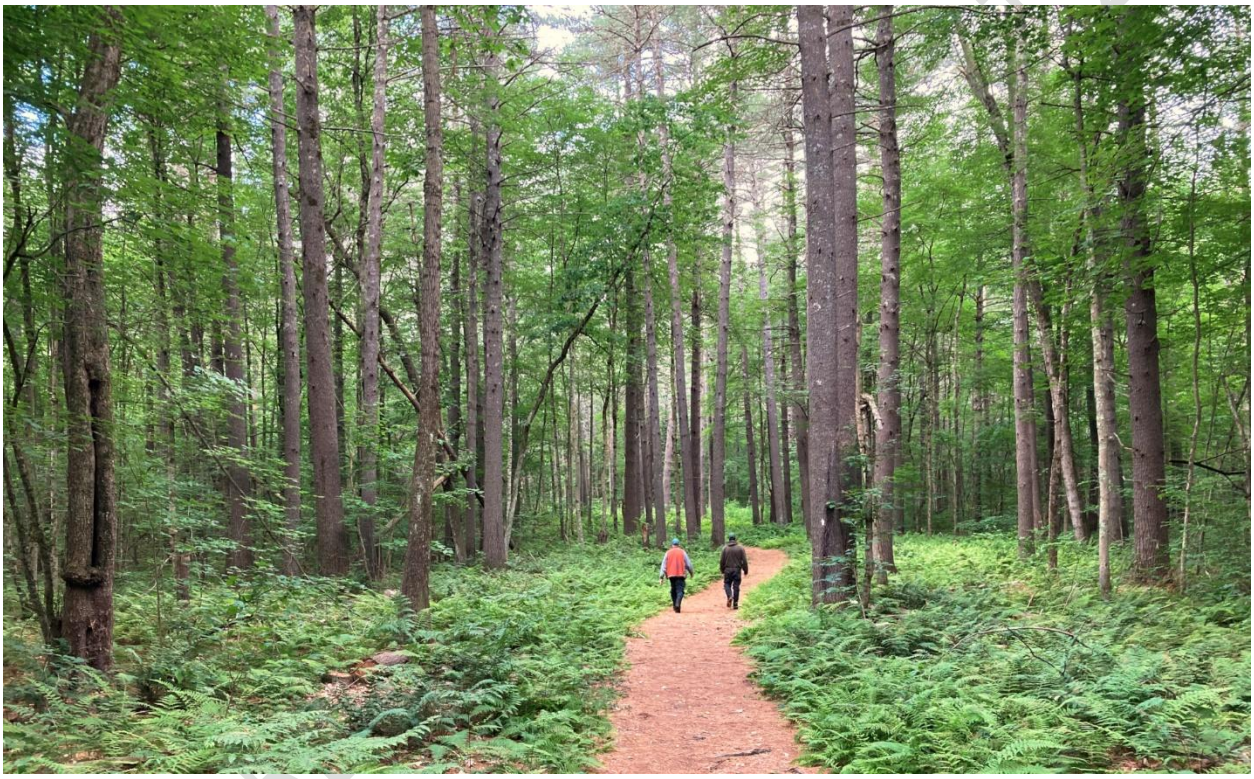
dcr
Massachusetts

Resource Management Plan
J. Harry Rich State Forest



Adopted by the DCR Stewardship Council Month, 2025

Massachusetts Department of Conservation and Recreation
Division of Conservation and Resource Stewardship
Office of Cultural Resources

Maura T. Healey, Governor
Kimberley Driscoll, Lieutenant Governor
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Purpose

Resource Management Plans (RMPs) are foundational documents that identify a park, forest, or reservation's defining natural, cultural, and recreational resources and identify potential threats and opportunities to guide DCR's continued stewardship of the property and to inform future decisions about the property in a way that celebrates and preserves its identity.

RMPs are prepared for "all reservations, parks, and forests under the management of the department" (M.G.L. c. 21, § 2F). These plans "shall include guidelines for the operation and land stewardship of the aforementioned reservations, parks and forests, shall provide for the protection and stewardship of natural and cultural resources and shall ensure consistency between recreation, resource protection, and sustainable forest management." DCR finalizes RMPs following a public process and adoption by the DCR Stewardship Council. The contents of this RMP represent the best available information at the time of adoption by the Stewardship Council.

Mission and Core Principles

The Massachusetts Department of Conservation and Recreation, an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, dams, parkways, and over 100 National Register listed properties. The agency's mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources for the well-being of all.

DCR strives to be an exemplary leader in conservation and recreation. DCR's staff is passionate, dedicated, and continuously employs best practices, expertise, and a sense of place in carrying out the mission. The following core principles ground the agency in its work. For the benefit and well-being of all—people and the environment—DCR pledges to:

- Provide access to a diversity of outdoor recreational experiences and unique landscapes that is equitable, inclusive, and welcoming.
- Conserve lands, water, and forests by integrating science, research, and technical expertise into the management of our natural resources.
- Advance climate change mitigation and adaptation efforts by implementing sustainable practices and advancing resiliency across our infrastructure, assets, and resources.
- Support healthy communities by providing places for people to connect with nature and each other.
- Inspire generations of stewards by recognizing and honoring our legacy through partnerships, public engagement, and education.

Stewardship

DCR honors Indigenous peoples for their care, throughout many generations, of the land that DCR now stewards on behalf of the people of the Commonwealth. DCR embraces this legacy of stewardship, fostering a sense of shared responsibility by all people for protection of the waters, lands and living things for the enjoyment and appreciation of all.

To learn more about the DCR, its facilities, and programs please visit us at www.mass.gov/dcr. Contact us at mass.parks@mass.gov.

J. Harry Rich State Forest

1. Property Overview

Characteristic	Value
Date Established	1981
Location	Groton, Pepperell
Ecoregion	New England Coastal Plains and Hills
Watershed	Nashua
DCR Region	Central
DCR District	Central Highlands
DCR Complex	Otter River
Management Forestry District	Northeast
Fire Control District	North Middlesex
Size (acres)	464.3
Boundary Length (miles)	10.7
Elevation - Minimum (feet)	197.2
Elevation - Maximum (feet)	278.9
Environmental Justice (acres)	0.0
Estimated Annual Attendance (2023)	10,000
Interpretive Programs (# programs, 2023)	0
Interpretive Programs (# attendees, 2023)	0

2. Landscape Designations

Designation	Acres
Parkland	0.0
Reserve	0.0
Woodland	464.3
No Designation	0.0

3. Regulatory Designations

Designation	Acres
Area of Critical Environmental Concern – Petapawag	464.3
Priority Habitat (MESA)	153.0

4. Long-Term Agreements

Agreement	Expiration Year
None Identified	N/A

5. Concessions

Concession Type
None

6. Partners & Friends

Group(s)
Friends of Groton Trails

7. Features of Interest

Feature
Beautiful white pine stands
Nashua River and scenic views
Nashua River Rail Trail
“Nod” settlement (early Groton history)
Trails

8. Natural Resources

Resource	Value
Tree Canopy (acres)	433.4
Rivers and Streams (miles)	6.2
Open Water (acres)	34.5
Wetlands (acres)	85.4
Certified Vernal Pools (#)	4
Potential Vernal Pools (#)	1
State-Listed Species (# Regulatory)	3
State-Listed Species (# Non-Regulatory)	0
Federally Listed Species (#)	0
Aquatic Invasive Plants (# known species)	1
Terrestrial Invasive Plants (# known species)	12

9. Forest Management (Since 2012)

Management Objective	Acres
Reduce the impact of biological stressors	45.0
Reduce the risk and long-term impacts of severe disturbances	7.2

10. History of Wildfires and Conditions Influencing Future Wildfires

Wildfire Attribute	Value or Characteristic
Number of wildfires on property; 2019–2023	1
Acres burned by wildfires on property; 2019–2023	0.2
Number of wildfires in Fire Control District; 2019–2023	253
Acres burned by wildfires in Fire Control District; 2019–2023	250.0
Type of Wildland-Urban Interface	Intermix
Predicted rate of spread, based on Fire Behavior Fuel Model 13	Moderate

11. Natural Hazards

Hazard Type	Acres
Flood (1.0%-chance)	207.3
Flood (0.2%-chance)	283.8
Hurricane Inundation (Cat. 1)	N/A
Hurricane Inundation (Cat. 4)	N/A

12. Climate Change (By 2070)

Type of Change	Amount of Change
Increase in annual days over 90° F	>30
Change in annual maximum daily rainfall (inches)	>10
Massachusetts Coastal Flood Risk Model area of inundation (acres)	N/A

13. Cultural Resources

Resource Type	#
Archaeological	0
Historic - Total MACRIS Listed	1
Historic - National Register Listed	0
Historic - National Historic Landmark	0

14. Recreation Resources

Resource	#
Accessible Trail	1
Picnic Area	1
Trails System	1

15. Recreation Activities

Activity
Bicycling, mountain
Boating, motor
Canoeing/Kayaking
Dog walking, on-leash
Fishing, fin fish
Hiking/Walking
Horseback riding
Hunting
Orienteering
Picnicking
Running/Jogging
Scenic Vista viewing
Skiing, cross-country
Snowmobiling
Snowshoeing
Trapping
Wildlife viewing

16. Roads and Trails

Metric	Value
Roads - Unpaved (miles)	0.1
Roads - Paved (miles)	0.2
Forest Roads - Unpaved (miles)	3.1
Forest Roads - Paved (miles)	0.0
Trails - Unpaved (miles)	2.4
Trails - Paved (miles)	0.0
Trails - Unauthorized (miles)	0.2
Trail Density (miles/acre)	0.012
Area of Impact (acres)	322.6

