the Smart Barn, informing visitors about the robotic milking system.

A routed wooden sign, now partially broken, marks the site of the Garrison House.

In the user survey undertaken for this RMP, several individuals suggested that better trail signage is needed.

Memorials and Markers

There is one memorial within the park, dedicated to Prospera, a prized cow of Farnham Smith's. Prospera was a champion Holstein heifer, who routinely won prizes from the Holstein-Friesien Association for her level of milk production. She is buried at the entrance to the farm, just off of North Road, and the spot is marked by a stone with a brass plaque that has raised lettering:

PROSPERA
1949 – 1969

5.4. Management Resources and Practices

See Section 2, Management Resources and Practices, for a description of the management resources and practices that apply to the entire Lowell/Great Brook Planning Unit.

Natural Resources

Water Resources

Drinking Water. The Transient Non-community Ground Water Sources (TNCs) within the park are tested under contract by WhiteWater Environmental Inc., a Massachusetts certified operator. These systems are operated in accordance with applicable regulations (310 CMR 22; Appendix F).

Massachusetts' regulations require a circular protective area around public water supply wells, including TNCs. The radius of this protective area, known as a Zone I, is based on the well's pumping

rate. The DEP requires that activities within Zone I be limited to those directly related to the provision of water. Best Management Practices (BMPs) for protecting Zone I areas include the following (DEP 2001):

- Keep out non-water supply activities.
- Do not establish parking areas.
- Do not store or use lawn chemicals, road salt/deicers, motor oil, gasoline or paints.
- Remove or relocate underground storage tanks, hazardous materials, and septic systems, if possible.
- Use propane or natural gas powered pumps.
- Seal floor drains.
- Properly label, store, and dispose of hazardous substances.
- Restrict access to the well and post water supply protection signs.

These are recommendations, and not requirements.

Vegetation

As part of the long-term lease agreement with the farmers, there are 16 separate fields, totaling 74 acres that are actively managed for agricultural purposes.

Wildlife

A population of beavers has been present in Great Brook Farm State Park for several years, and their dam building and culvert blocking activities effect water levels, impacting the surrounding trail system. The current approach to beaver management includes the installation of beaver deceivers at some of the culverts where there has been a lot of beaver activity, along with beaver trapping by a wildlife contractor through the DCR's Lake and Ponds Program. The wildlife contractor is used at least annually, and makes the final assessment on which approach will be most effective to address the problems on hand.

Great Brook Farm State Park has been included in a statewide Cerceris wasp monitoring project that started in 2010. The Cerecreis wasp is a non-stinging wasp that makes nests in sandy soils and prey on Buprestid beetles, a family of beetles that includes the Emerald Ash Borer (EAB). Monitors examine what kinds of beetles the wasps are bringing back to their nests as one method of potential early detection of EAB. The data is currently very limited, but EAB has not been detected in the nests of the population here.

Cultural Resources

The Litchfield House is under lease with the DCR and is being rehabilitated, occupied and maintained as a single family residence by Darrold and Janet Fritz-Endres through the DCR's Historic Curatorship Program. Through the program, outside partners are selected through an open and competitive proposal process to help the DCR preserve some of its vacant and dilapidated historic properties in exchange for a long-term lease. The current tenants signed a twenty-five year lease in 1996, have rehabilitated the house and grounds, and are in the final stages of restoring the historic barn. The curator's responsibilities for the property include the complete rehabilitation of the house and its systems, management of its reuse (including all utility and insurance costs), and all maintenance responsibilities for the house and surrounding 1.08 acres.

The Hounds House has been under lease to Old North Bridge Hounds since 1994. This lease was established by legislation (Chapter 424, S-1234, 1993), and there have been two subsequent lease clarifications between the Department and the lessees, in 2002 and 2007. As part of the 2007 clarification, the lessee agreed to pay the DCR $550 per month and to perform capital repairs on the buildings and grounds at 649 North Road. This lease expired on December 31, 2013; the business owners would like a new lease. While this issue is pending resolution, the lessees are continuing to pay their monthly rental fees to the agency.

Great Brook Farm itself has been leased to Mark and Tammy Duffy since 1987. The original lease, ten years in length, was extended first in 1997, and again in 2007, and next expires on April 30, 2017. The lease was amended in July, 2011 to include language covering the Smart Barn, and establish ownership and maintenance responsibilities, as well as to bring some other language up to date, including insurance provisions. Their lease area consists of 90 acres, including the farm complex, farm buildings several fields and the cranberry bog. As part of the lease agreement, the farmers pay two percent of their gross retail on a quarterly basis to the DCR. Stipulations include the provision of some public

access in selected areas of the farm during park hours, and maintaining building interiors and equipment.

Recreation Resources

The Hart Barn has been utilized as the cross-country ski concession since the 1977-1978 ski season, when a pilot program began with North Country Outfitters. Great Brook Ski Touring Center has been operating under a series of permit agreements with the same family since the 1982-1983 ski season. The operators groom the designated ski trails and provide lighting on some of the trails during the ski season for nighttime skiing. The current permit for this operation runs through the 2017-2018 ski season.

For the equestrian features within the park, the DCR mows the fields where the equestrian jumps are located; the Old North Bridge Hounds constructed these equestrian jumps and maintain them.

Infrastructure

Multiple buildings and structures are managed by outside lease holders (see Cultural Resources, above, for more information). Management responsibilities for these resources are stipulated in their lease agreements. Since these resources are predominantly historic, they must also coordinate their efforts in consultation with the DCR's Office of Cultural Resources.

Interpretive Services

A Comprehensive Interpretive Plan was drafted in 2011 for Great Brook Farm State Park by the DCR's Interpretive Services staff. Due to staff workload issues, this plan has not yet been finalized.

The Nature Center Pavilion serves as the home base area for interpretive services. Tours revolve primarily around the farm complex, and currently emphasize the workings of the dairy farm and the technological aspects of the Smart Barn. Tours run on weekends from Memorial Day through Columbus Day.

A Seasonal Interpreter is on site from mid-April through mid-October, providing guided tours of the farm complex, conducting junior ranger and nature programs, guiding school groups, and assisting with the planning and implementation of two major events, Picnic on the Farm, held the first Sunday in June, and Down on the Farm, held the last Sunday of September.

Great Brook Farm State Park is a participant in the Park Passport Program; the passport box is located within the Nature Center Pavilion.

Operational Resources

Supplemental Staffing

Mark and Tamma Duffy operate and staff the agricultural business at the park as part of the terms of their long-term lease agreement. The farm is a key attraction of the park, and the farmers maintain their lease areas so that the public can access much of it.

The park occasionally gets the assistance of a crew of volunteers from the Student Conservation Association (SCA) for specific trail-related projects. In the summer of 2013, the group did work on the Acorn Trail that will be continued in the summer of 2014.

Members of the Merrimack Valley Chapter of the New England Mountain Bike Association (MV-NEMBA) also volunteer at the park, and have been involved with trail construction within the park, as well as the purchase, construction and installation of boardwalks.

Given the wide range of opportunities this park presents to visitors, the many active user groups and the network of local and regional conservation organizations, the potential exists for the reformation of a Friends of Great Brook Farm State Park and their involvement in activities at the park.

Public Safety

DCR Rangers issue citations for violations of various forest and park rules. A summary of incident reports recorded in the state park during 2013 is provided below.

Table 5.4. Great Brook Farm State Park Incident Reports, January 1 through December 31, 2013

Incident	Number
Violation of DCR regulations[a]	3
Suspicious activity	1
Total	*4*

a. These violations were related to after hours use of the park and dogs not under control.

A large eastern white pine tree at Carlisle State Forest. (DCR)

SECTION 6. CARLISLE STATE FOREST

6.1. INTRODUCTION

Carlisle State Forest is the second smallest facility in the Lowell/Great Brook Planning Unit. Covering 25 acres, this property is tucked behind some relatively recent residential development (a subdivision known as Tall Pines), west of Hutchins Road. Access to the property is provided by Forest Park Drive on the south and Barnes Place on the north. Town owned conservation land and property owned by the Carlisle Conservation Foundation, a local land trust, abuts the property to the west.

6.2. HISTORY OF PROPERTY

In November of 1901, prominent landscape architect Warren Manning learned that a collection of about 100 very large eastern white pine were about to be harvested for lumber. Concerned about preserving this collection, he obtained a stay of proceedings and secured an option on the property, and convinced his fellow members of the executive committee of the Massachusetts Forestry Association to raise the funds to purchase the property.

Working in partnership with the Appalachian Mountain Club (AMC), $1,600 was raised through subscriptions by early 1902 to purchase approximately nine acres, with some excess funds collected going towards the AMC, which had agreed to serve as the property owner (Massachusetts Forestry Association, 1902*a* and 1902*b*).

Warren Manning at the Carlisle Pines. (Iowa State University Library Special Collections)

The AMC laid out trails and posted markers, and also selectively thinned some hardwoods on the property in order to showcase the large pines, improve growing conditions, and control gypsy moths (Goodall 1970; Shepard 1913). In 1912, the AMC expanded the reservation through the purchase of approximately 10 additional acres, and increasing

the collection of very large eastern white pine to approximately 150.

In 1934, the AMC sold the Commonwealth the Carlisle Pines and two other AMC reservations in Billerica and Warwick, with the stipulation that if these properties are no longer to be used as state forests, ownership would revert back to the AMC. Following transfer of the property to the Commonwealth, some small red pine plantations, as well as some additional white pine and Norway spruce were planted. The Hurricane of 1938 caused significant damage, knocking down all but 28 of the large eastern white pines, and after the Hurricane of 1954, further pines were lost. By 1980, there were only 14 of the large eastern white pines still standing (Stoddard 1980).

6.3. EXISTING CONDITIONS

Natural Resources

Physical Features

Topography. Carlisle State Forest is located between two ridges, and has relatively level to gently rolling terrain.

Geology. Carlisle State Forest falls within the Nashoba Terrane, formed of plutonic and metamorphic rocks including metamorphosed volcanic rock rich in biotite and hornblende. Surficial glacial deposits are found in the forest (Skehan 2001).

Soils. The soil of Carlisle State Forest consists primarily of Charlton-Hollis-Rock outcrop complex, which is a combination of soils and exposed bedrock encompassing about 50% Charlton soils, 25% Hollis soils, 15% rock outcrop and 10% other soils (Peragallo 2009). Found in upland areas, the Charlton soils can be found on toe slopes, while the Hollis soils are on hilltops and ridges. There are only slight limitations when it comes to potential trail and path development, with moderate limitations in areas where slope exceeds 15%. The Hollis soils are shallow and raise the risk of blown down trees, which could impact the forest. The Deerfield loamy sand, a very deep soil type, can be found on glacial stream terraces and deltas. These soils present moderate limitations to trail and path development due to its sandy composition (Peragallo 2009).

Table 6.1. Soils of Carlisle State Forest

Soil Series	% of Forest	Drainage Class
Charlton-Hollis-Rock outcrop complex	74.0	Well drained to somewhat excessively drained
Deerfield loamy sand	18.9	Moderately well drained
Swansea muck	5.6	Very poorly drained
Whitman fine sandy loam	1.3	Very poorly drained
Scarboro mucky fine sandy loam	0.2	Very poorly drained

Water Resources

Ponds. There are no ponds within the forest.

Wetlands. There are two small wooded swamp areas in Carlisle State Forest (see Figure 5). On the western edge of the property is a 0.4 acre wooded swamp composed of deciduous trees. On the southern edge of the property is a 0.6 acre wooded swamp composed of mixed trees.

Vernal Pools. There are no vernal pools within the forest.

Streams. There are no streams within the forest.

Groundwater. There are no aquifers beneath the forest.

Flood Zones. A very small sliver of the western most corner of the forest, 0.05 acres of property, falls within the 500-year flood zone.

Rare Species

There have been no rare species recorded in the forest.

Vegetation

Forest Types. Carlisle State Forest exists today due to an effort led by Warren Manning to protect an impressive stand of 200+ year old, very large eastern white pine from being logged in 1901. At the time, there were approximately 150 large, mature growth white pine; the hurricanes of both 1938 and 1954 took a serious toll on this stand and by 1980 only 14 remained (Stoddard 1980). DCR Forestry staff recently noted that more have since come down. Known historically (and locally) as the Carlisle Pines, Carlisle State Forest includes a stand of white

Placeholder for Figure 5.

Pine, some hemlock, and a small, centrally located plantation of red pine.

In 2003, the James W. Sewall Company developed a forest inventory/land cover classification dataset for the state forests and parks. The dataset is primarily based on the interpretation of infrared aerial photography, a process that identified four forest sub-types within Carlisle State Forest (Table 6.2). Some large eastern hemlock that appear to be old was also identified here during the RMP fieldwork, some of which appear to have been impacted by Hemlock Woody Adelgid.

There are no Continuous Forest Inventory (CFI) plots within Carlisle State Forest.

Table 6.2. Forest Sub-types of Carlisle State Forest

Forest Sub-type	Acres	% of Forest
Eastern white pine	10.0	40.0
Mixed oak	7.3	29.2
Eastern white pine – oak	3.0	12.0
Red pine plantation	0.6	2.4
Total	*20.9*[a]	*83.6*

a. The difference in total acreage is due to the exclusion of wetlands and areas of open water, as well as changes in the forest's boundaries since 2003.

Priority Natural Communities. There are no Priority Natural Communities within the forest.

Invasive Species. Common buckthorn (*Rhamnus cathartica*), a deciduous small tree or coarse shrub, threatens wetlands and field edges, where it can suppress other species. It has been observed in the southern portion of this forest in the past. Common buckthorn is often spread by seed dispersal through birds.

Pests and Disease. Hemlock woolly adelgid is present in the Eastern hemlock trees on this site. No other information has been located to date on pests and disease at Carlisle State Forest.

Wildlife

Birds. There is little current information on the forest's birds. Over 175 species that have been identified in some of the other properties in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.1.

Mammals. There is little current information on the forest's mammals. Over 45 species that have been identified in some of the other properties in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.2.

Reptiles. There is little current information on the forest's reptiles. Over 15 species that have been identified in some of the other properties in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.3.

