Boscawen Town Forest
Boscawen NH

Updated Timber Inventory and Recommended Forest Management Practices

Prepared for:
Boscawen Conservation Commission

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Introduction and Background

The Boscawen Town Forest consists of 438 acres located along Weir Road in the southwest corner of the Town, adjacent both the town lines of Webster and Concord. It abuts the NH Fish and Game Department's Hirst Wildlife Management Area and conservation land owned by the City of Concord, forming a large block of permanent conservation land with diverse wildlife habitat, productive forest soils and valuable timber resources, unique natural communities, and tremendous current and potential recreation values.

The Boscawen Conservation Commission (BCC) has had formal management responsibility of the Town Forest since 1982. In 1990, the Commission entered into a cooperative management agreement with the NH Fish and Game Department. In 1993-1994, timber harvesting took place on a small portion of the Town Forest, designed and implemented with the assistance of NH Fish and Game. Prior to this the only commercial timber harvest on the Town Forest since the BCC assumed management occurred in 1987-1988 under the guidance of licensed professional forester John Conde.

In 2001, the BCC hired licensed professional forester Ronald Klemarzcyk to conduct a timber inventory and prepare a forest management plan. The plan and inventory was presented to the BCC in March 2002. For a variety of reasons, few of the management activities recommended in that plan have been implemented in the intervening 15 year period, with the exception of maintenance of early successional habitat hear the historic Weir Farm site, recreational trail development and maintenance, and concerted efforts to contain the spread of non-native invasive plant species around the Weir Farm. No commercial timber harvesting has been conducted on the town forest since 1993-1994.

Owners of productive forestlands that are actively managed for multiple uses are generally advised to update their inventory and management plans every 10 to 15 years. In 2017, the BCC retained licensed forester Charles Niebling of Innovative Natural Resource Solutions LLC (INRS) to update an inventory of timber resource and timber and habitat management recommendations for the next 10 years.

This report summarizes the results of the timber inventory conducted in May, 2017, and presents recommended timber, habitat, natural area and recreational management activities for consideration by the BCC for the period 2017 through 2026.

Acknowledgements

INRS acknowledges the assistance of members of the Boscawen Conservation Commission, and Boscawen Land Use Coordinator Alan Hardy for their assistance in the preparation of this report and plan. INRS also acknowledges the assistance of Mr. James Oehler of the NH Fish and Game Department with helpful recommendations regarding habitat management. Finally, INRS acknowledges the excellent professional work of Ron Klemarzcyk, particularly the use of stand maps prepared as part of the 2002 forest management plan.

Timber Inventory Methodology

INRS LLC conducted a timber inventory of the property using the following cruise design and methodology:

1) INRS first estimated the land area to be inventoried by classifying operable and accessible acreage based on field reconnaissance and prior knowledge of the property. We excluded as inoperable or not to be managed for timber production wetland areas, the fields and early successional habitat immediately adjacent the historic Weir Farmstead, and the former landfill site that is now maintained in an open grassy condition. We also excluded as operable but not to be managed approximately 19 acres in the far western portion of the Barnard Lot as this land has no practical access due to it being surrounded on all sides by extensive wetlands and beaver flowage. The total Town Forest operable acreage was classified as summarized in Table 1:

Table 1. Boscawen Town Forest acreage classification.

Land Classification	Acreage
Operable, Inventoried	358
Operable, Not Inventoried	19
Inoperable, Wetland	48
Weir Farmstead, Former Landfill Site	13
TOTAL ACREAGE	438

2) We estimated a total number of 81 sample plots necessary in order to achieve 10-15% standard error with 95% confidence level for tract side inventory data. These plot locations were randomly distributed over the 358 operable acres using ForestMetrix software, as illustrated in Figure 1:

Figure 1. Location of inventory plots on operable, managed acreage of Boscawen Town Forest.

3) INRS conducted the variable radius plot sample inventory with a two man crew over the three day period from May 17-19, 2017, using a 10 factor basal area prism. We measured all trees 5" and over in diameter for both diameter (at diameter breast height, 4.5' above ground level) and estimated tree height in merchantable 16' log sections. We classified each log section as either veneer, sawlog, pallet log, pulpwood or growing stock. Data was collected using a hand-held IPad datalogger.

4) The resulting dataset was analyzed using ForestMetrix™ and MS Excel software.