17. Parking

Parking Resources	#
Lots	2
Parking Spaces - Total	7
Parking Spaces - Accessible (HP)	2
Parking Spaces - Other	5

INTRODUCTION

J. Harry Rich State Forest (J. Harry Rich or the Forest) is in the Towns of Groton and Pepperell, 33 miles northwest of Boston and 4 miles south of the Massachusetts-New Hampshire state line. The Forest's two land tracts, the Main Tract and the Pepperell Tract, are on the east (Groton) and west (Pepperell) sides, respectively, of the Nashua River (the Nashua). The Main Tract also includes islands within the river. (See Land Stewardship Zoning Map, page 26.) Both tracts are easily reached via state and local roads. Groton and Pepperell possess a mixed suburban-rural character that is reflected in properties that adjoin the Forest. In Groton, the Forest is bounded by the Nashua to the north and west, Nod and Sand Hill roads to the south, and the Nashua River Rail Trail to the east. The Pepperell tract (also known as the Walent Property) is bounded by the Nashua River and residential development. The Town of Pepperell contains Environmental Justice (EJ) Populations that are within one mile of the Forest. (The related census tracts are near, but not within, the Forest.) Public and private non-profit conserved lands are prevalent adjacent to the Forest. The Nashua River is impounded by the Pepperell Dam, built in 1918 and located a short distance north (downstream) of the Forest. The resulting flowage of the river's main and relic channels, known as Pepperell Pond, is a complicated network of ponds and wetlands that influences the hydrology, natural resources, and visitor experience of the Forest.

The Forest lies on two important connecting corridors for conservation and recreation: the Nashua River and DCR's Nashua River Rail Trail (Rail Trail). The Nashua River is a designated Wild & Scenic River along 27 miles of its main stem between Lancaster, Massachusetts, and the New Hampshire border. This river and its resource-rich environs were long valued by Indigenous peoples and are currently protected by its Scenic River designation and additional environmental designations and regulations (see additional discussion below). The Rail Trail is an 11-mile (in Massachusetts), paved, multi-use recreational trail. This regional trail loosely parallels the Nashua River from the trail's southern terminus at Ayer to the New Hampshire state line, where it continues to Nashua, New Hampshire, under that state's administration. The Rail Trail provides river access at several points north of J. Harry Rich, as well as connections to non-DCR conservation parcels. South of J. Harry Rich, the closest DCR property providing recreational access to the Nashua River is Johnny Appleseed State Park, Leominster, approximately 12 miles (over 20 river miles) away.

The Forest is on land shaped by generations of Indigenous and non-Indigenous inhabitants. Past and present Indigenous residents embody fluid, relational connections to the places and spaces now known as J. Harry Rich State Forest. Groups and individuals, including Indigenous peoples known as the Agawam, Nipmuc, Pawtucket Pennacook, and Wabanaki, are recorded in available documentation (Donta et al. 2011; Native Land Digital 2023) as having relationships to this place over seasons and generations. The Forest's land use history is rich and complex, due to the resource values of the Nashua River and its vicinity. The Nipmuc referred to the area as Petapawag, meaning "swampy" or "wet place" and benefitted from its natural resources and utility as a transportation corridor. Anecdotal accounts describe Indigenous archaeological sites near current Forest lands (Tritsch and Hanson 2011: 2). Following Indigenous peoples' dispossession, the Massachusetts General Court (MGC) established the Plantation of Groton in 1655. Groton's first permanent settlement occurred near what is now the Main Tract's southwest corner. This so-called "Nod" settlement was a trading post (especially for furs) with the Nipmuc (Donta et al. 2011). Farming and timber extraction occurred in the Forest over the subsequent two centuries. Between 1923 and 1952, Dr. J. Harry Rich, professor-emeritus of Forestry at

the University of Massachusetts, acquired the land and managed it for forestry. He obtained Tree Farm certification in 1956 and, in 1964, transferred ownership to the Rich Tree Farms and Forestry Corporation. After advocacy by the Nashua River Watershed Association (NRWA), MGC Act 798 of 1979, §3, allocated $300,000 to the Department of Environmental Management (DEM) "For the acquisition of approximately 507 acres of intensively managed tree farm property, including 160 acres of water on the Nashua River for future development as a passive recreation area." The DEM completed the purchase in 1981, with the deed stipulating that the property "shall be perpetually known and designated as the 'J. Harry Rich State Forest'" (DEM 1988: Appendix 4). A Guidelines for Operations and Land Stewardship (GOALS) plan has guided Forest stewardship since 1988. Approximately 56 acres have been added to the Forest, much of which constitutes the Pepperell Tract, since publication of the GOALS plan.

J. Harry Rich provides visitors with a wide variety of natural and cultural resources within short forest excursions. The nearly level uplands are transected in spots with unnamed streams and interspersed with forested wetlands. Towering stands of manicured plantation white pine trees (see cover photo) and other species, as well as various mixed stands encompassing oak, birch, hemlock, and maple, rise above a shrubby understory that includes blueberry and witch hazel. An easily navigated trails network of forest roads and trails runs throughout the Forest and includes an accessible trail with accessible parking. Cellar holes and charcoal pits (not yet inventoried in the Massachusetts Cultural Resources Information System, or MACRIS) associated with the land's pre-Forest history may be seen from the trails network or discovered through off-trail excursions. At the Nashua River's edge, there are low bluffs and sloping shorelines that allow river access for fishing, nature study, and scenic views through the Nashua River's channels and wetlands.

PARK IDENTITY

J. Harry Rich State Forest's identity is that of a former Tree Farm whose intensively managed stands occupy the banks, floodplain, and adjacent uplands of the Nashua River. In addition to its sustainable forest products, the Forest provides open space, habitat, and recreation values to the surrounding communities. It also helps to protect a landscape or site (and possibly important archaeological resources) associated with Indigenous occupancy and Euro-American settlement of the area. All future management activities and improvements should ensure continued stewardship of this historical forestry property, maintain the distinctive scenery and outstanding recreational values of the Nashua River corridor, and protect and promote the historic and potential archaeological values of the property.

DEFINING RESOURCES AND VALUES

Resources and values that define the Forest are related to the property's history of managed forestry, Groton's settlement and early economic development, and the Nashua River. They include:

- A riparian landscape supporting diverse natural communities, habitats, and species, including:
  - Priority Habitat for three species protected under the Massachusetts Endangered Species Act (MESA): a Threatened reptile and one bird and one plant designated as Species of Special Concern.
  - One plant species designated a Species of Special Concern is anecdotally reported in the Forest. No Priority Habitat is associated with this species.

  - A Hemlock Swamp with significant numbers of yellow birch trees on the Main Tract that is outside of the community's typical geographic distribution in the state. (Due to historical agricultural practices, few Hemlock swamps in Eastern Massachusetts survive.)
- Contributions to landscape-scale protection efforts:
  - The Forest helps to preserve a highly scenic landscape. The river and environs adjacent to the Forest were recognized as a "Distinctive" scenic landscape (the highest quality recognized) in the DEM's 1982 Massachusetts Landscape Inventory (DEM 1982:123–128). Subsequently, the Nashua River's main branch extending from Lancaster, Massachusetts, past the Forest, to the Massachusetts-New Hampshire border, was designated a Scenic River under the U.S. Wild & Scenic Rivers Act (Public Law 90-542; 16 U.S.C. 1274(a), 1968), as amended by Public Law 111-9, §1303 (March 12, 2019). The Scenic River is managed under the Nashua River Wild and Scenic River Study Committee's Nashua, Squannacook, and Nissitissit Rivers Stewardship Plan (2018). (The Scenic River designation explicitly excludes a 9,240-foot reach of Pepperell Pond that is partially adjacent to the Forest, due to the ongoing use of the pond and associated Pepperell Dam for hydroelectric generation.)
  - The Forest is one of the largest undeveloped areas under single ownership in the Petapawag Area of Critical Environmental Concern (ACEC) and creates one of the ACEC's core "Wildlife Habitat Focus Areas" (Secretary of Environmental Affairs 2002).
- Responsible and historic silviculture. The Main Tract, formerly a Tree Farm, has almost 100 years of forestry history and is one of just a few DCR properties with documented scientific forestry that predates the Commonwealth's acquisition. (Lawton State Forest is another noteworthy example.) The Tree Farm's status was maintained for a short period after DEM's acquisition of the land, making it the first state-owned Tree Farm in the nation (DEM 1988: 37). Stands of white pine, red pine, and other species demonstrate past forest management practices and create striking scenery for visitors.
- Archaeological sites and associations with the Town of Groton's settlement and early community development. Around 1655, trader John Tinker established a trading house for commerce with the Nipmuc tribe at the confluence of Nod Brook and the Nashua River, a site now within the Forest. This was the first permanent settlement in the Town and is recorded in MACRIS (Massachusetts Historical Commission No. GRO.L) (May 1967). Other domestic and industrial sites are also present in the forest.
- Equitable recreation access. The Forest's John Tinker Accessible Trail (Tinker Trail, completed 2016 by the Groton Trails Committee with Community Preservation Act funds) provides an accessible experience of the Nashua River shoreline for visitors of all ages and varied abilities. The Forest provides recreational amenities to and enhances environmental quality and equity for an EJ community that is less than 1.0 miles from the property.
- Regional recreational connectivity. The adjacent Nashua River Rail Trail and the Nashua River are intensively used and significant recreational corridors. J. Harry Rich is one of just three DCR properties on the Nashua River and thus provides important public access and recreational opportunities relating to the river.