Amphibians. There is little current information on the forest's amphibians. Over 15 species that have been identified in some of the other properties in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.4.

Fish. There is no current information on the forest's fish.

Cultural Resources

Pre-Contact Archaeological Sites

There are no recorded pre-Contact sites in the Carlisle State Forest, and the forest has not been subject to an archaeological survey. The physical characteristics, regional setting, and the known patterns of pre-Contact occupation in the region all confer a high archaeological potential for the forest.

Historic Archaeological Resources

There are no recorded historic archaeological sites in the Carlisle State Forest, and the forest has not been subject to an archaeological survey.

Historic Resources

Buildings. There are no historic buildings within the forest.

Structures. A dry laid stone wall lines much of the eastern boundary of Carlisle State Forest. A segment of another dry laid stone wall is centrally located on the west side of the property, and runs east to west. Constructed of glacial till, these walls are in fair to poor condition.

A stone wall in Carlisle State Forest, with a granite boundary marker in the foreground. (DCR)

Objects. A small granite boundary marker was identified next to the stone wall that lines the eastern boundary, near the Forest Park Drive entrance.

Landscapes. The stand of very old and large eastern white pines that are located in the northwest section of the property inspired the protection of this land, and the creation of the state forest. These natural resources have not only catalyzed the protection of this land, but are the primary draw for visitors to this small parcel and have become a part of its history.

Recreation Resources

Carlisle State Forest is primarily accessed via motor vehicle or on foot by local residents. Individuals who live nearby may walk or ride their bicycle to one of the two trailheads. There are no public transit options to reach this forest.

Recreation resources are limited to a network of 0.7 miles of trails through Carlisle State Forest. These trails are used primarily for hiking, as well as some dog walking, mountain biking, horseback riding, snowshoeing and cross-country skiing.

There is one known geocache located here as of October 2013.

Infrastructure

Property Boundary

Carlisle State Forest is a 25 acre undeveloped property in the northwest section of Carlisle, located west of Curve Street and north of Westford Road /Route 225. Town owned conservation land and property owned by the Carlisle Conservation Foundation, a local land trust, abuts the property to the west. Much of the eastern boundary is marked by a stone wall.

Buildings and Structures

There are no buildings or structures in the forest.

Roads

There are no roads in the forest.

Parking

There is no parking at Carlisle State Forest. At the end of Barnes Place, there is one unpaved parking space; it appears to be located on the abutting Town of Carlisle conservation land. Neighbors do express occasional frustration with the lack of parking in the area.

Trails

There are approximately 0.7 miles of well maintained trails in Carlisle State Forest. This network was mapped and assessed in 2009, and determined to be in good condition.

A trail map has not been created for Carlisle State Forest, and there is no information on the DCR website for the forest or its network of trails.

Signs and Kiosks

There are no Lead-in or Main Identification signs for Carlisle State Forest. The remnants of a wooden sign stanchion are located just off trail at the Forest Park Drive entrance. The only indications that this is state property are some boundary markers, found mostly at the southern edge of the property.

The former entrance sign stanchion. (DCR)

There are no informational kiosks at Carlisle State Forest.

Memorials and Markers

There are no memorials or markers in the forest.

6.4. Management Resources and Practices

See Section 2, Management Resources and Practices, for a description of the management resources and practices that apply to the entire Lowell/Great Brook Planning Unit.

Natural Resources

Vegetation

The DCR's forestry staff has periodically undertaken inventory of the remaining large eastern white pines, recording measurements. However, the most recent inventory was completed in 1980 (Stoddard 1980).

Wildlife

The DCR does not actively manage wildlife at Carlisle State Forest.

Cultural Resources

There are no cultural resource management activities that are unique to this state forest.

Recreation Resources

With the exception of keeping the small network of trails clear and usable, there are no other recreational resources in need of active management at this forest.

Infrastructure

With the exception of the small network of trails, there is no other infrastructure at this park to manage.

Interpretive Services

Interpretive service programs are not offered at Carlisle State Forest, nor is any other interpretive information provided.

Operational Resources

DCR Staffing

Carlisle State Forest does not have any full or part-time DCR staff on site.

Supplemental Staffing

The Carlisle Trails Committee has, in the recent past, completed volunteer trail clean ups on the trails at Carlisle State Forest, in conjunction with their work at the abutting town conservation lands.

A fitness trail through a white pine plantation at Warren Manning State Forest. (DCR)

SECTION 7. WARREN H. MANNING STATE FOREST

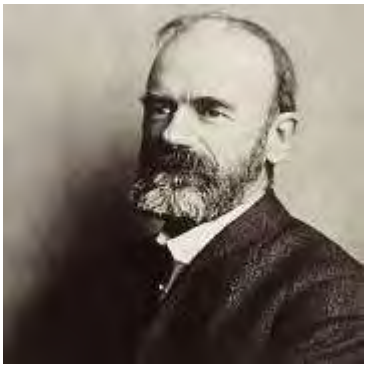
7.1. INTRODUCTION

Warren H. Manning State Forest, named for influential landscape architect Warren H. Manning (1860 – 1938), is a 183-acre property located in the northwest part of Billerica. The forest is located predominantly on the east side of Route 3, and is bisected by Chelmsford Road/Route 129 into two distinctly separate sections: a developed northern section and an undeveloped southern section (see Figure 6).

The forest includes a system of trails throughout the property, utilized mostly by local residents, as well as a picnic area, fitness trail and a small spray deck in the developed, northern section of the forest. The Billerica Recreation Department staffs the spray deck and manages the parking lot and bathhouse.

7.2. HISTORY OF PROPERTY

The area that is now Warren H. Manning State Forest is located in a part of Billerica that was not heavily settled through the 17th, 18th and most of the 19th centuries (MHC 1980*e*). One of the few settlers in this area was Samuel Manning, who built the Manning Manse, located at 56 Chelmsford Road/Route 129, in 1696. The ancestral home of Warren H. Manning, the Manning Manse was empty and in need of preservation when Manning moved to Billerica in 1895. A landscape architect who began working in his family's nursery business in Reading, MA, amassing an extensive horticultural background, Manning then honed his design skills in the Olmsted firm until branching out on his own in 1896. Manning was a founding member of the American Society of Landscape Architects in 1899, and pioneered a system of resource-based planning.



Warren Manning (The Cultural Landscape Foundation)

Placeholder for Figure 6.

After 1900, Manning began to acquire land in close proximity to the Manning Manse. In 1915, Manning moved his practice to Billerica, ultimately operating out of an octagonally-shaped office that was constructed in 1917 on the north side of Chelmsford Road (no longer extant). In 1923, Manning moved his practice to Cambridge when access to Boston and Lowell from Billerica became impossible via public transit.

Manning was very active in Billerica town affairs, and his efforts included promoting the creation of public woodlands in town, with a particular focus on developing a town forest system in Billerica. Manning developed the Billerica Town Forest Plan in the mid-1920s and it was accepted by the town in 1926. In 1934, Manning sold approximately 140 acres of his property surrounding the Manse to the Commonwealth, for the purpose of establishing a state forest, at a rate of $5.00 per acre (Manning n.d.). This property included Manning's former office, which was later removed by the Commonwealth sometime after his death in 1938 (Rockwell 2002). In 1935 and 1939, additional acreage in the area was purchased, increasing the size of the facility. In 1953, even more land was acquired through takings as the Old Middlesex Turnpike was realigned, and the new Middlesex Turnpike, Route 3, cut through a portion of the property. This project left a small portion of the forest on the western side of Route 3, impacting the trail system and making this parcel inaccessible to staff and visitors.

Around 1955, a recreation area was developed in the portion of the property north of Chelmsford Road/Route 129, in what is now known locally as Manning Park. The 1950s improvements included a wading pool, equipment cabin and picnic area.

In 1961, an Act of the Legislature led to the disposition of two parcels of land west of Route 3 to the Town of Billerica for industrial purposes. (See Appendix H for more information.) A lumber yard and self storage business are located here today.

A master plan completed for the forest in the early 1970s proposed an expansion of the picnic area and the installation of a full-sized swimming pool in the northern section of the property, and development of a camping area south of Chelmsford Road; none of these proposals came to fruition.

The Town of Billerica has been managing the recreation area in the northern section of the forest since 1990. A series of Special Use Permits from 1990 through December 2004 formalized this management arrangement. A renewed permit that was to run from 2005 through 2010 was never finalized, due to disagreements between the DCR and the Town over parking revenue. As a result, the Town of Billerica has been managing this area without any formalized agreement or permit in place for almost a decade.

In 2002, the recreation area was updated and the wading pool was replaced by a spray deck. An adult fitness trail is also located on this portion of the property, installed by the Town of Billerica in 2012.

7.3. EXISTING CONDITIONS

Natural Resources

Physical Features

Topography. Warren H. Manning State Forest is fairly level in the southern section, with some low rolling uplands in the northern portions of the forest.

Geology. Warren H. Manning State Forest lies within the Nashoba Terrane, and the bedrock of the area includes gneiss, schists and Andover granite, a pink to buff colored granite that has a granular texture (Skehan 2001). The gneiss and schists are metamorphic rocks that may have originated as volcanic rocks. Some glacial erratics are scattered throughout the property.

Soils. Warren H. Manning State Forest is comprised of a wide range of soil types, from loamy sands in the uplands to muck, reflecting the presence of wetlands. The deep Hinckley loamy sands can be found on glacial outwash plains and terraces, while the Canton fine sandy loam and the Scituate fine sandy loam soils are located on the side slopes and toe slopes of uplands (Peragallo 2009). Slight to moderate limitations on path and trail development exist in the upland areas, the limitations increasing with slope and the sandiness of the soil. Severe limitations are present in the wetter areas where the muck based soils are found. Limitations on playground and picnic area development range from slight to severe, based upon slope and the stoniness of the soils present (Peragallo 2009).

Table 7.1. Soils of Warren H. Manning State Forest

Soil Series	% of Forest	Drainage Class
Hinckley loamy sand	27.4	Excessively drained
Canton fine sandy loam	18.5	Well drained
Scituate fine sandy loam	14.2	Moderately well drained
Saco mucky silt loam	9.8	Very poorly drained
Freetown muck	9.3	Very poorly drained
Montauk fine sandy loam	6.7	Well drained
Windsor loamy sand	6.6	Excessively drained
Deerfield loamy sand	2.6	Moderately well drained
Urban land	2.4	N/A
Ridgebury fine sandy loam	1.8	Poorly drained
Charlton-Hollis-Rock outcrop complex	0.7	Well drained to somewhat excessively drained
Udorthents	0.1	Variable

Water Resources

Ponds. There are no ponds within the forest.

Wetlands. Wooded swamp areas containing deciduous trees can be found throughout the forest, totaling 14 acres; an additional 10 acres of wooded swamp area, centrally located within the forest, contains a mix of trees. Two smaller areas of shrub swamp, one in the center of the forest and one in the northern portion of the forest, have a combined total of just over seven acres in size. A small bog (0.9 acres), locally known as Spruce Pond, is located within the centrally located shrub swamp. See Figure 6.

Vernal Pools. There is one certified vernal pool located in Warren H. Manning State Forest. In addition, there are five potential vernal pools located within this facility.

Streams. Black Brook enters Warren H. Manning State Forest on the northern boundary and heads south, flowing under Route 129/Chelmsford Road and ends in the bog located in the western portion of the forest (see Figure 6).

Flood Zones. On the northern edge of the property, there are two small areas, totaling 0.09 acres of land, that abut wetlands on neighboring properties that fall within the 100-year flood zone. These same areas expand to cover nearly four acres within the 500-year flood zone.

Rare Species

Priority Habitat has been designated on 72 acres of Warren H. Manning State Forest, encompassing roughly two-thirds of the land between Route 3 and Route 129/Chelmsford Road.

The only rare species recorded here, the blue-spotted salamander, is an amphibian that utilizes wetland habitat for reproduction and upland forest habitat for foraging, both of which are present in this part of the forest (Natural Heritage and Endangered Species Program 2007*b*). This species has a MESA status of Species of Special Concern.

In 2010, MassWildlife and The Nature Conservancy (TNC) issued "BioMap 2: Conserving the Biodiversity of Massachusetts in a Changing World" (MassWildlife and TNC 2010). This guide identified two types of areas important for conservation: Core Habitat and Critical Natural Landscape. The first is crucial for the long-term persistence of rare species and other species of conservation concern. The second provides habitat for wide-ranging native wildlife, supports intact ecological processes, maintains connectivity among habitats, enhances ecological resilience and buffers aquatic Core Habitats to help ensure their long-term integrity. Protection of both areas, which may overlap, is "important to conserve the full suite of biodiversity" in Massachusetts (MassWildlife and TNC 2010).

In Warren H. Manning State Forest, there are 72 acres of Core Habitat, covering the same area that has been designated Priority Habitat. Critical Natural Landscape has not been identified at Warren H. Manning State Forest.

Vegetation

Forest Types. In 2003, the James W. Sewall Company developed a forest inventory/land cover classification dataset for the state forests and parks. The dataset is primarily based on the interpretation of infrared aerial photography, a process that identified four forest sub-types within Warren H. Manning State Forest (Table 7.2).

Table 7.2. Forest Sub-types of Warren H. Manning State Forest

Forest Sub-type	Acres	% of Forest
Mixed oak	74.1	40.5
Eastern white pine - oak	54.5	29.8
Eastern white pine	25.2	13.8
Red maple - swamp hardwood	1.9	1.0
Total	*155.7*[a]	*85.1*

a. The difference in total acreage is due to the exclusion of wetlands and areas of open water, as well as changes in the forest's boundaries since 2003.

Hardwood species – including oak – are uncommon in the town of Billerica. Most of the hardwood stands in town are located on DCR lands.

As part of the Massachusetts Continuous Forestry Inventory (CFI), a specific area within the forest was visited by DCR Management Foresters in 2000. The CFI is a network of permanent, one-fifth-acre plots on state forest lands that are routinely monitored for sivicultural purposes. The measurements and observations made within each CFI plot are recorded in a database that dates back to 1960, when the CFI was created. Approximately 10% of the state's CFI plots are inventoried each year, on an on-going basis. As of 2010, there were 1,768 CFI plots statewide (Goodwin 2014).