Results of Timber Inventory

The Boscawen Town Forest has a rich and diverse array of forest types and stands that have developed as a function of land use history, soils, species composition, natural events such as storms and insect infestations, and past timber harvesting activity. It is useful for forest management purposes to delineate the forest into stands or management units that have similar forest type characteristics and/or that create units that are convenient and practical for forest management activities. Below is a map (Figure 2) and Table 2 summarizing the forest type and description of each stand or management unit of the Boscawen Town Forest, using Mr. Klemarzcyk's 2002 stand map as the base.

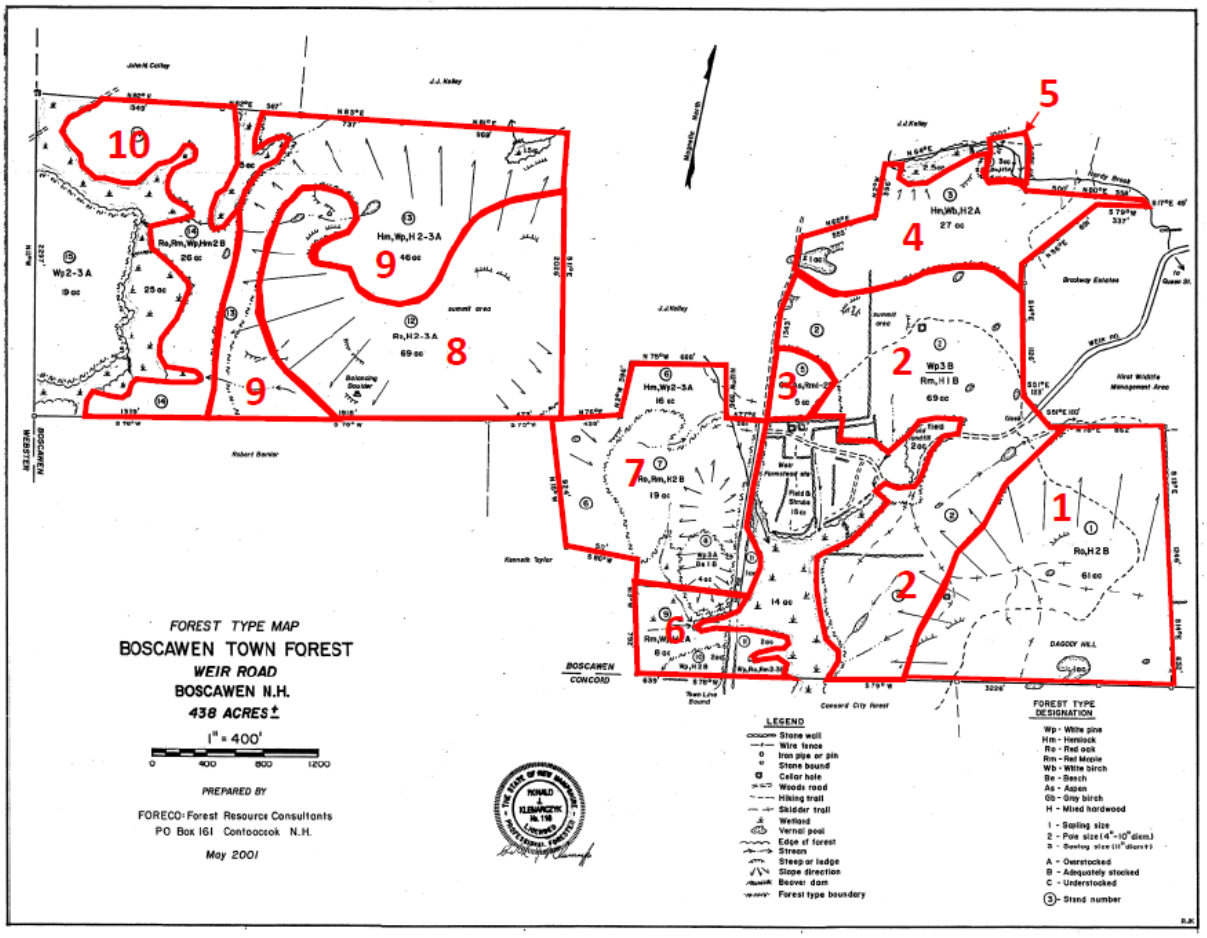


Figure 2. Stand map of Boscawen Town Forest.

Table 2. Operable stands or management units of the Boscawen Town Forest.