STATEMENTS OF SIGNIFICANCE

Statements of Significance describe the importance or distinctiveness of a place and its resources (National Park Service 1998). These statements reflect current scholarly inquiry and interpretation and go beyond a simple listing of resources to include contextual information that makes the facts more meaningful. When developing significance statements, the following criteria are considered:

- The property's significance at the time of its establishment.
- How the property, or society's understanding of the property, has changed since its acquisition that makes it significant or unique within the state park system today.
- The property's role in recreation and its importance to the community it supports, particularly regarding activities that are unique to that property.

For park planning, these statements focus management actions on the preservation and enjoyment of those attributes that most directly contribute to the importance of the place. For interpretive planning, they comprise the information upon which the interpretive themes and overall program are built.

The following Statements of Significance have been identified for J. Harry Rich State Forest. The sequence of these statements does not reflect their level of significance.

- An area of Priority Habitat of Rare Species (PH2035) is centered along the wetlands surrounding the Nashua River South of Clarkes Hill. Much of this area is also designated as Core Habitat Wetlands. A second area of the property on the eastern border is also designated as Priority Habitat (PH 1891), extending onto adjoining conservation land.
- The length of the Nashua River that runs through the site is an important habitat for birds, fish, and turtles. The meandering nature of the river, with oxbows and backwaters, offers a combination of warm, sluggish water, a few marshy areas, and wide, sandy lowlands that provide shelter, feeding, and breeding habitat for a variety of wildlife (Secretary of Environmental Affairs 2002: 23).
- As part of the larger Petapawag ACEC, the Forest is identified as part of a broader area of special recognition because of the quality, uniqueness, and significance of its natural and cultural resources. The river is also designated as a Scenic River under the National Wild and Scenic Rivers Program, indicating rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- In acquiring what is now J. Harry Rich State Forest, the Commonwealth sought to build on Professor Rich's projects and purpose. When Professor Rich had the property certified as a tree farm, he committed to going beyond timber harvesting to prioritize protecting environmental values.

UNIFYING THEME

The Unifying Theme is a statement that ties a property's stories together and shapes the overall interpretive message that DCR wants to share with visitors in their experience at the property. The theme provides an overarching conclusion for visitors to contemplate (Ham 2013) and answers the question "so what?". The theme guides all interpretation for the park, both personal (i.e., formal and informal interactions with visitors) and non-personal (e.g., exhibits, signage, brochures).

The Unifying Theme for J. Harry Rich State Forest is:

Forests are not managed arbitrarily. Responsible stewardship requires forethought and planning.

VISITOR EXPERIENCE

J. Harry Rich State Forest provides a variety of visitor experiences, including the following:

- **Virtual Experience.** Potential visitors will find little information about J. Harry Rich on DCR's web site. The "Find a Park" tool (https://www.mass.gov/info-details/find-a-park) identifies the Forest's location and lists Hiking/Walking as activities that visitors may enjoy here. There is no additional information to help potential visitors plan a trip. The Willard Brook State Forest web page does not list J. Harry Rich as being one of its "related parks."
- **Entering the Park.** The Forest's main entrance, marked by a Parks and Forests Entrance Sign, is located at the intersection of Nod Road and Common Street at the Main Tract. Visitors may access a small dirt pull-off adjacent to the forest road gate at this location. A second important entrance to the Forest is the trailhead for the Tinker Trail, located on Nod Road. This trailhead has a small, well-maintained gravel parking lot. A "Low-Profile" type sign mounted to a tree off the shoulder of the road identifies the property as "J. Harry Rich State Forest". Finally, a Nashua River Rail Trail parking lot is located adjacent to the Forest where Sand Hill Road crosses the Rail Trail. From this gravel lot, which is provided with a kiosk with information pertinent to rail trail use, visitors may travel approximately 0.4 miles on Sand Hill and Nod Road, or 1 mile on the rail trail, to access one of the Forest's marked trail heads. The Pepperell Tract is accessed via an unmarked forest road off of River Road (Rt. 111).
- **Trail-based Passive Recreation.** The Forest's modest trails network offers nearly 6 miles of official forest roads and trails extending along the Nashua River's bank and through woodlands, providing visitors the opportunity for a light hike and Forest exploration. The Tinker Trail provides an accessible experience of the Nashua River shoreline for visitors of all ages and includes accessible car and van parking and an accessible picnic table with a scenic view of the river. Several trail connections may be made to neighboring conserved parcels, including the Nashua River Rail Trail from the Main Tract and the 1.5-mile Westside Trail from the Pepperell Tract.
- **Picnicking.** Visitors utilizing the Tinker Trail may access a small picnic area (one table) adjacent to the Nashua River. This picnic area is carry-in-carry-out and has no bathroom facilities.
- **Fishing.** With peaceful views and easy water access, the Forest is a popular destination for fishing.
- **Boating.** Paddlers on the Nashua River enjoy the scenery and wildlife as they float past the Forest's undeveloped woodlands and wetlands. The Forest has no boat launch, but the Petapawag boat launch is located about 0.25 miles upstream of the Forest.

THREATS AND OPPORTUNITIES

The following information identifies potential threats to the park's natural and cultural resources and identifies opportunities to enhance their protection and stewardship. Although recreation is not considered a resource under statute (M.G.L. c. 21, § 2F), it is included below because recreation is an important part of the park-going experience, helps define a park's values, and is a key part of assessing the consistency of activities taking place in the Commonwealth's forests, parks, and reservations.

Threats and opportunities identified below are used to inform the development of management recommendations. Potential recommendations must meet prioritization criteria to be included in the Priority Recommendations table (Table 19, page 30).

Natural Resources

Threats

- There are discrepancies between historical and current acreage calculations that may require resolution through deed research and/or an instrument survey. According to the 1988 GOALS plan's narrative, the Forest was 506 acres, with 104 acres of this forest flowed by the Pepperell Dam. Current parcel data shows a total acreage of approximately 461 acres, including 55 acres that were added to the Forest after 1988. There are about 20 acres of land in the southerly end of the Groton portion of the Forest (Boutwell Island and vicinity) where ownership of the Forest is unclear between the Town of Groton and DCR. The lack of clarity concerning the quantity and location of DCR's property threatens DCR's ability to manage its lands appropriately.
- The Massachusetts Department of Environmental Protection (MassDEP) has identified several water quality impairments in the Nashua River (MA81-06) within and adjacent to the Forest, resulting in this stretch of the river being classified as not suitable habitat for sustaining a native, naturally diverse community of aquatic flora and fauna (MassDEP 2021: 106; MassDEP 2023*:* 191). Because MassDEP updates its Integrated List of Waters on a regular basis, readers are directed to the most recent version of that document for current information.
- Portions of the Forest's acreage in the Main Tract are subject to an easement and permanent right of flowage deeded to the owners of the Pepperell Dam and related hydroelectric power station (currently Eagle Creek Renewable Energy (Eagle Creek), a subsidiary of Ontario Power Generation (Eagle Creek 2022). About 140 acres of Forest are flowed under this easement. Substantial changes to management of the dam (which would require Federal Energy Regulatory Commission approval) could impact the natural and cultural resources, as well as the visitor experience, of the Forest. Any project to raise the dam's effective height would require a new legal agreement with DCR, as the original easement and current right of flowage was "according to the present [as of October 13, 1923] height of the said Nashua River Paper Company's dam" (Middlesex County Registry of Deeds, Book 4663, Page 231).
- Groton's Old Town Dump adjoins the Forest's Main Tract on the west side of Nod Brook at Nod Road. This landfill was closed in 1976, capped under a plan approved by Massachusetts Department of Public Health (DPH), and is currently listed by the MassDEP as an Inactive Landfill with incomplete closure. A fall 2022 site inspection noted leachate breakouts (which were not tested) on the north and east sides of the landfill, although they do not extend out into surface water features. Because MassDEP is not mandating corrective actions, the Town is intending to keep the landfill in current use. In the future, leachate from the site could contaminate the water table and open waters of the Forest (Town Select Board Meeting Minutes: 9 September, 17 October; 2022; Fabbri 2022).
- Transported sediments from upstream locations may adversely affect the Nashua River within the Forest (DEM 1988: 19). The location of the Pepperell Dam exacerbates sedimentation by creating ponded areas with low or no current within the Forest.

- Eutrophication of stagnant portions of the Nashua River within the Forest may impact plant and animal populations of the Forest (DEM 1988: 19).
- The Pepperell Dam increases Forest productivity for managed forestry by raising the water table of the property. Removal of the dam or permanent lowering of the water level in the impoundment could threaten tree plantations in the Forest.
- Habitat for and populations of a plant species of Species of Special Concern may be compromised in the Forest by forest succession, invasive glossy buckthorn, and by visitors picking flowers (MassWildlife 2015).
- Habitat for the plant Species of Special Concern is threatened by succession (Leddick 2024).
- The Hemlock Swamp may be threatened by invasive pests such as hemlock wooly adelgid and elongate hemlock scale, and by altered hydrology (Swain 2020: 199–200).
- The following 13 invasive species have been identified at the Forest: burningbush, common buckthorn, fig buttercup, glossy buckthorn, Japanese barberry, Japanese knotweed, Morrow's honeysuckle, multiflora rose, Oriental bittersweet, Norway maple, reed canarygrass, water chestnut, and yellow iris. One Likely Invasive plant, common barberry, is also present (BSC Group 2017: 29, 30). Invasive species may negatively impact both the ecological integrity and biodiversity of the Forest.
- The Forest's Pepperell Tract was not surveyed during the 2017 evaluation of invasives, due to project constraints (BSC Group 2017). Because information on the presence or distribution of invasive plants in J. Harry Rich State Forest is incomplete, it is unknown whether additional sensitive areas are being impacted by invasive plants.
- Variable watermilfoil was noted in the "Pepperell Pond impoundment" of the Nashua River by MassDEP staff in 2017. This invasive species may have or could spread into the Forest (MassDEP 2021: 107). Information concerning this impairment was not updated in the 2023 Integrated List of Waters (MassDEP 2023). Because MassDEP updates its Integrated List of Waters on a regular basis, readers are directed to the most recent version of that document for current information.
- The rail trail and neighboring conservation parcels provide access to the Forest. This means that user-created desire paths or unauthorized trails are sometimes established in the Forest, which may threaten natural resources.
- A lack of staffing due to an inability to fill vacant seasonal positions in the Otter River Complex leaves smaller properties such as J. Harry Rich undermaintained, which threatens natural resources in the forest.
- Hunting in the Forest (and the Towns of Groton and Pepperell generally) is becoming less popular due to demographic and cultural trends. A consequent overpopulation of deer may threaten natural resources in the Forest due to over-foraging.
- Unknown persons or organizations have created and marked an unsanctioned small craft landing in the Main Tract. (The landing does not appear in the NRWA's Nashua River Canoe and Kayak Guide.) This location is not marked with DCR signage, and unsanctioned recreational activity may threaten natural or cultural resources.
- There are multiple desire paths leading from official trails to the shore of the Nashua River. Erosion of desire paths on sloping land may endanger natural resources and water quality.