There is one CFI plot within Warren H. Manning State Forest. This even-aged, two storied stand is 55 to 60 years old and comprised of primarily of red maple, along with some white pine and swamp hardwoods, including American elm and gray birch.

As part of the CFI process, DCR Management Foresters also look for signs of disturbances that affect the development of vegetation in the vicinity of each CFI plot. One disturbance agent, snow and ice, was recorded here in 1996.

Priority Natural Communities. There are no Priority Natural Communities within the forest.

Invasive Species. A few invasive species have been observed within the forest by DCR staff however none of these species have been identified in the CFI plot. The invasive species observed here include:

- Common buckthorn (*Rhamnus cathartica*), a deciduous small tree or coarse shrub, has been observed by DCR Foresters. Common buckthorn threatens wetlands, where it can suppress other species, and field edges. It is often spread by seed dispersal through birds.
- Multiflora rose (*Rosa multiflora*) has also been observed here. It is a densely spreading shrub that forms thickets that crowd out native species.
- Japanese knotweed (*Fallopia japonica*) is a shrub-like herbaceous plant that forms dense thickets that crowd out native species and reduce wildlife habitat, posing significant threats in riparian areas in particular. This was observed along the edge of Black Brook during RMP fieldwork.

Pests and Disease. White pine weevil (*Pissodes strobe*) has been identified in Warren H. Manning State Forest. While tree mortality from this pest is low, damage does impact tree health and reduce wood quality. To a lesser extent, gypsy moths (*Lymantria dispar*) and Dutch elm disease have also been observed here.

Wildlife

Birds. There is little current information on the forest's birds. Over 175 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.1.

Mammals. There is little current information on the forest's mammals. Over 45 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.2.

Reptiles. There is little current information on the forest's reptiles. Over 15 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.3.

Amphibians. There is little current information on the forest's amphibians. Over 15 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.4. Only one of these, the blue-spotted salamander, has been recorded at this forest.

Fish. There is no current information on the forest's fish.

Cultural Resources

Pre-contact Archaeological Sites

There are no recorded pre-Contact sites recorded in the forest, and no archaeological surveys have been conducted. The physical characteristics, regional setting, and the known patterns of pre-Contact occupation in the region all contribute to a high archaeological potential for the forest.

Historic Archaeological Resources

The remnant of a concrete foundation (MHC Inventory Form #BIL-HA-46) from Manning's office complex is located just north of the Warren H. Manning Office Memorial Stone. A concrete curb covered by vegetation, it appears to have been approximately 12 feet square. Some of the ground cover in the area may be remnant plant material from when the office was in use. From c1911 – c1919, Manning built a series of buildings used by his practice, many of which were ultimately interconnected as spokes to a hub. All but two of the buildings were burned down or demolished after 1938.

The foundation of an outbuilding is located adjacent to Spruce Pond, just south of the Manning Manse property. This foundation of poured concrete has been built into a slope and is open on grade on the low sloped side, with a rustic stone retaining wall extending off the rear corner. In the corner formed by the retaining wall there is an overgrown tree that might date to Manning's involvement with the property.

Outbuilding Foundation (DCR)

Historic Resources

Buildings. There are no historic buildings within the forest.

Structures. Stone wall remnants are located in the southern portion of the property, extending north from Old Rangeway Road. These are dry laid, loose stone walls that are in fair to poor condition.

A concrete pad foundation is located just south of Route 129, near the intersection with Rangeway Road. This foundation, roughly 20 feet by 12 feet, is becoming covered in leafy vegetation and moss. A utility pole that once served this structure is located directly adjacent to the pad and still has some severed wires dangling from it. The structure once located on this site housed a forest fire control building.

A concrete pad is located adjacent to the spray deck, and appears to be the foundation of the former bathhouse that was installed in the 1950s as part of the recreational development. The building was removed in the 2002 improvements to the area.

A former bridge abutment was once located at the end of Old Rangeway Road (MHC Inventory From #BIL-HA-44), however that seems to have been removed in a recent culvert replacement project.

Objects. The Warren H. Manning Office Memorial Stone (MHC Inventory Form #BIL.937) is located east of the entrance, adjacent to the picnic area. This memorial stone marks the location of where Warren Manning's office once stood, when his landscape architecture practice operated seasonally out of Billerica from 1915–1923.

Warren H. Manning Office Memorial Stone(DCR)

The memorial stone marking the location of the office, installed sometime between 1938 and 1950, is inscribed as follows:

HERE STOOD THE OFFICE OF
WARREN H. MANNING
LANDSCAPE DESIGNER
A STUDENT AND LOVER OF NATURE
AND MAN. A PIONEER AND LEADER
IN THE FINE ART OF PLANNING THE
WISE USE OF THE LAND FOR THE
PLEASURE AND BENEFIT OF MANKIND.
1860 – 1938

Some lichen growth is present on the memorial stone.

A concrete marker, approximately 8 inches tall and 3 inches square, is located north of the spray deck area. Possibly a former property boundary marker, the letter "C" is inscribed on one side.

Concrete Marker (DCR)

Landscapes. The forest contains a collection of two miles of woods roads that were used in the 19th century for access to woodlots, and in the 20th century as forest roads for recreational purposes and some administrative access. These unpaved roads, approximately eight feet wide in predominantly good to fair condition, vary in terms of level vegetative growth in the road pathway and make up the bulk of the network of trails in use today.

Recreation Resources

Warren H. Manning State Forest is primarily accessed via motor vehicle. Individuals who live nearby may also choose to walk or ride their bicycle to any one of the trailheads, although the area is not particularly pedestrian friendly. The Lowell Regional Transit Authority offers an additional, though likely underutilized, means of accessing the forest. The nearest stop is about a one mile walk to the main entrance.

Recreation at the state forest includes trail-based activities such as hiking and running, dog walking and cross-country skiing. Geocaching also occurs throughout the forest, with participants both on and off trails. As of November 2013, there were three known geocaches at the state forest.

Hunting is currently allowed in Warren H. Manning State Forest. This activity is not allowed near the spray deck area, but it is still not popular with local residents. During the development of this RMP, some concerns were expressed that hunters may be coming too close to abutting properties.

Some bikers and snowmobilers use the forest as well.

The primary recreational feature at Warren H. Manning State Forest is the spray deck area (see Figure 6). A wading pool was constructed here in the 1950s and was in use until it was replaced in 2002 with the new spray deck equipment. The spray deck, which is managed by the Billerica Recreation Department, is operational from May through the end of September. This area is very popular with young families, and on hot days often reaches capacity (Hannon-Rizza 2013).

Complementing the spray deck area is an adjacent picnic area, located between the spray deck and the parking lot. This picnic area includes 18 picnic tables, three of which are accessible, as well as nine grills for use by visitors. Four of these grills are of the metal variety on a low post, while five are concrete bases on the ground. These grills get occasional use by visitors, more so in the off-season than during the summer months. Twice a year, the Billerica Recreation Department offers an outdoor cooking program here that is very popular with families (Hannon-Rizza 2013).

The Billerica Recreation Department has created a "Story Book Trail," a short trail that loops around a portion of the picnic area and includes a series of 10 wooden and plexiglass wayside panels. These panels have laminated pages of a children's book within each of them, so that it is possible to walk the trail and read a story. These panels are periodically updated with a new book so that visitors can read new stories. This trail was recently marked by local

girl scouts with green trail markers affixed to trees via screws.

The Billerica Recreation Department installed an adult fitness trail in 2012. Complete with fitness equipment composed primarily of powder coated metal piping, the fitness trail has five exercise stations with 19 total pieces of equipment and 11 signs providing instruction for safe use.

Fitness Trail (DCR)

The Billerica Recreation Department offers a pre-school program at the park in the summer. The scheduling of this program is coordinated with an adult fitness program that utilizes the fitness trail equipment, providing a unique recreational opportunity for the parents of these pre-schoolers (Hannon-Rizza 2013).

Infrastructure

Property Boundary

Warren H. Manning State Forest is a 183 acre property that is divided into three blocks of land: a developed area located north of Chelmsford Road/Route 129; an undeveloped area south of Chelmsford Road/Route 129 and bordered on the west by Route 3; and 40 acres (22% of the forest), located west of Route 3 and cut off from the remainder of the forest by the highway. This latter piece is inaccessible to DCR staff and visitors.

Billerica State Forest is located just to the south of Warren H. Manning State Forest, and those portions of Warren H. Manning State Forest that lie south of Chelmsford Road/Route 129 are often considered by the public to be a part of Billerica State Forest. Locals refer to the northern section of the forest that contains the spray deck as Manning Park.

A utility easement cuts through the park, as a part of an underground pipeline that is owned and managed by Tennessee Gas. A trail composed of loose stone is located on the northern segment of this corridor. One access stanchion pole was located during fieldwork, located on the north side of Route 129.

Buildings and Structures

There is one contact station, located at the main entrance and parking area. A small front gabled wooden structure with an asphalt roof, this station is portable, in good condition, and does not have electrical service. It is managed by the Billerica Recreation Department.

Contact Station (DCR)

There is one bathhouse at Warren H. Manning State Forest (see Figure 6). Located adjacent to the parking lot, the bathhouse is open when the park is staffed, and is also managed by the Billerica Recreation Department. It is a side gabled, concrete block structure with a metal roof that has plumbing (on town sewer system) and electrical service. It is in good condition.

Bathhouse (DCR)

The Town of Billerica has expressed interest in developing the recreation area further.

Roads

The access road into the parking lot is the only administrative, paved road within Warren H. Manning State Forest.

There are two miles of unpaved forest roads that pre-date the establishment of the forest and continue to be used for hiking and administrative purposes.

Parking

The only parking lot for the forest is at the main entrance, located off the north side of Chelmsford Road/Route 129 (see Figure 6). This paved lot holds 36 vehicles. There are no designated handicapped parking spaces. West of the main entrance on Chelmsford Road/Route 129, there is room for two or three cars to pull over on the north side of the road in front of a trail head.

Trails

There are approximately 3.4 miles of trails at Warren H. Manning State Forest (see Figure 6). All of the trails are located in the eastern portion of the property. Prior to the construction of Route 3 in 1953, some trails went through the northwestern portion of the forest, however the installation of Route 3 effectively cut off this western segment of the property, and any trails that were located here have since grown in.

Of these trails, two miles are comprised of unpaved forest roads, with an additional 1.4 miles of narrow trails that are in good to fair condition.

A trail map has not been created by the DCR for Warren H. Manning State Forest and there is no information on the DCR website for the forest or its network of trails. The Town has developed a map that covers the northern section of the park only. This map is available on the Town's website.

Signs and Kiosks

There are no Lead-in signs for this property.

The forest's Main Identification sign is located at the main entrance to the park on Chelmsford Road/Route 129. While the orientation, material and design of this sign does meet DCR signage standards (DCR n.d.), the information regarding management is not entirely accurate as this only applies to the northern section of the forest.

Main Identification Sign (DCR)

One kiosk, maintained by the Billerica Recreation Department, is located at the northern edge of the parking lot. A small mailbox for map distribution is attached to the kiosk, as is a pet waste bag dispenser.


Informational Kiosk (DCR)

The Billerica Recreation Department has created a "Story Book Trail," a short trail that loops around a portion of the picnic area. Ten panels located alongside the trail include the pages of a popular children's book, so that one reads a story from start to finish while walking along this trail.

Memorials and Markers

There is one memorial in Warren H. Manning State Forest, the Warren H. Manning Office Memorial Stone. For information on this memorial, please refer to the Cultural Resources section.

Other

Residents along the southeast side of Rangeway Road have installed their mailboxes across the street on the forest property, possibly within the road right-of-way.

Illegal Activities

At the southern end of the forest, just off the southernmost trail head off of Rangeway Road, tire dumping has been occurring. This appears to be relatively recent dumping, but may have occurred multiple times.

Dumping Area (DCR)

7.4. Management Resources and Practices

See Section 2, Management Resources and Practices, for a description of the management resources and practices that apply to the entire Lowell/Great Brook Planning Unit.

Natural Resources

Vegetation

In the past, the DCR used to allow Home Fuelwood harvests to occur at this state forest. However, since this property has been designated as a Parkland through the Landscape Designation process, this activity is no longer allowed at this facility.

The vegetation in the gas pipeline corridor is managed by Tennessee Gas.

Wildlife

The DCR does not actively manage wildlife at Billerica State Forest; however the hunting of game species is permitted.

Cultural Resources

The DCR's Office of Cultural Resources hired a team of cultural resource management professionals to undertake a survey of cultural resources at Warren Manning State Forest in 2002. The aforementioned MHC Inventory Forms are a result of that effort.

Recreation Resources

The Town of Billerica, through its Recreation Department, has been operating the recreation area in the northern section of the forest since 1990. A series of Special Use Permits formalizing this arrangement were in place from 1990 through December 2004. Attempts were made to get a new permit in place for the 2005 recreation season, but appear to have stalled due to questions regarding the collection and retention of revenue by the Town through the parking fees they collected. The conversation began again in 2006, but appears to have gone nowhere since then. Despite this, the Town continues to operate the area and has since invested in the property with the installation of the fitness equipment. This installation was done in consultation with the DCR Operations staff, however the town typically does not consult with the agency on smaller projects, volunteer requests and programming.

Hunting is currently allowed in Warren Manning State Forest.

Infrastructure

The parking lot, spray deck, bathhouse and "Story Book Trail" are all managed by the Billerica Recreation Department, as part of the Town's management of the northern section of the forest. The Town charges a parking fee of $3.00, and a season pass is available for $35.00. This revenue goes to the Town to help offset their operational costs.

Interpretive Services

There are no formal interpretive service programs provided here by DCR or by the Town of Billerica.

Operational Resources

DCR Staffing

DCR does not maintain a staff presence on site. DCR staff does periodically drive through the property in the off season, when the town does not actively manage the recreation area.