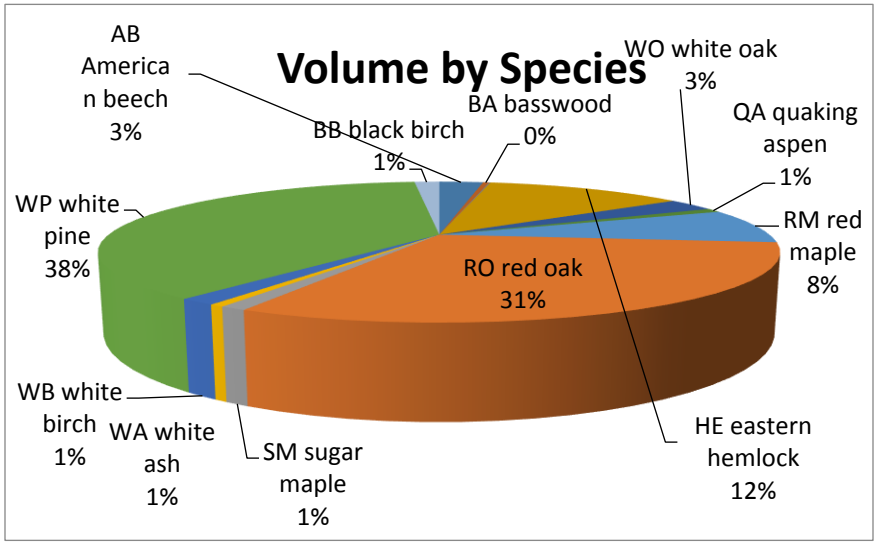
Stand #	Forest Type	Description	Acreage
1	Ro, H2A	Adequately stocked stand of sawtimber and pole sized hardwoods dominated by red oak. Small patch cuts harvested in this stand in 1993. Network of overgrown skid trails. Access from landfill site.	61
2	Wp3B/Rm,H2B	Adequately stocked stand of mature and overmature sawlog sized white pines with an understory of sapling and pole-sized hardwoods, dominated by red maple and black birch. Mature pine removed from this stand in 1987-1988 harvest. Network of overgrown skid trails. Access from landfill site.	69
3	Rm,As,Wp2B	Adequately stocked stand of generally poor quality hardwoods. Former Weir farms pasture abandoned around time farm came in to town ownership in 1940's. Will require development of truck access for any harvesting.	5
4	Hm,Wp,H2A	Overstocked stand of sawtimber and pole sized hemlock, white birch, red maple and other hardwoods. Some white pine. Access from landfill site.	27
5	Ro,BeH3A	Old forest grove adjacent Hardy Brook. Trees >125 years old. No access present or required – manage as natural area.	3
6	Wp,RmH2-3B	Adequately stocked stand of white pine and mixed hardwoods. Will require development of truck access for any harvesting.	12
7	Wp,Hm,H2-3A	Diverse age class stand with adequate- to over- stocking of mature pine and hemlock, some mature hardwoods dominated by red oak, other mixed hardwoods. Very little regeneration in pine/hemlock portions of this stand. Will require development of truck access for any harvesting.	40
8	Ro,H2-3A	Overstocked stand of pole and sawtimber sized red oak and other mixed hardwoods. No evidence of harvesting in last 75 years. Will require development of truck access for any harvesting, or right of way negotiation with abutting landowners.	64
9	Hm,WpH3A	Adequate to over-stocked stand of mature hemlock, white pine and mixed hardwoods. No evidence of harvesting in at least the last 75 years. Will require development of truck access for any harvesting, or right of way negotiation with abutting landowners.	51
10	Ro,Rm,Hm,Wp2B	Adequately stocked stand of pole and sawtimber-sized red oak, red maple, white pine and hemlock. Some evidence of harvesting 40-50 years ago. Will require development of truck access for any harvesting, or right of way negotiation with abutting landowners.	26

The inventory showed total standing sawtimber volume of **3,299,500 board feet** for all species and **10,193 tons of pulpwood** (Table 3). The average number of trees per acre is 175 and average basal area (a measure of stand density) is 123 square feet per acre, indicating a relatively densely stocked forest. Basal area ranges from a high of 158 sq. ft./acre in Stand 9 to a low of 58 sq. ft./acre in Stand 3. The inventory sampling precision at the 95% confidence level was +/-9.3% for sawtimber and +/- 6.7% for all volume.

Table 3. Summary of timber inventory results, by stand.