- Forest visitors have created several unsanctioned trails. Construction of trails without authorization or applicable regulatory review may threaten MESA-protected species habitat, natural communities, and/or ecosystem functions.
- There is an opportunity to improve fire safety and natural resources protection by improving the main forest road through the property.
- According to the property deed, the Nashoba Conservation Trust holds the following restriction on the Forest's parcels in Pepperell: "A restriction against the use, operation, or storage of any ORV (off-road vehicle) on the premises" (Middlesex (South) County Registry of Deeds: Book 35366, Page 139). The entrance to the Forest's Pepperell tract is not marked, nor gated, so visitors may be unaware of the Forest's presence and its regulations. If off-highway vehicle (OHV) users access the property, this could violate the conservation restriction.
- There are unapproved geocaches in the Forest, some of which are located away from trails. Inappropriately located geocaches may threaten sensitive natural resources.

Opportunities

- If variable watermilfoil is found in Forest waterbodies, there may be opportunities to partner with NRWA, the Town of Groton, and other entities on control measures for this aquatic invasive species.
- Forestry operations and prescribed burns could help to mitigate and/or eliminate invasive plant species in the Forest.
- A proposal has been drafted to conduct forest management on approximately 45 acres of the Forest. If implemented, this proposal will increase forest structure and diversity and reduce the prevalence of invasive plant species (Waterman 2018).
- There is an opportunity to document the Hemlock Swamp natural community in order to increase its protection and augment the scientific community's knowledge of this resource type.
- Monitoring of the Hemlock Swamp for hemlock wooly adelgid and invasives would help to protect this unique resource.
- There is an opportunity to further protect the Hemlock Swamp community by excluding it from active forest management, except as needed to reduce the impact of biological stressors or maintain this refugia.
- The Nashua River provides important breeding and migration habitat for migratory waterfowl and is a component of the North American Waterfowl Management Plan. In the future, there may be opportunities for resource protection activities and/or public interpretation of this conservation value.
- Portions of the Forest contain Priority Habitat for a bird species that is an NHESP Species of Special Concern. Managing timber harvests to avoid nesting and foraging areas will help to protect this species.
- Where consistent with the management of the Forest as Woodland, there may be opportunities to restore a barrens suite of Priority Natural Communities, as well as protect and expand habitat for a plant Species of Special Concern, through habitat management efforts in consultation with NHESP (Leddick 2024).

- There may be opportunities to engage with the Nipmuc and other Indigenous peoples, and other relevant state/federal agency partners that are in collaboration with Indigenous peoples, as stewardship partners for DCR's management of natural resources in the Forest.
- Accidental ingestion of recreational fishing gear may cause fatalities to a bird species that is an NHESP Species of Special Concern. There is an opportunity to reduce species mortality by posting of fishing locations in the Forest to encourage fishing gear removal.
- Portions of the Forest contain Priority Habitat for one Threatened reptile. The northern portion of the Petapawag ACEC, and Groton in particular, are thought to possess the largest populations of this reptile in the state (Nashua River Wild and Scenic River Study Committee 2018: 41–42). There is an opportunity to protect these habitats and to demonstrate exemplary forest management through habitat management and forestry controls that follow NHESP guidelines and forestry best practices.
- The Forest's one potential vernal pool may "support rich communities of vertebrates and invertebrates" (MassWildlife 2009) and serve as important habitat components for other wildlife, including one of the Forest's state-listed species. Surveying and certifying this pool (DCR (n.d.) and MassWildlife (2009)), as appropriate, may help better protect these animals.

Cultural Resources

Threats

- There is a lack of knowledge concerning the potential presence of ancient and historical period archaeological resources in the Forest that may compromise their appropriate management.
- Vegetation is taking over the cellar holes in the forest and threatens the integrity of these archaeological site features.
- Erosion due to weather events (especially flooding on the Nashua River) and trail usage may threaten archaeological resources in the Forest.
- Unfilled DCR positions in the Otter River Complex leave smaller properties such as J. Harry Rich undermaintained, which threatens cultural resources in the forest.
- Unknown persons or entities have marked an unsanctioned small craft landing in the Forest. This location is not marked with DCR signage, and unsanctioned recreational activity may threaten cultural resources.
- Substantial portions of the forest (roughly 50%) are within the 1.0%-chance and 0.2%-chance flood zones of the Nashua River, including the Regulatory Floodway (Massachusetts Bureau of Geographic Information (MassGIS) 2023). Significant cultural resources, including portions of the Nod Area (GRO.L) and cellar holes, may be damaged by flood events.
- There are unapproved geocaches in the Forest, some of which are located away from trails. Inappropriately located geocaches may threaten sensitive cultural resources.
- Construction and use of the previously mentioned unauthorized trails may disturb areas of the Forest that have potential archaeological resources.

Opportunities

- Because of the Forest vicinity's strong anecdotal associations with the Nipmuc tribe, archaeological survey may determine that ancient (12,000-450 years before present) archaeological sites are also a defining resource of the Forest.
- The lot of important Nod settler John Tinker, as well as other archaeological sites, are reported to be within the boundaries of the Forest (DEM 1988:50; May 1967). Archaeological survey of the Tinker lot could protect significant archaeological resources, contribute important data to DCR's understanding of the Forest's history, and expand the understanding of Groton's history and its relationship to the Nipmuc tribe. Such data could also be the basis for public interpretive programming and/or school programming.
- The presence of preserved historical charcoal pits, unusual in eastern Massachusetts, provides an opportunity for preservation and interpretation of this aspect of forest resource extraction.
- Partnerships with Indigenous tribes, the Towns of Groton and Pepperell, and local conservation groups offer opportunities to expand archaeological research and interpretation in the Forest.
- Certain public roads (Nod Road, Sand Hill Road, and Common Street) that are adjacent to the Forest are designated Scenic Roads under Town of Groton Bylaws (div. 4, art. X, p. 6; authorized under M.G.L. c. 40, § 15C). DCR's preservation of forest edges (i.e. buffer strips) and stone walls maintains the scenic character of these public ways.

Recreation

Threats

- Eutrophication of stagnant portions of the Nashua River within the Forest may make recreation on and adjacent to these areas undesirable and also limit fishing opportunities.
- Substantial portions of the forest (roughly 50%) are within the 1.0%-chance and 0.2%-chance flood zones of the Nashua River, including the Regulatory Floodway. There is approximately 2.8 miles of trails system within the flood zones that may be damaged by flood events.
- The Massachusetts DPH has issued a Fish Consumption Advisory for fish caught in the Pepperell Pond portion of the Nashua River (DPH 2023: 10). Signs informing the public of this health advisory are absent from access points at fishing locations and kiosks.
- Unfilled DCR staff positions in the Otter River Complex leave smaller properties such as J. Harry Rich undermaintained, which threatens cultural resources in the forest.
- There is limited official information available on the J. Harry Rich State Forest. DCR's web site does not include information on the Forest, making it difficult for potential visitors to become aware of the property and its recreational opportunities.
- There is no official trail map for the Forest. The Friends of the Groton Trails Network has published an unofficial map of the Forest's trails system that does not show Forest boundaries, nor include rules and regulations for the Forest (Friends of the Groton Trails Network 2018).
- Excessive erosion and rutting is occurring in portions of the trails system, which threatens the visitor experience as well as adjacent species habitat and natural communities. Horseback riders occasionally use the Tinker Trail, which damages the accessible surface of this trail and threatens access for some persons with limited mobility.

- Trail intersections in the Forest are unmarked, which may lead to visitor confusion.
- Friends of the Groton Trails have posted rules at the Forest's main entrance and Tinker Trail trailhead that are inconsistent with DCR regulations pertaining to pets. Posting of non-DCR signage, especially rules, confuses the identity of the Forest for visitors and may mislead visitors with respect to the rules and regulations of the Forest.
- The Tinker Trail's parking lot has no Lead-in or other sign type that is visible to passing motorists, making it easy for visitors to overlook.
- An abandoned car is located in the Forest and threatens user enjoyment of the property.
- Although the Forest's natural and cultural resources present opportunities for interpretive programming (see Cultural Resources Opportunities, above, and Recreational Opportunities, below), the quantity of parking limits the agency's ability to implement such programs.