Supplemental Staffing

The Billerica Recreation Department provides seasonal staffing for the northern portion of the forest. There is staff at the facility seven days a week, from 8:30am to 6pm, from May through the end of September. There is one person on duty at a time, and they are responsible for collecting parking fees, maintaining the restrooms and the trash, and doing periodic walk-throughs of the facility (Hannon-Rizza 2013). Billerica Recreation Department staff manages the Town programming at the site.

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A forest road in Billerica State Forest. (DCR)

SECTION 8. BILLERICA STATE FOREST

8.1. INTRODUCTION

Billerica State Forest is a 141-acre undeveloped property located in the northwest part of the town. Utilized primarily by local residents, due to a lack of parking, the network of trails and forest roads provide hikers with an opportunity to access nature in an otherwise dense suburban setting.

8.2. HISTORY OF PROPERTY

Billerica State Forest is located in an area that was not heavily settled through the 17th, 18th and 19th centuries (MHC 1980*e*). Gilson Hill is named for an early settler of Billerica, Samuel Gilson. The name first began appearing on maps in 1853. Maps from the 19th century show this area as being wooded and undeveloped; it was utilized for logging, with wood lots in active use until the turn of the 20th century.

In 1908, Warren H. Manning and John E. Rowell gifted about 25 acres of land that included Gilson Hill to the Appalachian Mountain Club (AMC), who in turn entered into a maintenance agreement with the Billerica Improvement Association (Rockwell 2002; Shepard 1913). Several other landowners soon followed their lead, encouraged by Manning and his efforts to promote and create public woodlands in town, with a particular focus on developing a town forest system in Billerica. Manning developed the Billerica Town Forest Plan in the mid-1920s, and it was accepted by the Town in 1926. He suggested in this plan that Gilson Hill be named Start Forest, in honor of Edwin F. Start, the first Commissioner of the Massachusetts Forest Commission. Manning also suggested names for the trails through this property, many of them for friends and family members, however none of his naming suggestions were ever implemented (Rockwell 2002).

The property was sold by the AMC to the Commonwealth in 1934, along with two other AMC properties (one in Carlisle and one in Warwick), at which time it was renamed Billerica State Forest. In 1953, the Old Middlesex Turnpike was realigned, and the new Middlesex Turnpike (Route 3) cut through a portion of the property, leaving a small portion of the forest on the western side of Route 3, impacting the trail system and leaving this parcel inaccessible.

In the late 1960s and early 1970s, local interest in developing Gilson Hill into a downhill ski facility led to legislation in 1971 authorizing a transfer of this property to the Town of Billerica for this purpose. However, shortly after the town started

planning for the ski area, it was determined that the transfer was not possible due to a stipulation in the original conveyance. The deed stated that if the land were ever discontinued as a state forest it would revert to the AMC. Local pressure on the Commonwealth to develop this for ski purposes followed, but the Department of Natural Resources (DNR), a predecessor to the Department of Conservation and Recreation, staff did not feel this was possible without considerable earth moving, and did not pursue this plan (DNR 1975).

Billerica State Forest was also considered as a potential location for a regional headquarters in 1973-1974, but that plan did not move forward either (Cook 1973; Maisner 1974).

8.3. EXISTING CONDITIONS

Natural Resources

Physical Features

Topography. The primary topographic feature of Billerica State Forest is Gilson Hill (see Figure 7). At 310 feet above sea level, Gilson Hill is the second highest point in Billerica. Large glacial erratics dot the slopes of the hill, and rolling uplands surround the base of the hill.

Geology. Billerica State Forest lies within the Nashoba terrane, and the bedrock of the area includes gneiss, schists and Andover granite, a pink to buff colored granite that has a granular texture (Skehan 2001). The gneiss and schists are metamorphic rocks that may have originated as volcanic rocks. Gilson Hill, like the other low lying hills in Billerica, is a glacial drumlin covered in glacial till (Northern Middlesex Council of Governments 2008).

Soils. Over half of the state forest is covered in Paxton fine sandy loam soils, found on the convex side slopes of glaciated hills. This soil is often found alongside Montauk, Charlton and Woodbridge soils in upland areas, which are also located here. Between the stoniness of these soils and septic tank limitations due to slow percolation rates, land composed of these soils are often woodland (Peragallo 2009). Scituate fine sandy loam, found on the slopes of uplands, is also found here. All of these soils have moderate to high potential productivity for forestry. These soil types generally present slight to moderate limitations with regards to path and trail development, as well as to picnic area and playground development (Peragallo 2009).

Table 8.1. Soils of Billerica State Forest

Soil Series	% of Forest	Drainage Class
Paxton fine sandy loam	46.8	Well drained
Woodbridge fine sandy loam	12.4	Moderately well drained
Charlton fine sandy loam	9.0	Well drained
Charlton-Hollis-Rock outcrop complex	8.8	Well drained to somewhat excessively drained
Montauk fine sandy loam	8.2	Well drained
Scituate fine sandy loam	6.5	Moderately well drained
Hinckley loamy sand	2.8	Excessively drained
Windsor loamy sand	2.8	Excessively drained
Swansea muck	1.4	Very poorly drained
Deerfield loamy sand	0.7	Moderately well drained
Whitman fine sandy loam	0.6	Very poorly drained

Water Resources

Billerica State Forest is largely upland, with little in the way of water resources within this facility.

Ponds. There are no ponds within the forest.

Wetlands. There are three small wetland areas within Billerica State Forest (see Figure 7). The largest one is a 0.8-acre wooded swamp, composed of deciduous trees. There is also a 0.46-acre shallow marsh meadow or fen, and a 0.08-acre shrub swamp.

Vernal Pools. There is one potential vernal pool at Billerica State Forest.

Streams. There are no streams within the forest.

Groundwater. There are no aquifers beneath Billerica State Forest.

Flood Zones. There are no flood zones within the forest.

Placeholder for Figure 7.

Rare Species

Priority Habitat has been designated on 26 acres of Billerica State Forest, encompassing a semi-circular shaped area on the northern boundary of the forest, extending northwest from the intersection of Treble Cove Road and Winning Street.

The only rare species recorded here, the blue-spotted salamander, is an amphibian that utilizes upland forest habitat for foraging (NHESP 2007*b)*. This species has a MESA status of Species of Special Concern.

In 2010, MassWildlife and The Nature Conservancy (TNC) issued "BioMap 2: Conserving the Biodiversity of Massachusetts in a Changing World" (MassWildlife and TNC 2010). This guide identified two types of areas important for conservation: Core Habitat and Critical Natural Landscape. The first is crucial for the long-term persistence of rare species and other species of conservation concern. The second provides habitat for wide-ranging native wildlife, supports intact ecological processes, maintains connectivity among habitats, enhances ecological resilience and buffers aquatic Core Habitats to help ensure their long-term integrity. Protection of both areas, which may overlap, is "important to conserve the full suite of biodiversity" in Massachusetts (MassWildlife and TNC 2010).

In Billerica State Forest, there are 26 acres of Core Habitat, the same area that has been designated as Priority Habitat. Critical Natural Landscape has not been identified at Billerica State Forest.

Vegetation

Forest Types. In 2003, the James W. Sewall Company developed a forest inventory/land cover classification dataset for the state forests and parks. The dataset is primarily based on the interpretation of infrared aerial photography, a process that identified four forest sub-types within Billerica State Forest (Table 8.2).

Table 8.2. Forest Sub-types of Billerica State Forest

Forest Sub-type	Acres	% of Forest
Mixed oak	124.7	88.4
Eastern white pine – oak	10.2	7.2
Eastern white pine	1.4	1.0
Norway spruce - white spruce	1.3	0.9
Total	*137.6*[a]	*97.5*

a. The difference in total acreage is due to the exclusion of wetlands and areas of open water, as well as changes in the forest's boundaries since 2003.

Hardwood species, including oak and maple, are uncommon in Billerica. Most of the hardwood stands in town can be found within Billerica and Warren H. Manning state forests. The stand of Norway spruce – white spruce is a small plantation stand that may date to Warren Manning's involvement with the property. Images of Norway Spruce appear in his slide collection, and his autobiography notes that some planting was done on the land he owned in Billerica with his staff as part of their training (Manning n.d.). There is a stand of some very large eastern white pine trees along the northern border of the property, adjacent to Winning Street, which is still a town road and may in fact fall within the road right of way.

As part of the Massachusetts Continuous Forestry Inventory (CFI), a specific area within this forest was visited by DCR Management Foresters in 2000. The CFI is a network of permanent, one-fifth-acre plots on state forest lands that are routinely monitored for silvicultural purposes. The measurements and observations made within each CFI plot are recorded in a database that dates back to 1960, when the CFI was created. Approximately 10% of the state's CFI plots are inventoried each year, on an on-going basis. As of 2010, there were 1,768 CFI plots statewide (Goodwin 2014).

There is one CFI plot within Billerica State Forest. The trees in this CFI plot range in age from approximately 75 to 100 years and the stand is comprised mostly of mixed oak with maple and birch associated with this sub-type. This stand has an even-aged, two-storied structure.

As part of the CFI process, DCR Management Foresters also look for signs of disturbances that affect the development of vegetation in the vicinity of each CFI plot. One disturbance agent, likely gypsy moth, was recorded here in 1981.

Priority Natural Communities. There are no Priority Natural Communities within Billerica State Forest.

Invasive Species. A number of invasive species have been observed at Billerica State Forest by DCR Management Foresters. Surprisingly however, none of these invasive species have been identified in the CFI plot. The invasive species observed here include:

- Common buckthorn (*Rhamnus cathartica*), a deciduous small tree or coarse shrub that threatens wetlands and field edges, where it can suppress other species. It is often spread by seed dispersal through birds.
- Garlic mustard (*Alliaria petiolata*), a biennial herb that can spread rapidly, displacing native vegetation and in turn altering habitat. Garlic mustard is very difficult to eradicate.
- Multiflora rose (*Rosa Multiflora*), a densely spreading shrub that forms thickets that crowd out native species.
- Japanese knotweed (*Fallopia japonica*) is a shrub-like herbaceous plant that forms dense thickets that crowd out native species and reduce wildlife habitat, posing significant threats in riparian areas in particular.
- Winged burning bush (*Euonymus alatus*), also known as winged euonymus or burning bush, is a deciduous shrub that forms dense thickets that crowd out native species.
- Japanese barberry (*Berberis thunbergii*), a spiny shrub that forms dense stands that can displace native plants and reduce wildlife habitat and forage. Barberry also harbors deer ticks that have the potential to carry the Lyme disease bacteria, functioning as a nursery of sorts for juvenile ticks (Benson 2011).
- Privet, a rapidly maturing semi-evergreen shrub that forms dense thickets that crowd out native species.

Pests and Disease. Billerica State Forest has experienced issues with gypsy moths, defoliators that commonly feed on oak, which is prevalent here. White pine weevil and bark beetles have also been observed here, although to a lesser extent.

Wildlife

Birds. There is little current information on the forest's birds. Over 175 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.1.

Mammals. There is little current information on the forest's mammals. Over 45 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.2.

Reptiles. There is little current information on the forest's reptiles. Over 15 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the forest, are listed in Appendix G, Table G.3.

Amphibians. There is little current information on the forest's amphibians. Over 15 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the forest, are identified in Appendix G, Table G.4. Only two of these, the blue-spotted salamander and American toad, have been recorded at this forest.

An American toad observed during fieldwork. (DCR)

Fish. There is no current information on the forest's fish.

Cultural Resources

Pre-contact Archaeological Sites

One pre-Contact site is recorded in the forest, but no data is available on it. There are many sites recorded adjacent to the forest including Woodland (1650 - 450 B.P.) and Late Archaic Period (5000-3000 B.P.) campsites, a village site, and burials. The physical characteristics, regional setting, and the confirmed

nearby pre-Contact occupation of the area, all confer a high archaeological potential for the forest.

Historic Archaeological Resources

Remnants of a 19th century sawmill are reportedly located off of Rangeway Road. This site was recorded in 2002 on a Massachusetts Historical Commission (MHC) Inventory Form (in MHC Area form #BIL.S), but the site could not be located during the fieldwork for this RMP.

Evidence of quarrying activity has been located in the northwestern portion of the forest, along the northern border of Gilson Hill. Waste stone with drill scars are visible. An MHC Inventory Form completed in 2002 (#BIL.S) noted two depressions that were likely the site of the quarrying, but these were not specifically located during the RMP fieldwork.

Historic Resources

Buildings. There are no historic buildings within the forest.

Structures. Remnants of stone walls can be found in Billerica State Forest, along the southwest and northern edges of the forest where the slope is low. These are dry laid walls, constructed using the large glacial till located on site. These remnants are in fair to poor condition, and are starting to fall apart.

Objects. The Rowell Memorial Stone (MHC Inventory Form #BIL.938) is located near the top of Gilson Hill. A glacial erratic that is approximately six feet wide, by 10 feet long, by three feet high, this stone contains the following inscription, in all block letters, on the north side of the boulder:

JOHN EDWIN ROWELL
MEMORIAL

John Rowell, a Billerica resident who was active in conservation, along with Warren Manning donated the land at Gilson Hill to establish the AMC Reservation here in 1908. It is suspected that the memorial inscription was completed shortly after Rowell's death in 1927.

Inscription on Rowell Memorial Stone (DCR)

This same stone was historically called Indian Rock, due to the three large holes on the top of the boulder that are thought to have been evidence of use for grinding, a remnant of pre-contact Native American use of the area.

Grinding holes located on top of the Rowell Memorial Stone. (DCR)

Lichen growth is impacting the resource, and the inscription is becoming difficult to read, resulting in a condition assessment of unsatisfactory.

Landscapes. The core of Billerica State Forest, Gilson Hill, includes a system of nearly one-and-a-half miles of connected wood roads that were used in the 19th century for access to woodlots, and in the 20th century as forest roads for recreational purposes and administrative access. These unpaved roads, approximately 8 to 10 feet wide, vary in terms of level vegetative growth in the road pathway, and are a part of the network of trails in use today. These roads were a part of the appeal of the property to Warren Manning when he set out to protect this land for public enjoyment.