Stand	Acreage	Total Sawtimber (1,000 board ft)	Sawtimber/Acre (1,000 board ft)	Total Pulp (Tons)	Trees Per Acre	Average Basal Area (sq.ft./acre)
1	61	374.8	6,145	1,330	164	108
2	69	839.1	12,162	2,180	146	121
3	5	14.7	2,933	128	95	58
4	27	115.5	4,278	318	200	108
5	3	44.7	14,902	83	172	140
6	12	127.9	10,658	463	208	143
7	40	461.9	11,548	1,708	192	133
8	64	462.8	7,238	1,907	182	116
9	51	646.8	12,682	1,270	204	158
10	26	211.3	8,127	806	196	128
TOTAL	358	3,299.5	9,217 (mean)	10,193	175 (mean)	123 (mean)

Figure 3. Species as % of total inventory volume on Boscawen Town Forest.



The commercially valuable species of white pine and red oak comprise a very high percentage of total volume, with 69% (77% of total sawtimber volume) in the commercially valuable species of white pine (47% of total sawtimber), and red oak (30%). By applying

conservative estimates of current market pricing for sawtimber stumpage value, we calculate an estimate of total sawtimber capital value of approximately $737,000. This is presented in Table 4. This does not include timber capital value of lower value pulpwood, firewood, fuel chips or other products, and so represents a very conservative estimate of the value of the timber resource on the Boscawen Town Forest.

The majority of high quality and high value oak and pine sawtimber is located in stands 1 and 2 adjacent the landfill site, and in stands 7, 8 and 9 of the Armstrong, Ellsworth and Barnard Lots. Stands 3, 4, 6 and 10 have more limited sawtimber value.

Table 4. Estimate of total sawtimber capital value using conservative estimates of current market pricing for sawtimber stumpage.

Species	Sawtimber Volume	Stumpage Value*	Total Sawtimber Capital Value
AB American beech	69,736	$200	$13,947
BA basswood	11,370	$200	$2,274
BC black cherry	-	$300	
HE eastern hemlock	322,672	$50	$16,133
WO white oak	69,296	$250	$17,324
QA aspen spp.	24,518	$50	$1,225
RM red maple	181,398	$200	$36,277
RO red oak	1,000,766	$400	$400,306
SM sugar maple	28,863	$300	$8,658
WA white ash	14,326	$250	$3,581
WB white birch	17,063	$50	$853
WP white pine	1,535,195	$150	$230,279
SB sweet (black) birch	24,398	$250	$6,099
TOTAL	3,299,601		$736,956

Note: Stumpage net of timber tax; average stumpage values from NHTOA quarterly market report, April 2017; values reflect combination of all sawtimber products: veneer, logs, pallet

Ten Year Recommended Timber, Wildlife Habitat, and Recreation Management Practices

The Boscawen Conservation is responsible for the stewardship of the Boscawen Town Forest for the citizens of the town to meet multiple objectives. These include:

- Recreational use by diverse stakeholders including hunters, hikers, bird watchers, snowmobilers and nature lovers.
- Protection of natural ecosystems and biological diversity.
- Protection and management of habitat for both game and non-game species of wildlife.
- Management of the productive capacity of the forest to produce forest products, and generate income to offset management expenses and support strategic acquisition of parcels that complement town forest ownership and conservation.

With these objectives in mind, INRS has developed recommended management practices that best balance these objectives to guide stewardship of the Boscawen Town Forest for the next ten years, through 2026. Management practices will be primarily implemented through carefully designed timber harvest to generate income, improve forest health and productivity, enhance wildlife habitat, and increase access to the town forest for outdoor recreation, where appropriate. These are organized by stand in Table 5 and chronologically by year in Table 6.

Table 5. Recommended timber, wildlife, and recreation management practices by stand.