Opportunities

- Adding a J. Harry Rich web page to DCR's web site would allow potential visitors to become aware of the Forest, its resources, and associated recreation opportunities, including the accessible Tinker Trail.
- Because of the Forest's close proximity (approximately 0.5 mile) to an EJ community, there may be opportunities to advance environmental justice and equity via DCR's Environmental Justice Strategy (see pages 79–88 in Massachusetts Executive Office of Energy & Environmental Affairs (EEA) 2024), in alignment with the EEA's EJ Policy (EEA 2021) and the Executive Order on Environmental Justice (No. 552) (Patrick 2014).
- J. Harry Rich is located within the Freedom's Way National Heritage Area, offering opportunities for agency partnerships, grants, and potentially higher visibility for the Forest (Freedom's Way Heritage Association, Inc. 2015).
- Water-based access to the Forest provides opportunities for unique interpretive programming and seasonal primitive camping (both recommended in the 1988 GOALS plan for the Forest).
- Unknown persons or entities have created and marked an unsanctioned small craft landing in the Forest. Additional landings of this type may be present. Identifying and possibly partnering with such persons or entities would provide an opportunity to create sanctioned landing points and increase visitation to, and user awareness of, the Forest.
- The Nashua River's relic oxbows and channels, including "The Ox Bow", the "Mote [sic, i.e., Moat]", and "Pepperell Pond" provide features of scenic interest, are landmarks relating to the Groton and Pepperell's history, and can contribute to public interpretation of the property.
- The level, looping trails system and low trail difficulty make the Forest accessible to a wide variety of users.
- More preventative maintenance on the trails system will eliminate the need for more intensive repair work in the future. Increased funding for trail maintenance would allow for more comprehensive ongoing implementation of trail maintenance Best Management Practices (BMPs)(DCR 2019).
- Several characteristics of this Forest make it an opportune site for interpretive programming for the public or school groups. These characteristics include: the proximity to and ease of access from densely populated areas, the low difficulty of the trails system, the rich history of the Forest and its

immediate environs, and the known and potential cultural resources (cellar holes, granite posts, roads, charcoal pits) that are located within a small geographic area.

- The presence of historical charcoal pits in the Forest (associated with railroad fuel production) provides an opportunity for interpretation of this unusual resource type within the context of the Forest's management history.
- Friends of the Groton Trails are interested in expanding recreational access to the Forest and enhancing existing trail infrastructure, especially the accessible trail network. (Plans for improvements to the Tinker Trail were under review and permitting at the time this RMP was prepared.) There is an opportunity to leverage this group's interest for forest improvements. However, recreational improvements must be consistent with the conservation and cultural resources values of the Forest.
- The 1988 GOALS plan (DEM 1988: 46) identified scientific forestry practices as an important conservation value of the Forest. The history and persistence of the Forest as a certified Tree Farm established by J. Harry Rich, as well as exemplary forestry practices employed at the property, presents a valuable opportunity to demonstrate and interpret the Tree Farm system and sustainable/aesthetic forestry management practices to the general public and woodland owners. There is an opportunity to perpetuate and augment this conservation value by preparing a property-specific Forest Resource Management Plan (FRMP) that reconciles 1988 GOALS recommendations, with the Forest Futures Visioning Process (DCR 2010), and the historical value of this managed forest.
- As forestry proposals (Waterman 2018) are implemented to enhance stand diversity, the distinctive appearance of white pine stands produced by historical forest management practices may be lost. Although this is beneficial for natural resources, it will change the character of the Forest. Techniques such as long-term regeneration and management and/or photographic recordation of select white pine forest stands produced by 20th-century forest management practices might allow DCR to better interpret the evolving character of the forest and of forestry practices for future generations of the public.

CLIMATE CHANGE

Climate change impacts nearly every aspect of DCR's properties, from ecosystem health, to infrastructure, to recreation. (See DCR 2024 for an overview of these impacts.) The Department is actively working to mitigate and adapt to current and future impacts through such actions as forest management; decarbonizing DCR's buildings, vehicles, and power equipment; protecting wetlands; and using nature-based solutions to minimize stormwater impacts. Information on these, and other, efforts is incorporated into RMPs as available and appropriate.

Any discussion of climate change requires a shared understanding of terminology. Because of this, this RMP section adopts commonly accepted terms to the greatest extent possible. In general, climate-related technical terms used in this RMP are as defined in the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2021). Exceptions to this are the terms Adaptation, Risk, and Sensitivity, which are used as defined in DCR's Climate Change Vulnerability Assessment (CCVA; Weston and Sampson 2022).

DCR manages its forests to provide a range of ecosystem services such as recreation, clean water, wood commodities, and wildlife habitat (DCR 2020). For ecosystems under its management, DCR carefully

considers both their vulnerability to climate change and their ability to mitigate the effects of climate change by storing carbon in ecosystems and harvested wood products. Several approaches are used to monitor DCR forests and to design forest management strategies to adapt to climate change and provide ecosystem services. (See Swanston et al. (2016) for information on adaptation strategies and approaches associated with DCR's forest management.) Established in 1957, DCR's Continuous Forest Inventory (CFI) system uses a network of more than 2,000 permanent plots on which repeated measurements are taken on an ongoing basis. The CFI measures the status, size, and health of over 100,000 trees; other vegetation; down woody material; and the forest floor. (See DCR 2022 for additional information on the CFI system.) This information helps DCR understand at a strategic scale the current character, condition, and trends of forest ecosystems under its care. DCR also uses operational inventory to help plan specific treatments and evaluate their outcomes. Using these different scales of information, remotely sensed data, and local and regional external expertise, DCR plans projects that help its stands, forests, and other lands adapt to climate change and mitigate greenhouse gas emissions. The conservation and science-based management of forest lands are an essential element to ensuring crucial carbon storage and advancing climate change resilience (EEA 2024). For additional information on the relationship between DCR's forest management practices and climate change, please see pages 77–85 in Massachusetts Forest Action Plan 2020 (DCR 2020) and Managing Our Forests…For Carbon Benefits (DCR 2023).

The Department is actively assessing and addressing the vulnerability of its properties and facilities to the impacts of climate change. In 2022, DCR conducted a CCVA (Weston and Sampson 2022). Findings from this CCVA are being used by DCR to enhance park operations and maintenance, inform resilient investment, and provide a framework for hazard mitigation and climate adaptation for natural resources, cultural resources, recreational activities, buildings, facilities, and other infrastructure. Property-specific climate change information from the CCVA is included in the Climate Change (by 2070) table (Table 12) at the beginning of this RMP. An overview of the impacts of climate change on DCR facilities and operations is presented in the DCR Climate Impacts Story Map (DCR 2024).

Climate Exposure and Impacts

A summary of the ways in which the Commonwealth's natural, cultural, and recreational resources may be impacted by climate change is provided below. During the preparation of RMPs some resources may be identified as having particularly high exposure and/or sensitivity to the anticipated hazards or consequences of climate change. When this occurs, these resources and the projected impacts to them are described. In some instances, the potential impacts of climate change on a given resource are not well understood. When this occurs, only exposure is discussed.

Natural Resources—General Impacts

Climate change affects temperature, precipitation, and atmospheric and ocean chemistry, which in turn directly and indirectly affect the natural environment, including the plants, animals, and natural communities of DCR's forests, parks, and reservations.

Climate is known to influence the presence, absence, distribution, reproductive success, and survival of both native and non-native plants (Finch et al. 2021). Native northern and boreal species, including balsam fir, red spruce, and black spruce may fare worse under future conditions, but other species may benefit from the projected changes in climate (Janowiak et al. 2018). Some non-native invasive species will be affected by climate change while others will remain unaffected, and some non-invasive non-

native species are likely to become invasive (Finch et al. 2021). In general, elevated temperature and CO_2 enrichment associated with climate change increases the performance of non-native plants more strongly than the performance of native plants (Liu et al. 2017). Climate change may result in the presence of new non-native invasive plants on a property, and changes to the distribution and/or abundance of invasives already present on a property.

Exposure to a changing climate affects wildlife in a variety of ways. For animals that live in or near aquatic environments, "changes in habitat and hydrological regimes are expected to shift their abundance and distribution" (Isaak et al. 2018: 89). Impacts to terrestrial animals are expected to be highly variable (Halofsky et al. 2018) but may be considered to fall into the following four categories: 1. habitat loss and fragmentation; 2. physiological sensitivities (i.e., innate characteristics that influence the ability to cope with changing temperature and precipitation conditions); 3. alterations in the timing of species' life cycles; and 4. indirect effects (e.g., disruption of ecological relationships) (Friggens et al. 2018). Although all Northeast wildlife are exposed to hazards associated with climate change, some groups, "including montane birds, salamanders, cold-adapted fish, and freshwater mussels, could be particularly affected by changing temperatures, precipitation, sea and lake level, and ocean processes" (MassWildlife 2015: 357). In addition, it is the position of the Massachusetts Natural Heritage and Endangered Species Program that state-listed species and Priority Natural Communities are likely to be highly sensitive to climate change and that all state-listed species will be negatively affected by hydrologic changes, changes in water, soil, and air temperature, and changes in forest composition.

Natural Resources—Property-Specific Exposure and Impacts

Climate change may cause some vernal pools to dry earlier in the season than they have historically, potentially interfering with amphibian life cycles (Cartwright et al. 2022). Because of this, some of the Forest's pools and associated wildlife may be negatively impacted. Similar impacts may occur at the potential vernal pool, if it functions as a vernal pool.

The freshwater mussel eastern elliptio has been reported in the Forest. Populations of these invertebrates may be threatened by the impacts of climate change.