Slide from a lecture Warren Manning gave to the Billerica Improvement Association. Source: Iowa State Library – Warren H. Manning Digital Collection

Recreation Resources

Billerica State Forest is primarily accessed via motor vehicle or on foot by local residents. Individuals who live nearby may walk or ride their bicycle to any one of the trailheads, although the area is not particularly pedestrian friendly. There are no public transit options to reach this forest.

Recreation resources are limited to a network of nearly three miles of trails on the eastern portion of the forest. These trails are used primarily for hiking, as well as some dog walking, mountain biking, snowshoeing and cross-country skiing. The construction of Route 3 in 1953, which cut off a small segment of the northwest portion of the forest, disrupted trail access to this area. This segment of the forest is now inaccessible for use.

Hunting is currently allowed in Billerica State Forest.

There is one known geocache located here as of August 2013.

There are no camping facilities at Billerica State Forest, and back country camping is not allowed here. However, a makeshift lean-to using tree branches and other camping materials (e.g., tarps and other debris) was observed just west of the peak of Gilson Hill. The landscape adjacent to this area also showed evidence of minor fire damage in the past, although it is unclear if this came about through unauthorized camping or a natural cause, such as lightning.

A stone fire ring (not recently used) was also found along one of the forest roads at the top of Gilson Hill, along with evidence of its use as a party spot.

Infrastructure

Property Boundary

Billerica State Forest is a 141-acre undeveloped property located in the northwest part of Billerica, south of Rangeway Road and Winning Street (a town road that is partially gated off from use), lying primarily in between Treble Cove Road and Route 3. A small and inaccessible portion of the forest – 12 acres (8.5%) – is located just west of Route 3 (see Figure 7).

Warren H. Manning State Forest is located just to the north of this property, and the southern portion of that property is often considered by the public to be a part of Billerica State Forest.

Buildings and Structures

There are no buildings and structures within Billerica State Forest.

Roads

There are no paved roads within Billerica State Forest.

There are 1.4 miles of unpaved forest roads that pre-date the establishment of the park and continue to be used for hiking and administrative purposes.

Parking

There are no designated parking areas for Billerica State Forest. There is a place to pull off and park one vehicle in front of the northernmost gate along Treble Cove Road. This lack of access not only discourages use, but also prevents DCR staff and first responders from being able to enter the forest at that gate in the event of an emergency.

Parking also occurs informally at the gated end of Winning Street, which is not a part of the forest, but is a town road.

Trails

There are approximately 2.8 miles of trails at Billerica State Forest, 2.6 miles of which are legal trails. All of the trails are located in the eastern portion of the property. Prior to the construction of Route 3, some trails went through the northwestern

portion of the forest. However the installation of Route 3 effectively cut off this western segment of the property, and the trails that were located here have since been lost to vegetation.

Forest roads make up just about half of the trail system, with almost 1.5 miles of unpaved forest roads that pre-date the establishment of the forest. These historic pathways were mapped and evaluated in 2008, at which time it was determined that approximately 70% were in fair condition, while the remaining 30% were in poor condition.

The remainder of the trail network consists of approximately 1.2 miles of trails, 80% of which were deemed to be in fair condition; the remaining 20% of trails were categorized as poor.

It is worth noting that the percentage of trails rated as poor is higher than normal, and none of the trails at Billerica State Forest were determined to be in good condition. This is likely due, in part, to low visitation rates. Without regular use, vegetative growth impacts both the base and the width of the trail system.

A trail map has not been created for Billerica State Forest, and there is no information on the DCR website for the forest or its network of trails.

Winning Street, which is gated a short way in from Treble Cove Road, continues heading northwest and serves as the functional northern boundary for Billerica State Forest (see Figure 7). This town road is unpaved beyond the gate and is currently not in active use. It is not counted in the total trail mileage as it is not owned by the DCR and not a part of the forest. However, it does serve as a link for several trails from the forest and is used by visitors for recreational purposes.

Signs and Kiosks

There are no Lead-in or Forest Entrance signs for Billerica State Forest.

There are no informational kiosks at Billerica State Forest.

Memorials and Markers

There is one memorial in Billerica State Forest, the Rowell Memorial Stone. For information on this memorial, please refer to the Cultural Resources section.

Other

There are a set of fire hydrants along Treble Cove Road. These hydrants are located within the road right of way, are owned by the town, and maintained by the Billerica Water Department (Conway 2013).

Illegal Activities

Debris has been collecting near the eastern edge of the property, adjacent to Winning Street, reflecting some illegal dumping activity. The top of Gilson Hill also appears to be used as a party spot, with debris and a makeshift fire ring found in the area during fieldwork.

8.4. Management Resources and Practices

See Section 2, Management Resources and Practices, for a description of the management resources and practices that apply to the entire Lowell/Great Brook Planning Unit.

Natural Resources

Vegetation

Vegetation around fire hydrants is maintained by the Billerica Water Department.

Wildlife

The DCR does not actively manage wildlife at Billerica State Forest; however the hunting of game species is permitted.

Cultural Resources

The DCR's Office of Cultural Resources hired a team of Cultural Resource Management professionals to undertake a survey of cultural resources at Billerica State Forest in 2002, resulting in the completion of the MHC Inventory Form for the Rowell Memorial Stone.

Recreation Resources

There are no unique recreation resource management practices at this property, beyond the trail maintenance practices described under Infrastructure.

Infrastructure

Buildings and Structures

The Town of Billerica owns the fire hydrants located alongside Treble Cove Road, within the road right-of-way; these hydrants are maintained by the Billerica Water Department. There is no Memorandum of Agreement (MOA), or similar document, between the DCR and the town that guides this management activity.

Roads

The DCR's Forest Fire Control District 6 provides forest road maintenance on an annual basis.

Trails

Trail maintenance is performed on a limited basis by DCR staff, and is typically at the request of the DCR's Forest Fire Control District 6 to meet their access needs.

Interpretive Services

Interpretive service programming is not offered at Billerica State Forest, nor is any other interpretive information provided.

Operational Resources

Billerica State Forest does not have any full or part-time DCR staff on site.

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The Concord River, as viewed from Governor Thomas Dudley State Park. (DCR)

SECTION 9. GOVERNOR THOMAS DUDLEY STATE PARK

9.1. INTRODUCTION

Governor Thomas Dudley State Park is the smallest facility in the Lowell/Great Brook Planning Unit, just under 11 acres in size. The park is located off of Dudley Road in Billerica, a locally designated scenic road, providing access to the Concord River (see Figure 8). Access to the property is through an adjacent parcel of Town of Billerica conservation land, as there is no frontage on Dudley Road. Other abutting properties include a parcel owned by the Department of Fish and Game (DFG) and a parcel that is part of the Great Meadows National Wildlife Refuge. This park is approximately one quarter of a mile from the town line with Bedford.

The three properties now owned by the DCR, DFG and Town of Billerica was once a single 21 acre parcel that was split and acquired by these three entities for conservation purposes. A management agreement between these organizations exists, and the Town of Billerica is the primary management and enforcement authority for all three parcels.

This park is located within the Two Brothers Rocks-Dudley Road National Register Historic District, which is located in both Billerica and Bedford. This property was identified in the Massachusetts Scenic Landscape Inventory of 1982.

This section of the Concord River is also within the Sudbury, Assabet and Concord National Wild and Scenic Rivers designation and the Sudbury/Concord River Valley State Important Bird Area, as recognized by the National Audubon Society (National Park Service 2008; National Audubon Society 2008).

9.2. HISTORY OF PROPERTY

Part of a 1637 Massachusetts General Court land grant of 1,000 acres to then Deputy Governor Thomas Dudley, this area was known at the time as Dudley Farm. Sold in 1652 in several parcels, the farm became an early focus of settlement in Billerica (Broomer 2010). The land along this section of Dudley Road became a part of the Stearns family farm holdings in the late 17th century, and stayed in the family until 1850 when Moses Greenwood purchased the property. The western edge of the Greenwood property along the Concord River was known as Greenwood Grove as early as 1891, and likely functioned as a picnic grove. By 1910, the Greenwood family owned 10 cottages on the property, probably providing a source of income in

Placeholder for Figure 8.

the form of summer rentals. The cottage community grew to 17 by 1930, but was back down to 10 by 1939, and by 1950 only six remained (Broomer 2010). No cottages survive.

Parcels of Greenwood Grove began to be subdivided and sold off in the late 1970s. In 1985, 24 acres of the former Greenwood property were sold for the development of a subdivision known as Heatherwood Estates, with 17 individual homesites planned. In January 1988, three adjoining parcels in Billerica were jointly acquired from the developer for open space protection by the Town of Billerica, the Department of Environmental Management (the DCR's predecessor agency), and the Department of Fisheries, Wildlife and Environmental Law Enforcement (the DFG's predecessor), totaling approximately 21 acres. Acquisition of this land occurred in part to contribute to the Massachusetts Bay Circuit Trail land protection efforts. A cooperative management agreement among these three entities details how the entities agreed to manage the land. Lands adjacent to these three properties are also protected as part of the Great Meadows National Wildlife Refuge property, which is owned by the US Fish and Wildlife Service (USFWS).

9.3. EXISTING CONDITIONS

Natural Resources

A portion of the Great Meadows National Wildlife Refuge abuts Governor Thomas Dudley State Park along the park's western border. The Final Comprehensive Conservation Plan for the wildlife refuge identifies a wide range of natural resources within the property (USFWS 2005). It is worth noting that some of the resources identified within the refuge, particularly flora and fauna, may also exist within the state park.

Physical Features

Topography. The topography is rolling uplands, with a high point of approximately 150 feet above sea level roughly in the middle of the property, and decreasing elevations to the eastern side and on the western side, by the Concord River.

Geology. Falling within the Nashoba terrane, the bedrock of the area surrounding Governor Thomas Dudley State Park is largely Andover granite, commonly pink granite with a granular texture. (Skehan 2001).

Soils. Soils for this property are primarily Merrimac fine sandy loam, with some concentrations of Hinckley loamy sand. The Merrimac fine sandy loam is a very deep, somewhat excessively drained soil. The Hinckley loamy sand deposits in the Concord River Valley are three to four feet thick, and are underlain by glacial till (Northern Middlesex Council of Governments 2005). These soil types are formed in glaciofluvial deposits. Both types have primarily slight limitations for path and trail development, with some moderate to severe limitations in areas where the slope is above 15% (Peragallo 2009).

Table 9.1. Soil Types of Governor Thomas Dudley State Park

Soil Type	% of Park	Drainage Class
Merrimac fine sandy loam	66.3	Somewhat excessively drained
Hinckley loamy sand	22.3	Excessively drained
Deerfield loamy sand	9.3	Moderately well drained
Rippowam fine sandy loam	1.5	Poorly drained
Saco mucky silt loam	0.3	Very poorly drained
Windsor loamy sand	0.03	Excessively drained

Water Resources

Ponds. There are no ponds within the park.

Wetlands. There is a small shrub swamp, less than a half acre in size, located in this park.

Vernal Pools. There are no vernal pools within the park.

Streams. Governor Thomas Dudley State Park lies on the eastern shore of the Concord River, a 16 mile long river that drains an area of 27 miles. The Concord River has slow moving characteristics and little change in elevation along its length (USFWS 2005). A portion of the Concord River, including the section that abuts the park, has been designated as a Wild and Scenic River. The Town of Billerica utilizes the Concord River as its sole source of drinking water (Northern Middlesex Council of Governments 2005).

Groundwater. There are no aquifers beneath the park.

Flood Zones. A small half-acre section of the western most edge of the park, alongside the Concord River, falls within the 100-year flood zone.

Rare Species

No part of Governor Thomas Dudley State Park falls within land that has been designated as Priority Habitat. A very large swath of land just south of the park, extending into the western edge of Bedford and encompassing much of the northern half of Concord is currently designated as Priority Habitat.

In 2010, MassWildlife and The Nature Conservancy issued "BioMap 2: Conserving the Biodiversity of Massachusetts in a Changing World" (MassWildlife and TNC 2010). This guide identified two types of areas important for conservation: Core Habitat and Critical Natural Landscape. The first is crucial for the long-term persistence of rare species and other species of conservation concern. The second provides habitat for wide-ranging native wildlife, supports intact ecological processes, maintains connectivity among habitats, enhances ecological resilience, and buffers aquatic Core Habitats to help ensure their long-term integrity. Protection of both areas, which may overlap, is "important to conserve the full suite of biodiversity" in Massachusetts (MassWildlife and TNC 2010). The entire park has been designated Core Habitat, and three-and-a-half of these acres (33%) have also been designated as Critical Natural Landscape.

Despite the lack of Priority Habitat designation within this facility, two rare species have been identified by the Natural Heritage and Endangered Species Program (NHESP) here: Blanding's turtle and river bulrush.

Blanding's turtles are reptiles that use both wetland and upland habitats and travel long distances during their active season (NHESP 2007a). This species has a MESA status of Threatened.

River bulrush, a plant, was formerly protected under MESA but has been delisted, and is now on the NHESP Plant Watch list, which is a non-regulatory tool. It is robust perennial sedge that can be found on river shores and in floodplains.

Vegetation

Forest Types. In 2003, the James W. Sewall Company developed a forest inventory/land cover classification dataset for the state forests and parks. The dataset is primarily based on the interpretation of infrared aerial photography, a process that identified two forest sub-types within Governor Thomas Dudley State Park (Table 9.2).

Table 9.2. Forest Sub-types of Governor Thomas Dudley State Park

Forest Sub-type	Acres	% of Park
Eastern white pine - hardwoods	8.1	73.6
Eastern white pine	1.7	15.5
Total	*9.8*	*89.1*

a. The difference in total acreage is due to the exclusion of wetlands and areas of open water, as well as changes in the park's boundaries since 2003.

The 2008 Billerica Open Space and Recreation Plan Update identified the predominant species in town as red oak and white pine, noting that white pine thrives in this area (Northern Middlesex Council of Governments 2008).

There are no Continuous Forest Inventory (CFI) plots within Governor Thomas Dudley State Park providing additional site specific data for any part of this property.

Priority Natural Communities. There are no Priority Natural Communities within Governor Thomas Dudley State Park.

Invasive Species. No information has been located to date on invasive species within Governor Thomas Dudley State Park.