Stand	Acreage	Timber management	Wildlife Management	Recreation Management
1	**61**	½-1 acre patch cuts on 10-15 year entry cycle, treating approximately ¼ of this stand with each entry; group and single tree selection between patches; regenerate young age classes and remove mature and low quality timber.	Enhance age class diversity with early successional growth; introduce softwood cover by regenerating white pine in openings. Protect perched wetlands and vernal pools at top of Dagody Hill.	Care to protect Dagody Hill trail during harvest; consider some of small patch cuts along ledge area below Dagody Hill trail to open views to west
2	**69**	Two stage shelterwood harvest to remove most of mature pine overstory and regenerate white pine, timing harvests to coincide with good white pine seed years; open ground harvest to scarify seed bed; care and attention to protect better quality hardwood regeneration from 1987-1988 harvest. Stage 1 in next two years, followed by stage 2 in 8-10 years.	Harvest small patch cuts with each stage along beaver flowage south of old Weir farmstead to create young hardwood regeneration as food source for beavers; retain some large pines for raptor perch trees and eventual snag and cavity trees	Care to protect Weir farmstead trail during harvest; other skid trails can potentially be maintained in open condition to develop additional trail loop(s).

Stand	Acreage	Timber management	Wildlife Management	Recreation Management
3	**5**	Possible clearcut of some/all of this stand to open old pasture north of old Weir farmstead and re-establish early successional habitat that can be maintained by mowing. Otherwise leave unharvested as there is little desireable growing stock in this stand and harvest will predispose this area to spread of invasive plant species from Weir farmstead	Clearcut would create extensive area of additional early successional habitat that can be maintained through mowing for species to require young forest habitat.	Care to protect Weir farmstead trail during harvest; care to protect existing interior stone walls in this stand.
4	**27**	Single tree and group selection, small patch cuts to remove low grade and release better quality saw and poletimber; regenerate pine and oak in openings; extensive thinning of low grade to improve overall stand health and vigor.	Group selection and small patch cuts create early successional habitat.	Possible area of new hiking trail loops toward stand 5 natural area and along Hardy Brook.
5	**3+**	No management; designate as natural area.	Protect old aged forest condition along Hardy Brook and small pond, provides unique habitat values	Build hiking trail loop to this stand to allow visitors to enjoy this beautiful part of town forest.
6	**12**	Single tree and group selection, small patch cuts to remove low grade and release better quality saw and poletimber; regenerate pine and oak in openings; extensive thinning of low grade to improve overall stand health and vigor. Ground conditions in this stand are very wet and will require frozen ground operating only. Will require development of new truck access to west side of Weir Road.	Group selection and small patch cuts create early successional habitat. Possibly some deer wintering in this stand – maintain crown cover at 70%.	No compelling recreation management opportunities in this stand. Protect aesthetics of stand during any harvesting within visible distance of old Weir Road.

Stand	Acreage	Timber management	Wildlife Management	Recreation Management
7	**40**	Single tree and group selection, small patch cuts to remove low grade and release better quality saw and poletimber; regenerate pine and oak in openings; extensive thinning of low grade to improve overall stand health and vigor. Will require development of new truck access to west side of Weir Road.	Extensive nearly pure hemlock/pine stands should be managed to perpetuate winter cover for deer and other species. Will want to get clear guidance from NH Fish and Game before any harvest in this stand.	Possible location of new multi-use, non-motorized recreation trail through this stand to Barnard Lot.
8	**64**	This stand is characterized by shallow, ledgy soils, very dry summer conditions; and very slow timber growth. Timber harvesting is not recommended in this stand, with the possible exception of some small view cuts to open views from the top of Barnard Hill looking south and west. If required, could access this part of Barnard Lot from adjacent Parnassus LLC ownership to south.	Maintain closed canopy oak and beech habitat for turkey, deer, bear and other species. Minimal to no disturbance of recommended. Manage primarily as natural area to allow old forest to develop over time.	Develop trail loop option(s) of varying distances to height of hill, "balancing boulder" and other unique natural features of this stand.
9	**51**	Single tree and group selection, small patch cuts to remove mature high quality sawtimber and regenerate pine and oak in openings; extensive thinning of low grade to improve overall stand health and vigor. This stand best accessed from north across land of Kaufmann.	Maintain some areas of old aged mature forest for age class diversity. Manage beautiful beaver pond and drainage in northeast corner of this stand as permanent natural area.	Extension of trail loop from stand 8 into west end of Barnard Lot and to natural area in northeast corner of Barnard Lot.
10	**26**	Single tree and group selection, small patch cuts to remove low grade and release better quality saw and poletimber; regenerate pine and oak in openings; extensive thinning of low grade to improve overall stand health and vigor. This stand best accessed from north across land of Kaufmann.	Maintain uncut buffers along wetlands and beaver flowages with the exception of some small patch cuts to edge of beaver flowages to create young hardwood food source for beaver.	Extension of trail loop from stand 8 into west end of Barnard Lot.