Responses of Massachusetts' invasive plants (i.e., those categorized as Invasive by the Massachusetts Invasive Plant Advisory Group (MIPAG) (n.d.)) to a changing climate are largely unknown. However, sufficient information exists to project the likely future trend of Japanese barberry and Oriental bittersweet. Climate change facilitates invasion by Japanese barberry "because of higher growth and germination in warmer climates" (Merow et al. 2017: E3276). Because of this, it is anticipated that barberry will further spread at J. Harry Rich State Forest. "Available data suggest that bittersweet is likely to benefit from the warming and increased precipitation that are predicted for the Northeast" (Rustad et al. 2012), resulting in expansion throughout New England. Areas where the forest canopy or forest floor has been disturbed are particularly susceptible (McNab and Loftis 2002). Because of this, it is anticipated that Oriental bittersweet will continue to expand within J. Harry Rich in response to climate change.

Cultural Resources—General Impacts

Climate change may negatively affect cultural resources, their preservation, and maintenance (EEA 2022a; International Council on Monuments and Sites (ICOMOS) Climate Change and Cultural Heritage Working Group 2019; Rockman et al. 2016: 3, 18; United Nations Educational, Scientific and Cultural

Organization (UNESCO) World Heritage Center 2007). In Massachusetts, cultural resources may be exposed to the following natural phenomena that are correlated with adverse impacts: higher annual average temperature (especially in winter), increased numbers of freeze-thaw cycles, increased precipitation intensity, higher relative humidity, higher wind speeds, an increase in severe storm events, increased numbers and severity of wildfires, more severe seasonal droughts, increase in number and severity of inland flood events, increased coastal flooding and erosion, increased probability of landslides, changes in groundwater levels, shifts in native and invasive species distribution, performance, and phenology; and changes in oceanic and atmospheric chemistry (Rockman at al. 2016; Commonwealth of Massachusetts 2023: 5.1-31–5.1-61).

The phenomena listed above may produce a variety of adverse impacts to Massachusetts' cultural resources. Sensitivity and potential impacts vary based on resource category (i.e., archaeological sites, cultural landscapes, ethnographic landscapes and sites, and buildings and structures). Resource-specific factors such as location, design, materials, condition, etc. will also influence sensitivity and consequent impacts. All categories of cultural resources may be subject to complete or partial destruction through wildfire, inland flooding, sea level rise, storm surge, or landslides. Additionally, these resource categories may be subject to other types of impacts, as follows. Archaeological sites may have site stratigraphy disrupted by changes in hydrography, may suffer accelerated decomposition of artifacts and features, and may be impacted inadvertently during disaster response. Cultural landscapes may lose plantings due to a variety of stressors (e.g., drought or flood, pests, soil salinity), may be infiltrated by invasives, may be eroded by surface runoff, may experience more rapid deterioration of hardscaping and site furnishings, and may be damaged by high wind or heavy snow events. Ethnographic landscapes, traditional cultural places, and associated communities (including Indigenous peoples) may suffer both tangible and intangible impacts such as loss or diminishment of natural species used for food, ceremony, or medicine; alterations in timing of hunts, etc.; increased difficulty of vulnerable subgroups (e.g., the elderly) to perform outdoor tasks; and a loss of cultural knowledge associated with resources and practices. Buildings and structures may be damaged or destroyed by high wind or heavy snow events, suffer accelerated deterioration through a variety of mechanisms (e.g., elevated humidity, chemical reactions, destructive pests and organisms), may be destabilized by hydrological changes, or be damaged by inadequate gutters or drainage systems (ICOMOS Climate Change and Cultural Heritage Working Group 2019: 73–89; Rockman et al. 2016: 20–24). (See Rockman et al. 2016: 19–24 for a detailed assessment of the potential impacts of climate change on cultural resources.)

Cultural Resources—Property-Specific Exposure and Impacts

The Forest's known cultural resource with high exposure to climate change hazards is the Nod Area (GRO.L), which is within the most recent Federal Emergency Management Agency (FEMA) 1.0%-chance and 0.2%-chance flood zones of the Nashua River, including the Regulatory Floodway (MassGIS 2023). (Precipitation changes due to climate change (see EEA 2022b and Weston and Sampson 2022) are not factored into FEMA flood plain modeling. Climate change may result in additional exposure to and impacts from flooding for cultural resources in the future. A FEMA-contracted report (AECOM 2013) finds that: "For the riverine environment, the typical 1% annual chance floodplain area nationally is projected to grow by about 45%, with very large regional variations ... approximately 70% of the 45% (or 31.5%) growth in the 1% annual chance floodplain is due solely to climate change" (AECOM 2013: ES6–ES7). Site-specific projections for future floodplain areas were not available at the time this RMP was prepared.)

Recreation—General Impacts

Outdoor recreation and park visitation are dependent on weather and climate and will be affected by a warming climate (Wilkins and Horne 2024). Higher temperatures positively affect participation in most outdoor activities, except snow-based activities (Wilkins and Horne 2024). "Winter is warming substantially faster than other seasons, and winter warming is especially pronounced in the...Northeastern United States" (Wilkins and Horne 2024: 15). Exposure to this climate change phenomenon is projected to significantly reduce the length of winter recreation seasons for downhill skiing, cross-country skiing, and snowmobiling, decreasing recreational opportunities and causing substantial economic impacts (Wobus et al. 2017). Whitewater rafting, primitive area use, and hunting are also projected to be negatively impacted by exposure changing weather patterns associated with climate change (Askew and Bowker 2018). Although "coldwater fishing habitat is expected to decline under a warming climate, which will likely result in fewer fishing days," overall fishing participation in the Northeast is projected to rise "due to the more favorable temperatures" (Wilkins and Horne 2024: 11). Horseback riding on trails, boating, swimming, and visiting interpretive sites are also expected to see higher participation in the Northeast under climate change (Askew and Bowker 2018). Temperature preferences of campers indicate that the "number of ideal days" for camping will also increase (Wilkins and Horne 2024: 13). Participation in biking is also projected to increase, especially in the winter and shoulder months (Wilkins and Horne 2024: 13). Climate change may also impact outdoor recreation through increased impacts to recreation infrastructure (e.g., flooding impacts), and increased exposure to disease vectors (e.g., mosquitoes and ticks), longer pollen seasons, and heat-related illnesses (O'Toole et al. 2019).

Recreation—Property-Specific Exposure and Impacts

Recreation activities at the Forest likely to be negatively impacted by exposure to weather changes resulting from climate change include hunting and snow-dependent sports (i.e., cross-country skiing, snowmobiling, and snowshoeing). Other recreation activities may see increased participation, especially those associated with the waters of the Nashua River. Fishing and cartop boat (i.e. canoeing and kayaking) use may experience increased participation due to the anticipated increase in temperature (i.e., more than 30 additional days with temperatures over 90° F; Table 12).

Recreation infrastructure with exposure to increased precipitation and flooding associated with climate change include approximately 2.8 miles of trails system within the most recent FEMA 1.0%-chance and 0.2%-chance flood zones (MassGIS 2023) of the Nashua River, including the Regulatory Floodway. These segments are exposed to anticipated increase in precipitation (i.e., a greater than 10-inch increase in maximum daily rainfall; Table 12). (As noted above, precipitation changes due to climate change are not factored into FEMA flood plain models and projections for future floodplain areas were not available at the time this RMP was prepared.)

APPLIED LAND STEWARDSHIP ZONING

DCR assesses the appropriate uses and stewardship of its properties at two spatial scales: the landscape level and the property level.

Landscape Designation

In 2012, DCR engaged in a comprehensive system-wide assessment of lands managed by its Division of State Parks and Recreation, designating them as Reserve, Woodland, or Parkland. (See Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines (DCR 2012) for details.) Multiple Landscape Designations may apply to individual properties with diverse resources and levels of development. All of J. Harry Rich State Forest was designated Woodland. Identification of Land Stewardship Zones within J. Harry Rich was performed in the context of the Woodland Landscape Designation.

The following Land Stewardship Zoning is recommended to guide management and any future development. (See Figure 1. Land Stewardship Zoning Map, page 26, and the Land Stewardship Zoning layer on DCR's Stewardship Map: https://dcrsgis-mass-eoeea.hub.arcgis.com/.)

Zone 1

Zone 1 areas have highly sensitive ecological and/or cultural resources that require additional management approaches and practices to protect and preserve these special features and their values (DCR 2012). The following areas of J. Harry Rich have been designated Zone 1.

- DCR-owned islands in the Nashua River, flooded lands under DCR ownership, and land within 200 feet of both riverbanks. Where MassDEP Wetlands are present that are coterminous with the river, Zone 1 encompasses the entirety of these wetlands. This Zone 1 designation is intended to preserve the river's character as a Wild and Scenic River, to perpetuate natural and recreational values recognized in the Petapawag ACEC, and to protect Priority Habitat for a bird species designated under MESA.

Zone 2

Zone 2 areas provide for a balance between resource stewardship and recreational opportunities that can be appropriately sustained. They include stable yet important cultural and natural resources. These areas provide a buffer for sensitive resources, recharge areas for surface and groundwaters, and large areas where existing public recreation activities can be managed at sustainable levels (DCR 2012). The following areas of J. Harry Rich have been designated Zone 2.

- All areas not identified as Zone 1 or 3.

Zone 3

Zone 3 areas include altered landscapes in active use and areas suitable for future administrative, maintenance, and recreation areas (DCR 2012). The following areas of J. Harry Rich are currently developed, appropriate for potential future development, or intensively used for recreation. They have been designated Zone 3.