Pests and Disease. No information has been located to date on pests and disease within Governor Thomas Dudley State Park.

Wildlife

Birds. There is little current information on the park's birds. Over 175 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the park, are listed in Appendix G, Table G.1. The Final Comprehensive Conservation Plan for the wildlife refuge also contains information that may apply here (USFWS 2005).

Mammals. There is little current information on the park's mammals. Over 45 species that have been

identified in some of the other facilities in this planning unit, and may possibly occur within the park, are listed in Appendix G, Table G.2. The Final Comprehensive Conservation Plan for the wildlife refuge also contains information that may apply here (USFWS 2005).

Reptiles. There is little current information on the park's reptiles. Over 15 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the park, are listed in Appendix G, Table G.3. Only one of these, Blanding's turtle, has been recorded at this park. The Final Comprehensive Conservation Plan for the wildlife refuge also contains information that may apply here (USFWS 2005).

Amphibians. There is little current information on the park's amphibians. Over 15 species that have been identified in some of the other facilities in this planning unit, and may possibly occur within the park, are listed in Appendix G, Table G.4. The Final Comprehensive Conservation Plan for the wildlife refuge also contains information that may apply here (USFWS 2005).

Fish. A small portion of the boundary of this property is at the edge of the Concord River. The Final Comprehensive Conservation Plan for the wildlife refuge identifies 19 different species of fish, including several common varieties of pike, perch and trout (USFWS 2005). The plan also notes an alewife recovery program that was underway while the plan was being written (USFWS 2005). Many of these species may be present in the waters off of Governor Thomas Dudley State Park.

Cultural Resources

Pre-contact Archaeological Sites

Governor Thomas Dudley State Park has not been systematically surveyed and contains no recorded pre-Contact sites. The physical characteristics, regional setting, and the known patterns of pre-Contact occupation in the region all confer a high archaeological potential for the park.

Historic Archaeological Resources

Governor Thomas Dudley State Park has not been systematically surveyed and contains no recorded historic archaeological sites.

Historic Resources

Buildings. There are no historic buildings within the park.

Structures. A small stretch of dry laid stone wall can be found on this property, and more of the historic system of walls can also be seen on adjacent properties. This wall is in fair to poor condition.

Objects. There are no historic objects within the park.

Landscapes. The primary entrance trail into the property is a former cart path that passes through the Town of Billerica conservation land, and has an aging allee of white pine trees. The majority of this allee is on the town owned land, but the western end of it does fall on DCR property. This historic allee may be a remnant from Greenwood Grove.

White Pine Allee (DCR)

Recreation Resources

Governor Thomas Dudley State Park is primarily accessed via motor vehicle. There are no public transit options to reach this park.

Recreation resources within Governor Thomas Dudley State Park consist of a small network of trails for passive walking and hiking use. These trails connect the DCR parcel to the adjacent town, DFG and USFWS lands. There is no boat access to the river.

One picnic table is located alongside the entrance trail, providing a place to rest about halfway between the entrance and the western edge of the property.

There is one known geocache located here as of November 2013.

Infrastructure

Property Boundary

Governor Thomas Dudley State Park is an 11 acre undeveloped property located in the southwest corner of Billerica, very close to the town line with Bedford (see Figure 8). The park is located west of Route 4, and east of the Concord River. A small portion of the western property line abuts the river itself. Directly to the north is property owned by the DFG, and to the east is property owned by the Town of Billerica. These parcels are collectively managed by the town. Much of the western boundary abuts a portion of the Great Meadows Wildlife Refuge, which is managed by the USFWS, and to the south is private property.

No boundary markers were noted during fieldwork, and only one trail marker was located.

Buildings and Structures

There are no buildings or structures at Governor Thomas Dudley State Park.

Roads

There are no roads in Governor Thomas Dudley State Park. The main entrance trail on the property, a former cart path, is wide enough at the entry to be gated, but it quickly narrows.

Parking

There is no parking on the DCR portion of Governor Thomas Dudley State Park. This parcel does not have frontage access on nearby Dudley Road.

One small unpaved parking area is located off of Dudley Road on the adjacent parcel owned by the Town of Billerica. This lot can fit approximately six vehicles.

Trails

There are 0.4 miles of trails in good to fair condition within Governor Thomas Dudley State Park (see Figure 8). With the exception of the main entrance trail, a former cart path, the trails are narrow in nature and do not appear to be extensively utilized. Primary use of these trails is for walking and hiking. These trails connect to a similar system of trails that fall on the DFG land, with some leading further north, into the Great Meadows Wildlife Refuge.

Signs and Kiosks

There is currently no signage at this facility of any kind, and as a result, visitors and local residents are not entirely familiar with the ownership or management of the property. There are no kiosks providing any information. The management agreement between the Town, DCR and DFG stipulated that the three agencies would provide identification and informational signage, as well as a trail map for the property, but it does not appear as if this occurred.

Memorials and Markers

There are no memorials and markers in Governor Thomas Dudley State Park.

9.4. Management Resources and Practices

See Section 2, Management Resources and Practices, for a description of the management resources and practices that apply to the entire Lowell/Great Brook Planning Unit.

The facility is managed by the Billerica Conservation Commission as per the management agreement between the Commonwealth and the Town. This agreement is supposed to be reviewed every five years; however DCR staff indicates that this does not currently occur.

Despite the lack of management responsibilities here, DCR Operations staff does periodically walk through the facility.

Natural Resources

The DCR does not actively manage the natural resources at this park.

Cultural Resources

The DCR does not actively manage the cultural resources at this park.

Recreation Resources

The DCR does not actively manage the recreational resources at this park. As per the management agreement, trails are to be managed by the Town of Billerica.

Hunting is not allowed at Governor Thomas Dudley State Park.

Infrastructure

With the exception of the small network of trails, there is no other infrastructure at this park to manage.

A trail map has not been created for Governor Thomas Dudley State Park, and there is no information on the DCR website for the park or its network of trails.

Interpretive Services

There are no interpretive services provided at Governor Thomas Dudley State Park, either by DCR, DFG or the Town of Billerica.

Operational Resources

DCR Staffing

Governor Thomas Dudley State Park does not have any full or part-time DCR staff on site.

Supplemental Staffing

The facility is managed by the Billerica Conservation Commission as per the management agreement between the Commonwealth and the Town. This management agreement is supposed to be reviewed by all parties every five years.

Public Safety

As per the management agreement between the DCR, DFG and Town of Billerica, the Town is responsible for policing the property and enforcing use restrictions.

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Pawtucket Falls and Gatehouse (Peter E. Lee; CC BY-NC 2.0; cropped from original)

SECTION 10. RECOMMENDATIONS

10.1. INTRODUCTION

The DCR has a broad and dynamic mission that encompasses resource protection, providing public access to recreational opportunities, and active forest management. This multi-faceted mission often results in complex management challenges. These responsibilities are central to the agency's mission and statutory charge.

To help meet this broad mission, the DCR has developed a two-tier system for guiding the management of all state forest and park properties under its care. The two systems, known as Landscape Designations and Land Stewardship Zoning, work in an integrated fashion to accommodate primary ecosystem services while recognizing and providing site-specific resource protection.

The application of Landscape Designations and Land Stewardship Zoning to properties within the Lowell/Great Brook Planning Unit is summarized below. For a more detailed description of Landscape Designations and Land Stewardship Zoning, please see Appendix I.

10.2. LANDSCAPE DESIGNATIONS

Applied statewide at the property level to assess and guide management activities throughout the DCR system, Landscape Designations are based on primary ecosystem services and guide management decisions based upon these services. The designations also communicate the agency's landscape-level management objectives to the public.

As a result of a robust public process called Forest Futures Visioning, the DCR established the following designations for properties under its jurisdiction:

Reserves. Properties designated as reserves provide backcountry recreational experiences and protect the least fragmented forested areas and diverse ecological settings. Successional processes are allowed to progress unimpeded by human disturbance, and are monitored to assess and inform long-term forest stewardship.

Woodlands. Woodlands demonstrate exemplary forest management practices for landowners and the general public, while supporting the range of ecosystem services that sustainably-managed forests

offer, including a diversity of native species and age classes, and compatible recreational opportunities.

Parklands. Areas designated as parklands focus on providing public recreational opportunities while protecting resources of ecological and cultural significance.

Selection criteria and management guidelines for all three landscape designations are described in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines* (DCR 2012*b*).

Applied Landscape Designations

All properties within the Lowell/Great Brook Planning Unit have been designated as Parklands.

10.3. LAND STEWARDSHIP ZONING

Land Stewardship Zoning, and the resource management planning process of which it is a part, addresses the agency's statutory responsibilities in M.G.L. Chapter 21: Section 2F. The legislation requires the DCR to prepare management plans that encompass all reservations, forests and parks; provide for the protection and stewardship of natural, cultural and recreation resources under the agency's management; and ensure consistency between recreation, resource protection and sustainable forest management.

Land Stewardship Zoning Guidelines

The Land Stewardship Zoning Guidelines define three types of zones to ensure resource protection based upon site-specific field data and provide guidance for current and future management based upon resource sensitivities. The inventory and assessment of resources during the preparation of an RMP is factored into land use management and decision-making, and provides guidance for stewardship of these resources. The process results in zoning of areas and specific sites within DCR properties based on their sensitivity to recreational and management activities that are appropriate for each facility as recognized during the RMP process. In this way, the Land Stewardship Zoning system helps to ensure that recreational and management activities do not degrade various resources and values.

The three land stewardship zones provide a general continuum to categorize resources (relative to potential degradation from human activities) from undisturbed sites with highly sensitive resources, through stable/hardy resources, to sites that have been developed and are consistently used for intensive recreation or park administration purposes. The Land Stewardship Zoning system also includes Significant Feature Overlays that may be applied to highlight resource features that have been assessed and documented by professional resource specialists.

Below is a description on the various zones used for Land Stewardship Zoning.

Zone 1

Management Objective. Protection of sensitive resources from management, or other human activities, that may adversely impact the resources.

General Description. This zone encompasses areas with highly sensitive ecological and cultural resources that require additional management approaches and practices to protect and preserve the special features and values identified in the RMP. Zone 1 areas are not suitable for future intensive development.

Examples. Examples identified as being highly sensitive to human activities include rare species habitat or natural communities, areas with concentrations of sensitive aquatic habitats, excessively steep slopes with erodible soils, and archaeological sites or fragile cultural sites, where stewardship of these resources must be the primary consideration when assessing management and recreational activities in these areas.

Zone 2

Management Objective. Provide for a balance between the stewardship of natural and cultural resources and recreational opportunities that can be appropriately sustained.

General Description. This zone encompasses stable yet important natural and cultural resources. Zone 2 is a very important component to the DCR's management responsibilities, because the protected landscape within this zone provides a buffer for sensitive resources, recharge for surface and groundwater, and large areas where existing types of public recreational activities can be managed at sustainable levels.

Examples. Examples include areas of non-intensive use that contain diverse ecosystems, rare species habitat that is compatible with dispersed recreation and sustainable management practices, and cultural resources that are not highly sensitive to human activities.

Zone 3

Management Objective. Provide public access to safe and accessible recreational opportunities, as well as administrative and maintenance facilities that meet the needs of DCR visitors and staff.

General Description. This zone includes altered landscapes in active use and areas suitable for future administrative, maintenance and recreation purposes. The resources in this zone can accommodate concentrated use and require regular maintenance by DCR staff.

Examples. Examples of areas of concentrated use include park headquarters and maintenance areas, parking lots, swimming pools and skating rinks, paved bikeways, swimming beaches, campgrounds, playgrounds and athletic fields, parkways, golf courses, picnic areas and pavilions, and concessions. Examples of future use areas include disturbed sites with no significant ecological or cultural values that are not suitable for restoration, identified through the RMP or in a Master Plan as being suitable for intensive recreation or park administration sites. Note that development would be preceded by detailed site assessments to ensure protection of natural and cultural resources.

Significant Feature Overlays

Management Objective. Provide precise management guidance in order to maintain or preserve recognized resource features, regardless of the zone in which they occur.

General Description. The three land stewardship zones may be supplemented with Significant Feature Overlays that identify formally designated or recognized resources. These resource features have been recognized through research and assessment by professional resource specialists. Information on the significant features is brought into the RMP process via review of previous research projects and associated designations.

Examples. A natural or cultural resource, recognized through professional inventory or research, which cuts across more than one land stewardship zone, or which is located in an area characterized by intensive visitor use. In the latter case, the Significant Feature Overlay is used to highlight the potential conflict between resource stewardship and ongoing visitor use, and provide mitigation strategies. Examples include:

- National Register Historic District.
- Areas subject to public drinking water regulations.
- Priority Habitat for species that are not sensitive to human activities.
- BioMap 2 Core Habitat.
- Designated Areas of Critical Environmental Concern.
- A NHESP Priority Natural Community associated with a summit that is also a popular destination for hikers.
- A barrier beach that provides habitat for rare shorebirds and is subject to CZM barrier beach management guidelines and coastal wetlands regulations, but also supports thousands of visitors during the summer season.
- A significant cultural site such as Plymouth Rock that is subject to ongoing, intensive visitation.
- A natural or cultural resource, recognized through professional inventory or research, which is located in an area characterized by intensive visitor use.

Applied Land Stewardship Zoning

The following Land Stewardship Zoning is recommended for properties in the Lowell/Great Brook Planning Unit. A figure (i.e., Figure 9, 10 and 11) accompanies each property with more than one type of zoning. The remaining properties, which only have one type of zoning, do not have a corresponding figure.

Lowell-Dracut-Tyngsborough State Forest

Zone 1. Spruce Swamp, home to several rare species and a rare Priority Natural Community, is designated a Zone 1 (see Figure 9).

Zone 2. The remainder of the forest is designated a Zone 2; it is not particularly sensitive or heavily developed.

Zone 3. The former headquarters site, the main parking area for the forest, located at the end of Trotting Park Road (Lowell), and the area containing the Dracut Water Supply District's infrastructure are designated a Zone 3 (see Figure 9).

Significant Feature Overlay. There are no significant feature overlays.

Lowell Heritage State Park

Zone 1. No sections of the park have been designated a Zone 1.

Zone 2. No sections of the park have been designated a Zone 2.

Zone 3. The entire park has been designated a Zone 3. While it is historically significant, it is also an integral part of a heavily developed urban landscape.

Significant Feature Overlay. There are no significant feature overlays.

Great Brook Farm State Park

Zone 1. Due to the sensitivity of the area around "The City," it is designated a Zone 1 (see Figure 10).

Zone 2. The remainder of the park is designated a Zone 2; it is not particularly sensitive or heavily developed.

Zone 3. The portion of the park that includes the active farm complex, the Hart Barn, the North Schoolhouse (home of the park headquarters), and the two largest parking areas in the park, are all designated a Zone 3 (see Figure 10).

Significant Feature Overlay. There are no significant feature overlays.

Carlisle State Forest

Zone 1. No sections of the forest have been designated a Zone 1.

Zone 2. The entire forest has been designated a Zone 2; it is not particularly sensitive or heavily developed.

Zone 3. No sections of the forest have been designated a Zone 3.

Significant Feature Overlay. There are no significant feature overlays.

The Land Stewardship Zoning for Carlisle State Forest should be reviewed following the recommendation to update the large tree inventory, in order to determine if there should be a Zone 1 designation or a Significant Feature Overlay to encompass these resources.

Warren H. Manning State Forest

Zone 1. No sections of the forest have been designated a Zone 1.

Zone 2. The remainder of the forest outside of the active recreation area has been designated a Zone 2; it is not particularly sensitive or heavily developed.

Zone 3. The active recreation area, including the parking lot, spray deck and picnic area, has been designated a Zone 3 (see Figure 11).

Significant Feature Overlay. There are no significant feature overlays.

Billerica State Forest

Zone 1. No sections of the forest have been designated a Zone 1.

Zone 2. The entire forest has been designated a Zone 2; it is not particularly sensitive or heavily developed.

Zone 3. No sections of the forest have been designated a Zone 3.

Significant Feature Overlay. There are no significant feature overlays.

Governor Thomas Dudley State Park

Zone 1. No sections of the park have been designated a Zone 1.

Zone 2. The entire park has been designated a Zone 2; it is not particularly sensitive or heavily developed.

Zone 3. No sections of the park have been designated a Zone 3.

Significant Feature Overlay. There are no significant feature overlays.

Placeholder for Figure 9.

Placeholder for Figure 10.

Placeholder for Figure 11.

10.4. MANAGEMENT RECOMMENDATIONS

Management Principle

The resource management planning process for the Lowell/Great Brook Planning Unit resulted in the following management principle:

Protect the natural and cultural resources of the planning unit and provide enhanced recreational and educational opportunities for visitors through the creative use of state resources and partnerships.

Management Goals

The following management goals have been identified to achieve the management principle. These goals are of equal importance, and are not presented in order of priority.

Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.

Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.

Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.

Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.

Recommendations

These management recommendations have been organized first by the planning unit in its entirety, for those that apply to all or most of the properties, and then by individual property. Each set of recommendations is presented by the management goals identified for the planning unit.

Recommendations are also characterized on the basis of priority (i.e., high, medium or low) and resource availability. High priority recommendations are those that address regulatory compliance or public health and safety; prevent immediate damage to, or loss of, resources; or repair or replace damaged equipment or systems critical to operations. They are typically time sensitive. Medium priority recommendations maintain existing resources and visitor experiences. Low priority recommendations enhance resources or visitor experiences; they are not time sensitive.

Resource availability considers both funding and labor. A resource availability of one (1) indicates that funding and/or labor are available to implement the recommendation. A resource availability of two (2) indicates that funding and/or labor are not currently available, but may become so in the near future (i.e., the next five years). A resource availability of three (3) indicates that funding and/or labor are not anticipated in the next five years. Resources to implement these recommendations may, or may not, become available after five years.

Table 10.1. Recommendations for the Lowell/Great Brook Planning Unit[a]

Recommendation	Priority[b]	Resources[c]	Implementation[d]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Complete the certification process for the potential vernal pools within the planning unit.	M	2	P, M, V
Develop a Vegetation Management Plan to address the invasive species observed within the planning unit.	M	2	P, C, F
Undertake a mapping effort to document the stone walls located on these properties and record their condition.	L	3	P, F
Review and apply the Best Management Practices developed by the Office of Cultural Resources for stone wall protection.	M	1	P, M
Explore the use of technology to make interpretive materials and trail maps readily available, such as using QR codes to direct visitors to online self-guided tours.	L	2	M, X
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.			
Review and update or create, where appropriate, a trail map for each of the properties in the planning unit and make the maps available through multiple outlets.	H	1	M, X
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
There are no recommendations associated with this goal.	-	-	-
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.			
Fill the Metro West District Ranger position.	H	3	M
Establish webpages on the DCR website for the properties in the planning unit that currently do not have a webpage.	H	1	M, X
Establish relationships with local neighborhood associations and other local citizens groups that are interested in these properties.	H	1	M, X

a. These recommendations apply to all, or most, properties in the planning unit.
b. Priorities are High (H), Medium (M), or Low (L).
c. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the near future; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.
d. The following codes identify the party or parties responsible for implementing the recommendation: C = Contractor; E = Division of Engineering; F = Bureau of Forest Fire Control and Forestry; L = Office of the General Counsel; M = Division of MassParks; O = Other; P = Bureau of Planning, Design and Resource Protection; U = Universal Access Program; V = Volunteer or partner; and X = Office of External Affairs and Partnerships.

Table 10.2. Recommendations for Lowell-Dracut-Tyngsborough State Forest

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Work with the Natural Heritage & Endangered Species Program to conduct a survey for the blue-spotted salamander.	M	2	P, M, O, V
Investigate the nature and extent of the Coburn mill site.	L	2	P, M
Acquire additional land in the southern part of the forest, if necessary, in order to protect the Coburn mill site.	L	2	P, L
Remove the debris at the former headquarters site that poses a threat to significant resources (i.e., the pump house cellar hole) and public safety (i.e., glass bottles).	H	1	M, V
Undertake further research on the cellar holes that were not located during the fieldwork for this plan.	L	3	P, M
Stabilize the walls and remove the vegetation from the forest's CCC water holes.	M	2	P, M
Address the culverts within the forest that are blocked and/or collapsing.	H	2	P, M, E
Reposition and clean, where applicable, the stone markers within the forest.	L	2	P, M
Remove the graffiti from Sheep Rock and work with the Environmental Police to curb the illegal activities that take place at the site.	H	2	P, M, O
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.			
Work with the Environmental Police to curb the illegal recreation activities (e.g., off-highway vehicle use and paintball games) taking place at the forest.	H	1	M, O
Post signs that clearly indicate the boundary of the forest's "No Hunting Areas."	H	1	M, F, V
Formalize the main parking area at the forest's main entrance on Trotting Park Road in Lowell; consider signing and expanding the area, lining the spaces and designating at least one accessible space.	H	2	P, M, C
Investigate the options for establishing a more suitable parking area on Trotting Park Road in Tyngsborough, as well as additional formal parking areas within the forest.	L	1	P, M
Improve the trail signage within the forest, adding trail names and intersection numbers where appropriate.	H	2	M, F, V
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
Investigate the options for removing the illegal dam on Trotting Park Road in Tyngsborough.	M	1	E

Continued on next page.

Table 10.2. Recommendations for Lowell-Dracut-Tyngsborough State Forest (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.			
Renew the agreement with the Greater Lowell Indian Cultural Association (GLICA).	H	2	M, L
Work with the Dracut Water Supply District to address and resolve the issues surrounding the current location of their water supply infrastructure.	M	2	M, L
Establish a formal agreement with the Dracut Water Supply District regarding their access to and maintenance of the water supply infrastructure located on Gage Hill.	M	2	M, L
Arrange a meeting between the Dracut Water Supply District and appropriate DCR staff to discuss their need to replace the reservoir at the forest.	H	1	M, L
Work with the Merrimack Valley Chapter of the New England Mountain Bike Association to review and approve, where appropriate, the existing technical features in the forest.	H	1	P, M, L
Develop a formal agreement with the Merrimack Valley Chapter of the New England Mountain Bike Association regarding the review and approval of their trail maintenance, repair and construction projects within the forest.	H	1	P, M, L
Install an updated DCR Main Identification sign and several new Road Marker signs at the forest.	M	1	M, O

a. Priorities are High (H), Medium (M), or Low (L).
b. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the near future; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.
c. The following codes identify the party or parties responsible for implementing the recommendation: C = Contractor; E = Division of Engineering; F = Bureau of Forest Fire Control and Forestry; L = Office of the General Counsel; M = Division of MassParks; O = Other; P = Bureau of Planning, Design and Resource Protection; U = Universal Access Program; V = Volunteer or partner; and X = Office of External Affairs and Partnerships.

Table 10.3. Recommendations for Lowell Heritage State Park

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Assess the condition of the interior and exterior of the Rynne bathhouse and make repairs, where necessary.	H	2	P, E, M
Renovate the public restrooms in the Rynne bathhouse to make them universally accessible.	H	3	P, E, M
Coordinate with the National Park Service on the repair of the cracked end wall of the Pawtucket Gatehouse.	M	2	P, E, M, V
Coordinate with the National Park Service on the development and implementation of a preservation plan for the Hamilton Wasteway Gatehouse.	H	1	P, E, M, V
Coordinate with the National Park Service on the removal of Boston ivy from the Boott Dam Gatehouse.	M	2	P, E, M, V
Coordinate with the National Park Service on assessing the impacts to the Northern Canal Wasteway Gatehouse, and design and implement a permanent solution to stabilize the building.	H	3	P, E, M, V
Work with Boott Hydropower, Inc. to assess the condition of the Lowell Canal System and make repairs, where necessary.	L	3	P, E, M, V
Work with Boott Hydropower, Inc. to implement the recommendations featured in the DCR's Office of Dam Safety dam inspection reports for the Northern Canal Great Wall, Guard Locks, Swamp Locks and Lower Locks dams.	M	3	P, E, M, V
Repair the steel rail and granite post fences at the Mack plaza and Victorian garden.	H	3	P, E, M, C
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.			
Post fish consumption advisory signs in multiple, locally spoken languages at popular fishing spots along the Merrimack River and Lowell Canal System.	H	1	M, X, V
Maintain the plantings within the Victorian garden to reflect the original design of the space and replace plant material, as needed.	M	2	P, M, V
Ensure that all of the violations noted in the most recent inspection of the Lord pool are addressed in the upcoming modernization project.	H	1	E, C
Install a bike rack at the Lord pool.	M	2	P, M, C, V
Plant additional trees or construct a shade structure(s) in the lawn surrounding the Lord pool.	L	3	P, M, C, V
Update the inventory of benches on the Vandenberg esplanade and make repairs, or replacements, where necessary.	H	2	P, M, C, V
Work with the Department of Transportation and City of Lowell to improve the parking area at regatta field.	M	2	M, O, C
Assess and repair, where necessary, the condition of the Scott Finneral Memorial Riverwalk.	M	2	P, M, C
Consider adding a formal, off-road connection between the Scott Finneral Memorial Riverwalk and the eastern end of the Vandenberg esplanade.	L	3	P, M
Consider options, such as the DCR's Matching Funds Program, for acquiring a small, motorized boat for public safety purposes at Rynne beach.	M	3	P, M, X
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
Complete an assessment of the Merrimack River retaining wall and make repairs, where needed.	M	2	M, E

Continued on next page.

Table 10.3. Recommendations for Lowell Heritage State Park (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.			
Determine the owner of the Hadley House and establish an agreement that guides the management and use of the building.	H	1	P, M, L
Meet with the University of Massachusetts Lowell to develop and implement a preservation plan for the eastern section of the wall in the Tremont Yard parking area.	M	2	P, M, L
Meet with Tremont Yard, LLC to discuss ways in which the preserved, below grade water power features within the Jeanne D'Arc Credit Union can be promoted.	L	2	M, L
Install DCR signs at the parking areas along the Vandenberg esplanade, next to the Lord pool and on Broadway Street.	H	2	M, O
Install gates at the parking areas next to the Lord pool and on Broadway Street.	H	3	M, C
Install an updated Main Identification Sign at Francis Gate Park.	M	2	M, O
Establish an agreement with Lowell General Hospital regarding the placement and maintenance of their three-sided directional sign.	M	2	M, L
Replace the bronze plaque for the brick vault.	L	3	P, M
Confirm that the namesake of the Vandenberg esplanade is Hoyt S. Vandenberg and update DCR signage to reflect the full and proper name of the esplanade, where needed.	L	3	P, L, O
Renew the agreements with the City of Lowell related to their management of the regatta field and Rynne beach, as well as their use of the Rynne bathhouse.	H	1	M, L
Renew the agreement with the stakeholders in the Lowell Canal System.	H	1	M, L
Renew the agreement with the New England Electric Railway Historical Society / Seashore Trolley Museum.	H	1	M, L
Establish an agreement with the Boston & Maine Railroad Historical Society regarding their maintenance of the B&M 410.	H	2	M, L
Finalize the transfer of the Bellegarde boathouse, obtaining a copy of the items listed in Section 4.4. and executing the care, custody, management and control agreement.	H	1	L
Work with the National Park Service to establish signage at the visitor center lot that indicates the parking area is open to state park visitors.	M	2	M, V

a. Priorities are High (H), Medium (M), or Low (L).
b. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the near future; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.
c. The following codes identify the party or parties responsible for implementing the recommendation: C = Contractor; E = Division of Engineering; F = Bureau of Forest Fire Control and Forestry; L = Office of the General Counsel; M = Division of MassParks; O = Other; P = Bureau of Planning, Design and Resource Protection; U = Universal Access Program; V = Volunteer or partner; and X = Office of External Affairs and Partnerships.