- Two existing parking areas on the Main Tract. The first at the main entrance and the second at the Tinker Trail trailhead. These Zone 3 areas are restricted to their existing footprints due to the status of Nod Road and Sand Road as designated Scenic Roads by the Town of Groton, the location of the Forest within the Petapawag ACEC, and the presence of additional parking at the Rail Trail parking lot.

Significant Feature Overlay

Significant Feature Overlays provide precise management guidance in order to maintain or preserve recognized resources features regardless of the zone in which they occur. The following Significant Feature Overlay was developed for J. Harry Rich.

- **Area of Critical Environmental Concern (ACEC) Overlay**. The Petapawag ACEC encompasses the entirety of the Forest and recognizes and protects habitat for numerous endangered plant and animal species, wetlands and waterbodies including the Nashua River, drinking water resources, BioMap Core Habitat, and significant cultural and historic resources and scenic landscapes (Secretary of Environmental Affairs 2002). Projects and activities within ACECs must minimize adverse effects on sensitive resources and are guided by a variety of regulations and programs that are summarized in the ACEC Guide to State Regulations and Programs (DCR 2017).

DCR Stewardship Map Tool

This RMP should be viewed in conjunction with DCR's Stewardship Map, a GIS-based tool that allows users to view a property's natural, cultural, and recreational resources. The Stewardship Map tool is dynamic, and information continues to be updated after adoption of an RMP. Guidance for using the tool, as well as BMPs for resource stewardship, are located on the Stewardship Map site: https://dcrsgis-mass-eoeea.hub.arcgis.com/.

Because authorized trails are located within State-Listed Species Habitat on this property, managers should consult an additional GIS-based tool, the NHESP 2022 Guidance Codes for DCR Trail Maintenance Map. (https://mass-eoeea.maps.arcgis.com/home/item.html?id=cb252e8df40d408c81fe8fcf690e14f6) This tool allows users to select specific trail segments and identify restrictions and regulatory review associated with performing 10 common trail maintenance activities on these segments. Because site-specific rare species information is confidential under Massachusetts law (M.G.L. c. 66, § 17D), access to this tool is restricted.

Consistency Review

Resource Management Plans "shall ensure consistency between recreation, resource protection, and sustainable forest management" (M.G.L. c. 21, § 2F). For planning purposes, an activity is considered consistent with resource protection if it has no significant, long-term, adverse impact on resources. To this end, a series of indicators were developed to evaluate the impacts of recreation and forest management on natural and cultural resources.

Many activities with the potential to negatively affect resources are already subject to agency and/or regulatory review (e.g., forest management activities, projects within Priority Habitat). For these activities, compliance with state regulations, regulatory authority guidance, DCR policies and processes, and BMPs is considered an indicator of consistency between park use and resource protection. New indicators were generated for activities not subject to agency or regulatory review, and are based on available data, information readily identifiable via aerial imagery or site visits, assessments by DCR subject matter experts, or the property manager's knowledge of park conditions and use. (See Table 18, page 27.)

Indicators are applied during the RMP planning process in order to ensure a standardized assessment of consistency across all properties in the DCR system. Inconsistencies identified via the application of indicators are used to inform the development of management recommendations.

The status of indicators (Yes, No, Unknown, and N/A) were accurate at the time this RMP was prepared and were used for planning purposes. However, they represent a snapshot in time and may not reflect future conditions. In addition, the status of indicators will change as recommendations get implemented.

MANAGEMENT RECOMMENDATIONS

Nineteen priority management recommendations were developed for this property. They are presented in Table 19, page 30. All recommendations are of equal importance.

Priority management recommendations derive from Threats, Opportunities, and Consistency Assessment information presented in this RMP. For a recommendation to be considered a priority and listed in the table, it must meet one or more of the criteria listed below. Maintenance and management needs not meeting one or more of these criteria are not included in the table but are identified in the Threats and Opportunities sections.

The following types of recommendations are considered priority:

- Natural resource stewardship and restoration activities consistent with park identity and intended to improve ecological function and connectivity.
- Cultural resource management activities consistent with park identity and intended to prevent the loss of integrity of significant cultural resources.
- Improvements consistent with park identity that are needed to support intended park activities.
- Actions required for regulatory compliance or compliance with legal agreements.
- Activities that prevent or ameliorate threats to the health and safety of park visitors and employees.
- Activities that address inconsistencies among recreation, resource protection, and sustainable forest management, as identified through use of the Consistency Assessment checklist.

Progress toward implementing priority recommendations is tracked through the use of DCR's Capital Asset Management Information System (CAMIS). The property manager should enter each recommendation listed in Table 19 (page 30) into CAMIS as a separate work order, noting "*RMP" in the description field. Non-traditional work orders (e.g., volunteer trail work, posting of DPH Fish Consumption Advisory posters, certification of vernal pools) should be closed out by the property manager, once the recommendation has been implemented.

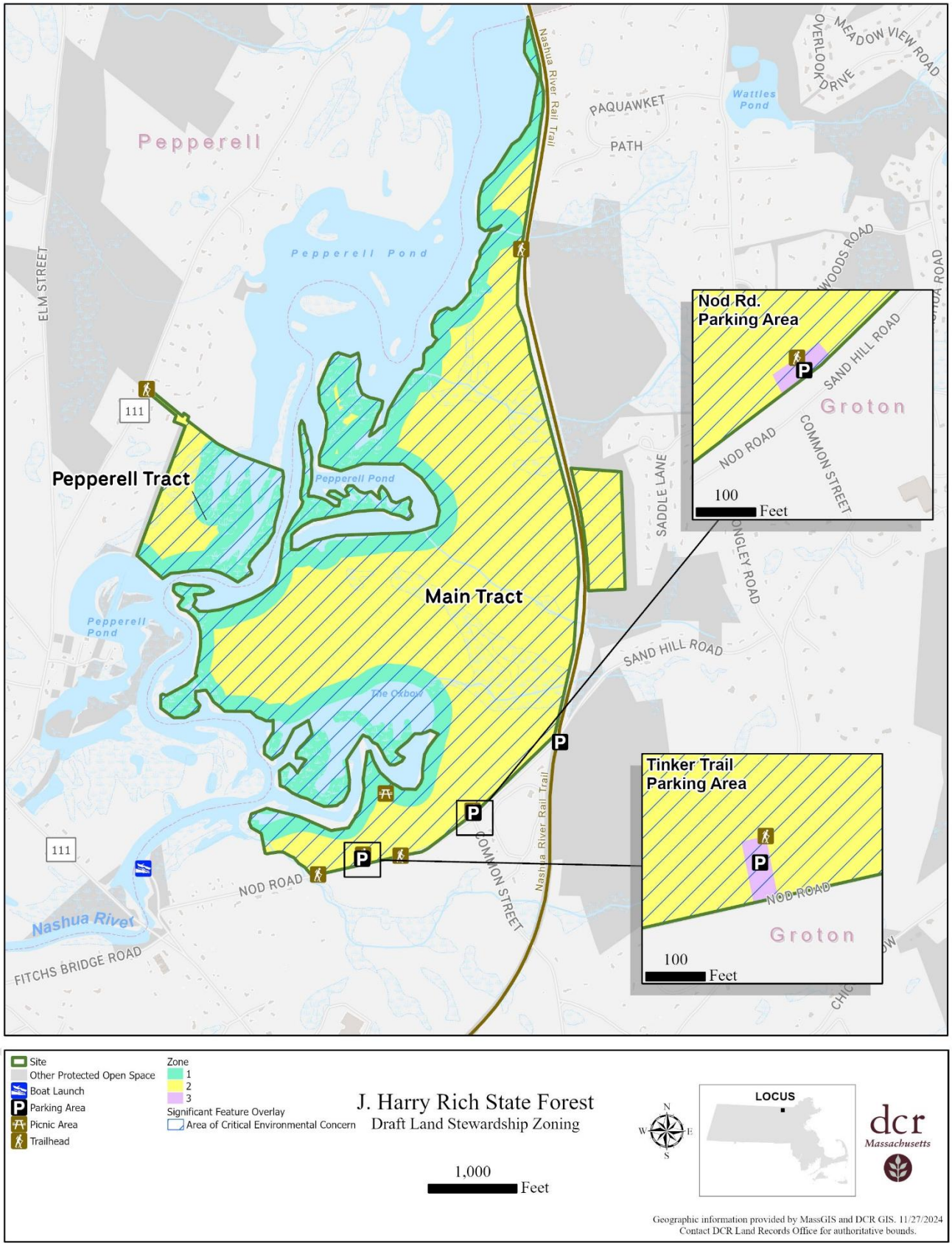

Figure 1. Land Stewardship Zoning Map.

Table 18. Consistency Assessment. This assessment represents a snapshot in time and may not reflect future conditions.