Table 10.4. Recommendations for Great Brook Farm State Park

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Work with the DCR Lakes and Ponds program to assess the water chestnut growth in Meadow Pond and make a plan for eradication.	M	1	P, O, M
Undertake a hydrological study to gain a complete understanding of water flow through the park, assessment of existing culvert capacity and impacts to trails, and make recommendations for improvements.	H	3	P, C
Revisit the draft Comprehensive Interpretive Plan; revise and update it as necessary and finalize.	H	1	M
Develop interpretive programs, opportunities and products as identified in the Comprehensive Interpretive Plan, working to expand interpretive offerings beyond the "smart" barn tours.	H	2	M
Clear the debris currently built up around the beaver deceivers to maintain water flow and keep them operational.	H	1	M, C
Make sure park and regional staff are aware of local scenic road designations and local review requirements.	L	1	P, M
Remove leaf and brush debris from all cellar holes and routinely monitor these sites for other disturbances.	M	2	M
Routinely monitor the Adam's Mill dam site for stability and potential disturbances.	M	2	M
Routinely monitor "The City," particularly the Garrison House site, for stability and potential disturbances.	H	1	M, P
Remove the broken sign at the Garrison House site.	H	1	M
North Schoolhouse: Carefully remove the English ivy from the walls, with guidance from the DCR's Office of Cultural Resources.	H	2	M, P
North Schoolhouse: Assess the condition of the chimney, and identify and address the moisture issue that is causing the spalling.	M	2	P, E
Main Farm Area: Request a reevaluation of the Main Farm Area for National Register eligibility by the Massachusetts Historical Commission, and complete a nomination if still deemed eligible.	L	3	P
Hart Barn: Replace the roofing shingles on the north side of the barn.	M	2	E, C
Hart Barn: Assess the effectiveness and stability of the recent mortar repairs.	M	2	E
Main Farm House: Install an appropriate gutter, with guidance from the DCR's Office of Cultural Resources.	H	2	P, V, C
Main Farm House: Clean the lichen growth that has appeared on the walls of the house.	M	2	V
Main Farm House: Complete minor repairs to the siding and the front door sill, with guidance from the DCR's Office of Cultural Resources.	H	2	P, V, C
Tie Stall Barn: Undertake selective siding repair, with guidance from DCR's Office of Cultural Resources.	M	3	P, V, C
Tie Stall Barn: Replace the roofing shingles on the north side of the barn.	M	2	E, V, C
Tie Stall Barn: Assess the stability of the foundation in areas where it has visibly been compromised and repair as necessary, with guidance from the DCR's Office of Cultural Resources.	H	1	P, E, V, C
Pole Barn: Carefully remove vegetation from the rear façade.	L	3	V
Duck Coop: Assess the stability of the foundation.	L	3	E
Duck Coop: Work with the farmer to determine if any new uses are possible for this building.	L	2	P, E, V, M
Silos: Assess structural stability of each and explore possible interpretive opportunities with farmer, park, and interpretive staff.	M	2	E, M, V

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Table 10.4. Recommendations for Great Brook Farm State Park (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Silos: Assess structural stability of each and explore possible interpretive opportunities with farmer, park, and interpretive staff.	M	2	E, M, V
Litchfield House: Complete repairs to the barn.	H	2	V, P
Litchfield House: Clean the lichen growth that has appeared on the walls of the house.	M	2	V
Litchfield House: Identify the cause of the lichen growth on the roof and address.	M	2	V, P
Litchfield House: Assess the chimneys to determine if any repairs are necessary.	M	3	V, P
Cemetery: Apply the BMP developed by the office of Cultural Resources.	L	1	M, P
Working with the local fire department and the conservation commission, revisit the suggestion to dredge the duck pond for emergency firefighting use.	H	3	E, F, M, O, P
Keep the vegetation on Old North Road trimmed back to ensure emergency access capabilities.	H	2	M
Review all buildings for visibility of street numbers, and correct where needed.	H	1	M
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.			
Working with the Lakes and Ponds program, determine if a new canoe launch should be designed and installed to reopen Meadow Pond for recreational boating.	M	1	M, O
Develop a trails plan, assessing trail density and incorporating critical information developed through the hydrological study to better address areas that have trail washout problems.	H	2	P
Work with the local equestrian community to formalize the maintenance of the horse jumps, and prune the vegetation growth around them.	M	1	M, X, V
Securely cover the open well located southeast of the Litchfield House.	H	1	M
Reassess all boardwalk crossings to identify older ones in need of replacement, including those on the Acorn Trail.	H	1	M
Continue to work with the cross-country ski concessionaire to assess and continue to improve upon separation of winter uses on the trail system.	M	2	M, X
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
Routinely monitor the area around the rock shelters for possible illicit activities.	M	1	M
Former Regional HQ Site: Remove the former sign holder and pavement to let the site return to a natural state.	H	2	M, E
Tie Stall Barn: Address the outstanding permit issues for the event space and renew discussions about future use.	H	2	V, E, M
Farnham Smith's Cabin: Undertake a structural assessment, feasibility study and code analysis to determine if reuse is possible and develop some potential options.	H	2	P, E, M
Cabin Shed: Access and clean out the interior of the shed, so that it does not become a potential nuisance.	H	1	M
Boat House: Complete and submit an MHC inventory form.	H	1	P
Boat House: Undertake demolition.	H	2	E, C
District 6 Fire Control Office: Assess for any reuse possibilities by the park and/or the region, such as accommodating the storage needs currently being met by the Hadley House and the Anderson Barn.	H	2	F, M, P

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Table 10.4. Recommendations for Great Brook Farm State Park (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
Hadley House: Investigate alternative uses of the property, possibly making it available to be moved. If not possible, identify a funding source for demolition before it becomes an attractive nuisance.	H	2	P, M, E
Manseau House: Assess for inclusion in the Historic Curatorship Program. If not a good candidate, identify a funding source for demolition before it becomes an attractive nuisance.	H	2	P, M, E
North Farm House and Barn: Make sure the buildings are secure and routinely monitored to ensure they are not damaged or broken into.	H	1	M
North Farm House and Barn: Work with current long-term lease holders of other facilities within the park to identify any potential complementary reuses for this property, and explore putting out a Request for Proposals.	H	1	P, X, M
Anderson Barn: Explore any potential interest in, and options for, permitting use of the barn by others, and relocate current storage closer to the Park Headquarters.	H	2	P, M
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.			
Conduct annual meetings with lease holders and annual property inspections of leased property as specified in lease agreements and permits.	H	1	M, L
Twice a year, hold a joint meeting of park staff and all leaseholders, to maintain the lines of communication among all parties and make sure that everyone is aware of activities, events, or other projects that have the potential to impact each other.	M	1	M, X
Encourage and support the re-establishment of a Friends of Great Brook Farm State Park.	L	1	M, X
Pine Point Loop Parking Area: Streamline the signage as to not visually overwhelm visitors, but still inform them.	M	1	M, X
Main Parking Area: Streamline the signage as to not visually overwhelm visitors, but still inform them.	M	1	M, X
Litchfield House: Identify joint interpretive and public programming opportunities with the Curators that enhance interpretive activities while promoting DCR's Historic Curatorship Program.	L	1	P, M, V, X
Hounds House: Update and renew the expired lease agreement with the Old North Bridge Hounds.	H	1	L

a. Priorities are High (H), Medium (M), or Low (L).

b. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the near future; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.

c. The following codes identify the party or parties responsible for implementing the recommendation: C = Contractor; E = Division of Engineering; F = Bureau of Forest Fire Control and Forestry; L = Office of the General Counsel; M = Division of MassParks; O = Other; P = Bureau of Planning, Design and Resource Protection; U = Universal Access Program; V = Volunteer or partner; and X = Office of External Affairs and Partnerships.

Table 10.5. Recommendations for Carlisle State Forest

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Update the inventory of the large eastern white pine trees, last done in 1980.	H	1	F
After completing the tree inventory update, revisit the Land Stewardship Zoning to determine if any changes are applicable.	H	1	P, F
Establish a Continuous Forest Inventory (CFI) plot within the forest.	L	2	F
Develop an interpretive program around the natural and cultural history of the Carlisle Pines.	L	1	M, P
Monitor and assess red pine stands within the forest; manage if necessary for public safety or ecological need.	M	1	F
Monitor for invasive pests, especially hemlock wooly adelgid. Propose biological or chemical controls, if warranted, on the specimen trees.	H	1	F
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.			
Develop and install an informational kiosk that includes interpretive information, for installation within the interior of the property.	M	2	M
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
There are no recommendations associated with this goal.	-	-	-
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.			
Clear the vegetation from around the former DEM sign stanchion and hang a new DCR Main Identification sign from the existing sign stanchion.	H	1	M
Continue to partner with the Carlisle Trails Committee for assistance with trail work.	M	1	M, P, X,

a. Priorities are High (H), Medium (M), or Low (L).
b. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the near future; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.
c. The following codes identify the party or parties responsible for implementing the recommendation: C = Contractor; E = Division of Engineering; F = Bureau of Forest Fire Control and Forestry; L = Office of the General Counsel; M = Division of MassParks; O = Other; P = Bureau of Planning, Design and Resource Protection; U = Universal Access Program; V = Volunteer or partner; and X = Office of External Affairs and Partnerships.

Table 10.6. Recommendations for Warren H. Manning State Forest

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Undertake further research on the outbuilding foundation located near Spruce Pond to determine if it has any connection to Warren Manning.	L	2	P
Clean up the dumping debris located off of Rangeway Road and continue to monitor the area for illegal dumping.	H	2	M
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.			
Establish designated accessible spaces in the parking lot, the total number to be determined in consultation with the DCR's Universal Access Program.	H	1	E, U
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
Assess the accessibility and potential uses of the portion of the state forest west of Route 3, and evaluate options to better utilize this space and/or establishing connections to other nearby open space.	L	2	P, M, V, X
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.			
Work with the Town of Billerica to get a Special Use Permit in place, formalizing their operation of the recreation area.	H	1	L, M
Hold bi-annual meetings with the Town of Billerica Recreation Department to discuss programs, events and the maintenance and operation of the recreation area.	H	1	M, X
Provide DCR information on the informational kiosk.	H	1	X

a. Priorities are High (H), Medium (M), or Low (L).
b. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the near future; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.
c. The following codes identify the party or parties responsible for implementing the recommendation: C = Contractor; E = Division of Engineering; F = Bureau of Forest Fire Control and Forestry; L = Office of the General Counsel; M = Division of MassParks; O = Other; P = Bureau of Planning, Design and Resource Protection; U = Universal Access Program; V = Volunteer or partner; and X = Office of External Affairs and Partnerships.

Table 10.7. Recommendations for Billerica State Forest

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Carefully clean the lichen from the Rowell Memorial Stone.	L	1	P, M
Document the network of historic forest roads on a MHC inventory form.	L	2	P
Clean up illegal camping debris located near the top of Gilson Hill.	M	1	M
Dismantle the fire ring located at the top of Gilson Hill to discourage use.	H	1	M
Clean up the dumping debris located adjacent to Winning Street and continue to monitor the area for illegal dumping.	H	2	M
Develop interpretive materials to tell the story of this land and the establishment of the forest – it is an interesting piece of Billerica history.	L	2	M
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.			
Establish a system of routine trail maintenance to address the high percentage of trails in poor condition, possibly partnering with other organizations such as the Student Conservation Association or other local organizations for assistance with specific projects.	M	3	M, P
Consider moving the northernmost DCR gate on Treble Cove Road further into the property by 25 to 50 feet to make room for the establishment of a small formal parking area to facilitate safe access to the forest.	M	3	M, E, C
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
Assess the accessibility and potential uses of the portion of the state forest west of Route 3, and evaluate options to better utilize this space and/or establishing connections to other nearby open space.	L	2	P, M, V, X
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.			
Monitor the area for future illegal camping activities, engaging local residents and police for additional assistance.	M	1	M
Identify an appropriate location and install a DCR Main Identification sign for the forest.	H	1	M

a. Priorities are High (H), Medium (M), or Low (L).
b. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the near future; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.
c. The following codes identify the party or parties responsible for implementing the recommendation: C = Contractor; E = Division of Engineering; F = Bureau of Forest Fire Control and Forestry; L = Office of the General Counsel; M = Division of MassParks; O = Other; P = Bureau of Planning, Design and Resource Protection; U = Universal Access Program; V = Volunteer or partner; and X = Office of External Affairs and Partnerships.

Table 10.8. Recommendations for Governor Thomas Dudley State Park

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Goal 1. Preserve natural and cultural resources through appropriate stewardship strategies.			
Conduct further research on the historic drive and allee of trees to determine if it is a remnant of Greenwood Grove.	L	2	P
Develop interpretive materials to tell the story of this property and the connection to Governor Dudley.	M	2	M
Goal 2. Offer diverse recreational opportunities and facilities to ensure visitor safety and access.			
In coordination with abutting property owners, establish a system of routine trail maintenance for the park, possibly partnering with other organizations such as the Student Conservation Association for assistance with specific projects.	M	3	M, X, V
Goal 3. Address underutilized buildings and structures to improve visitor experiences and DCR operational responsibilities.			
There are no recommendations associated with this goal.	-	-	-
Goal 4. Improve engagement with partners, stakeholders, visitors and volunteers.			
Hold an annual meeting with the MA Department of Fish & Game and the Town of Billerica Conservation Commission to discuss any issues, plans or projects.	H	1	M
With the MA Department of Fish & Game and the Town of Billerica Conservation Commission, conduct the stipulated five-year review of the management agreement.	H	1	M, L
Establish and maintain an active relationship with the Sudbury, Assabet and Concord Wild & Scenic River Stewardship Council.	M	2	M
Establish and maintain active communication with US Fish & Wildlife about the resources in this general area and potential collaborative efforts.	M	2	M, P
Working with the MA Department of Fish & Game and Town of Billerica, identify an appropriate location and install a DCR Main Identification sign for the park that recognizes the partners.	H	2	M

a. Priorities are High (H), Medium (M), or Low (L).
b. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the near future; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.
c. The following codes identify the party or parties responsible for implementing the recommendation: C = Contractor; E = Division of Engineering; F = Bureau of Forest Fire Control and Forestry; L = Office of the General Counsel; M = Division of MassParks; O = Other; P = Bureau of Planning, Design and Resource Protection; U = Universal Access Program; V = Volunteer or partner; and X = Office of External Affairs and Partnerships.