Category	Metric	Status
Landscape Designation	1. All development and uses of the park since 2012, or currently planned for the park, are consistent with its Landscape Designation(s).	Yes
Natural Resources	1. All projects (normal maintenance activities, special projects, volunteer projects) conducted within Priority Habitat were reviewed and approved through DCR's internal review process and by NHESP for potential impacts to rare species and their habitats.	Yes
Natural Resources	2. All projects conducted within areas subject to state and/or federal wetlands or waterways regulations were reviewed and approved through DCR's internal review process; reviewed and approved through the appropriate, local, state, and/or federal review process; and were carried out in accordance with the terms of a valid permit.	Yes
Natural Resources	3. Sensitive resource areas, such as steep slopes, riverbanks, streambanks, pond and lakeshores, wetlands, and dunes are free of desire paths and other user-created trails.	No
Natural Resources	4. Aquatic areas adjacent to beaches, boat ramps and launches, roads, and hiking trails are free of eroded sediments.	No
Natural Resources	5. The extent of exposed soil in campground and/or picnic sites is stable or decreasing.	No
Natural Resources	6. The extent of native vegetation in campground and/or picnic sites is stable or increasing. (As assessed by property manager.)	No
Natural Resources	7. Area of trail impacts in Reserves is less than 50% of total area. (See Naughton (2021) for information on primary area of trail impacts.)	N/A
Natural Resources	8. Congregations of breeding, migratory, or wintering wildlife are protected from disturbance by temporary (e.g., seasonal) restrictions on recreational access.	Yes
Natural Resources	9. Geocaches, letterboxes, orienteering control locations, and other discovery destinations are located outside sensitive natural resource areas and their locations have been reviewed and approved by park personnel. (As assessed by property manager.)	No
Natural Resources	10. Zone I wellhead protection areas are free of vehicle parking, chemical storage, or concentrated recreation.	N/A

Category	Metric	Status
Natural Resources	11. All boat ramps and launches have cleaning stations and/or educational signs and materials on preventing the spread of aquatic invasive organisms. (As assessed by property manager.)	No
Natural Resources	12. For each barrier beach there is a current, approved Barrier Beach Management Plan and all beach-related activities are conducted in accordance with this plan.	N/A
Cultural Resources	1. All maintenance activities and projects with the potential to cause sub-surface disturbance are being reviewed by the DCR archaeologist for potential impacts to archaeological resources.	Yes
Cultural Resources	2. All maintenance activities and projects affecting historic properties (buildings, structures, and landscapes over 50-years-old) are being reviewed by the Office of Cultural Resources to avoid adverse impacts.	Yes
Cultural Resources	3. Historic buildings, structures, and landscapes are being used, maintained, and repaired in a manner that preserves their cultural integrity and conveys their historic significance to park visitors.	No
Cultural Resources	4. Recreational activities such as hiking, biking, and boating are not eroding cultural properties such as archaeological sites or historic landscapes through creation of desire lines, rutting in the landscape, damage to historic built features, or excessive scouring (erosion) of coastal and shoreline areas.	No
Cultural Resources	5. Geocaches, letterboxes, and other discovery destinations are located away from sensitive cultural resources, and their locations have been reviewed and approved by park personnel.	No
Cultural Resources	6. Historic buildings, structures, landscapes, archaeological sites, and concentrations of historic resources are located outside of areas predicted to be subject to flooding, storm surge, or sea-level rise.	No
Recreation	1. Types of recreation, levels of recreational use, and types and extent of recreation infrastructure are consistent with the park's identity statement.	Yes
Recreation	2. Trail density is consistent with the park's Landscape Designation(s). (See Trails Guidelines and Best Practices Manual (DCR 2019) for density thresholds.)	Yes

Category	Metric	Status
Recreation	3. All authorized trail construction was performed in accordance with an approved Trail Proposal Form.	Yes
Recreation	4. Over 90% of the park's official trails network is classified as being in Fair or better condition.	No
Recreation	5. Recurring use by OHVs is restricted to authorized trails. (As assessed by property manager.)	N/A
Recreation	6. There is a high level of compliance with dog leash regulations and policies. (As assessed by property manager.)	Yes
Recreation	7. Athletic fields are free of recreation-caused impacts (e.g., bare spots) to turf. (As assessed by property manager.)	N/A
Recreation	8. Water-based recreation is consistent with "Uses Attained" designation as identified by MassDEP in its most current integrated list of waters (e.g., MassDEP 2023); DPH fish consumption advisories; and/or water quality testing at waterfront areas.	Yes
Recreation	9. Recreation facilities are located outside of areas subject to flooding, storm surge, or sea-level rise.	No
Sustainable Forest Management	1. Forestry activities are consistent with Landscape Designation and associated forestry guidelines.	Yes
Sustainable Forest Management	2. Forestry activities are consistent with current Forest Resource Management Plan.	N/A
Sustainable Forest Management	3. Tree cutting is performed in accordance with an approved cutting plan, if required under the Massachusetts Forest Cutting Practices Act (M.G.L. c. 132, §§ 40–46).	N/A

Table 19. Priority Recommendations for J. Harry Rich State Forest. All recommendations are of equal importance. When multiple agency parties are responsible for implementing a recommendation, the lead party, or parties, are identified parenthetically in the Implementation column. Property managers should enter these recommendations as work orders in CAMIS to ensure their tracking and implementation.

Category	Recommendation	Implementation
Natural Resources	Clarify the extent of DCR land ownership and boundaries in the Boutwell Island area of the Forest, including mainland shoreline and islands.	GIS Program, Management Forestry (Lead), Office of General Council
Natural Resources	Install a gate and DCR rules and regulations sign at the trailhead of the Pepperell Tract. Install rules and regulations signs where trails enter this portion of the Forest from other conserved lands.	Park Operations
Natural Resources	Survey, document, and submit documentation to certify the potential vernal pool, in accordance with DCR (n.d.) and MassWildlife (2009), as warranted.	Office of Natural Resources (Lead), Volunteers
Natural Resources	Following appropriate review and permitting, implement the Invasive Plant Management Plan: Central Region (BSC 2017). Maintain actions as needed.	Management Forestry, Office of Natural Resources (Lead), Park Operations, Partner
Natural Resources	Prepare a property-specific Forest Resource Management Plan for the property that incorporates the Forest Futures Visioning Process (DCR 2010) and forestry-related recommendations in the 1988 Guidelines for Operations and Land Stewardship plan (if still appropriate). As part of this review, consider whether to implement special demonstration forestry practices in the Forest and whether to preserve and regenerate a white pine stand according to the forestry management principles of J. Harry Rich.	Office of Cultural Resources, Management Forestry (Lead), Interpretive Services
Natural Resources	Document the presence of the Hemlock Swamp by completing a Natural Community Field Form and submitting it to the Natural Heritage & Endangered Species Program.	Office of Natural Resources
Natural Resources	Design and implement monitoring program at the Hemlock Swamp to protect this resource from hemlock wooly adelgid and invasive plant species.	Office of Natural Resources (Lead), Park Operations, Volunteers

Category	Recommendation	Implementation
Cultural Resources	Conduct an archaeological reconnaissance survey (950 CMR 70) and prepare a sensitivity map of the Forest to identify the presence and extent of known and potential archaeological resources. Complete appropriate Massachusetts Historical Commission archaeological site forms for identified archaeological resources. As warranted, revise this Resource Management Plan with modified Land Stewardship Zoning, resource protection, and public interpretation activities.	Office of Cultural Resources (Lead), Park Operations, Partner(s)
Cultural Resources	Clear vegetation from cellar holes in accordance with DCR Best Management Practices (BMPs) and redirect paths around these resources.	Office of Cultural Resources, Park Operations (Lead), Volunteers
Recreation	Establish a DCR web page for the Forest.	Interpretive Services, Regional Staff (Lead), State Parks Operations, Web Content Creator
Recreation	Create a Forest trail map.	GIS Program, Interpretive Services, Trails and Greenways Section (Lead)
Recreation	Explore feasibility of preparation and implementation of an interpretive plan based on results of archaeological survey, historical research, and input from the Bureau of Fire Control and Forestry. Potential topics for interpretation include Indigenous peoples, 17th-century settlement, and forestry practices.	Interpretive Services (Lead), Management Forestry, Office of Cultural Resources
Recreation	Locate all unsanctioned small craft landings in the Forest and determine their appropriateness (based on potential threats to natural and cultural resources) for continued recreational use. Identify party or parties responsible for such landings and establish working relationship, license, or formal partnership, as appropriate, to close and/or facilitate responsible use of such landings. Erect DCR Internal Park Information Signs and rules at landings that are appropriate for continued use.	Park Operations, Trails and Greenways Section (Lead)

Category	Recommendation	Implementation
Recreation	Resolve trail-related threats and opportunities identified in this RMP, in accordance with Trails Guidelines and Best Practices (DCR 2019, or update), through the following actions: • Maintain authorized trails, as identified in the DCR Trail Data Layer provided to the Natural Heritage and Endangered Species Program in 2021, and in accordance with the Recreational Trail Maintenance and Biodiversity Conservation 2021 update. • Evaluate trail segments for discontinuation or active closure, including those that are: unauthorized, unsafe, connecting to privately-owned property, located in environmentally or culturally sensitive areas, or otherwise inconsistent with DCR Trails Guidelines and Best Practices. Provide an updated trail data layer to the Natural Heritage and Endangered Species Program. • Establish new trails, as warranted, following regulatory review. Provide an updated trail data layer to the Natural Heritage and Endangered Species Program.	Management Forestry, Office of Natural Resources, Park Operations (Co-Lead), Partners, Trails and Greenways Section (Co-Lead)
Recreation	Remove non-DCR park rules signs at trailheads for the main entrance and the Tinker Trail and replace with official DCR Rules & Regulations signs. Install a kiosk with a Welcome Wayside at the Tinker Trail.	Park Operations
Recreation	Ensure that Department of Public Health Fish Consumption Advisory Posters (https://www.mass.gov/doc/fish-consumption-advisory-poster-for-marine-and-fresh-water-bodies-0/download) are posted at fishing access locations.	Park Operations (Lead), Partner
Recreation	Augment the rail trail kiosk at Sand Hill Road with Forest information.	Park Operations
Recreation	Add a Lead-In or Cantilevered Identification Sign to the Tinker Trail trailhead lot.	Trails and Greenways Section

Category	Recommendation	Implementation
Recreation	Work with the geocaching community to ensure that caches located in sensitive natural and cultural resources are relocated out of those areas and that any new geocaches are placed outside of sensitive areas and with the approval of the property manager.	Park Operations

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