Table 6. Chronological sequencing of proposed recommended management activities between 2017-2026 and estimated gross revenues (2017 $).

Years	Stand	Prescription Summary	Objectives	Harvest Volume	Gross Harvest $	Comments
2017-2019	2	Significant overstory removal of mature pine, 1st stage of 2 stage shelterwood	Harvest mature pine before quality deteriorates; open canopy to allow regeneration of pine; provide young hardwood regeneration as food source for beaver; release hardwood regen. from 1987-1994 harvests	250 MBF 750 tons	$35,000	Time harvest to coincide with good pine cone crop, operate on bare ground in fall/early winter; care to minimize impact on existing trails. Maintain uncut buffer near landfill site to minimize spread of invasive species into harvested area.
2017-2019	1	½-1 acre patch cuts, group selection	Establish early successional habitat/age class diversity; emphasize regeneration of pine and oak	75 MBF 250 tons	$27,500	Create views from Dagody Hill Trail; sensitivity to trail use. Protect perched wetlands and vernal pools at top of hill.
2018-2020	4	Single tree/group selection, small patch cuts	Remove low grade and improve stand quality, regenerate pine and oak in openings	40 MBF 500 tons	$7,500	Site trail to stand 5 (Hardy Brook natural area) during harvest.
2019-2021	6	Single tree/group selection	Remove low grade and improve stand quality, regenerate pine and oak in openings	40 MBF 150 tons	$7,500	Will require truck access to new landing adjacent old Weir Rd. Frozen ground conditions only due to wet ground.
2019-2021	7	Single tree/group selection and small patch cut	Harvest mature pine and hemlock; retain crown closure to 70% to favor winter cover for deer use.	150 MBF 500 tons	$25,000	Will require truck access to new landing adjacent old Weir Rd. Site trail to Barnard Lot through harvest area.
2020-2023	8	Limited harvesting to opne views from top of Barnard Hill	Open views from top of hill in Barnard Lot; establish trail network using skid road layout	75 MBF 300 tons	$27,500	Contingent on truck access to Barnard Lot, through land of Parnassus LLC

Years	Stands	Prescription	Objectives	Harvest Volume	Gross Harvest $	Comments
2020-2023	9	Single tree/group selection and small patch cuts, 1-2 acre	Harvest mature pine, oak and hemlock; use patch cuts to establish young age classes and habitat diversity	200 MBF 400 tons	$47,500	Contingent on truck access to Barnard Lot
2024-2026	2	2nd stage of 2 stage shelterwood	Harvest majority of remaining mature pine; pre-commercial thinning of regeneration	250 MBF 400 tons	$45,000	Sensitivity to young regeneration from prior harvest.
2025-2026	1	½-1 acre patch cuts, group selection	Continue introducing young age class diversity; regeneration of pine and oak in openings	60 MBF 250 tons	$22,500	

Discussion of Management Access

Responsible timber harvesting requires development of good access for truck removal of forest products. Excellent truck access and reasonable skidding distances exist for any proposed timber harvesting in stands 1, 2, 3, and 4. However, stands in the Armstrong, Ellsworth and Barnard Lots will require development of new truck access to a landing site on the west side of the old Weir Road (Armstrong, Ellsworth – stands 6, 7) or access via negotiated right of way through abutting ownerships (stands 8, 9 and 10 of the Barnard Lot).

INRS recommends construction of a truck road of approximately 1,200' in length from the current landfill site (north end of maintained grassy area) at the terminus of Weir Road off Queen St., to a point at the northeast corner of the Armstrong Lot (Figure 4). This road would extend to the north of the old Weir Farmstead, taking care to minimize stone wall crossings, and cross the old Weir Road just west of the Weir farmstead. This route avoids any aesthetic impact to the south side of the Weir Farmstead and its historic and cultural values. From this landing site, management activities in stands 6 and 7 could be efficiently accessed via skidder trails. The cost of this truck road and landing is estimated to be $10/linear foot for drainage, crushed stone fill where necessary, and gates to control vehicular access, or approximately $12,000.

Access to the Barnard Lot and stands 8, 9 and 10 presents significant challenges. Ideally the Barnard Lot could be accessed through the purchase of a 3-5 acre addition adjacent to the Ellworth Lot, thus consolidating the town's ownership at the point of intersecting boundary lines between the Armstrong and Barnard Lots. However, discussions with the abutting landowner's (Jon Kaufmann) representative

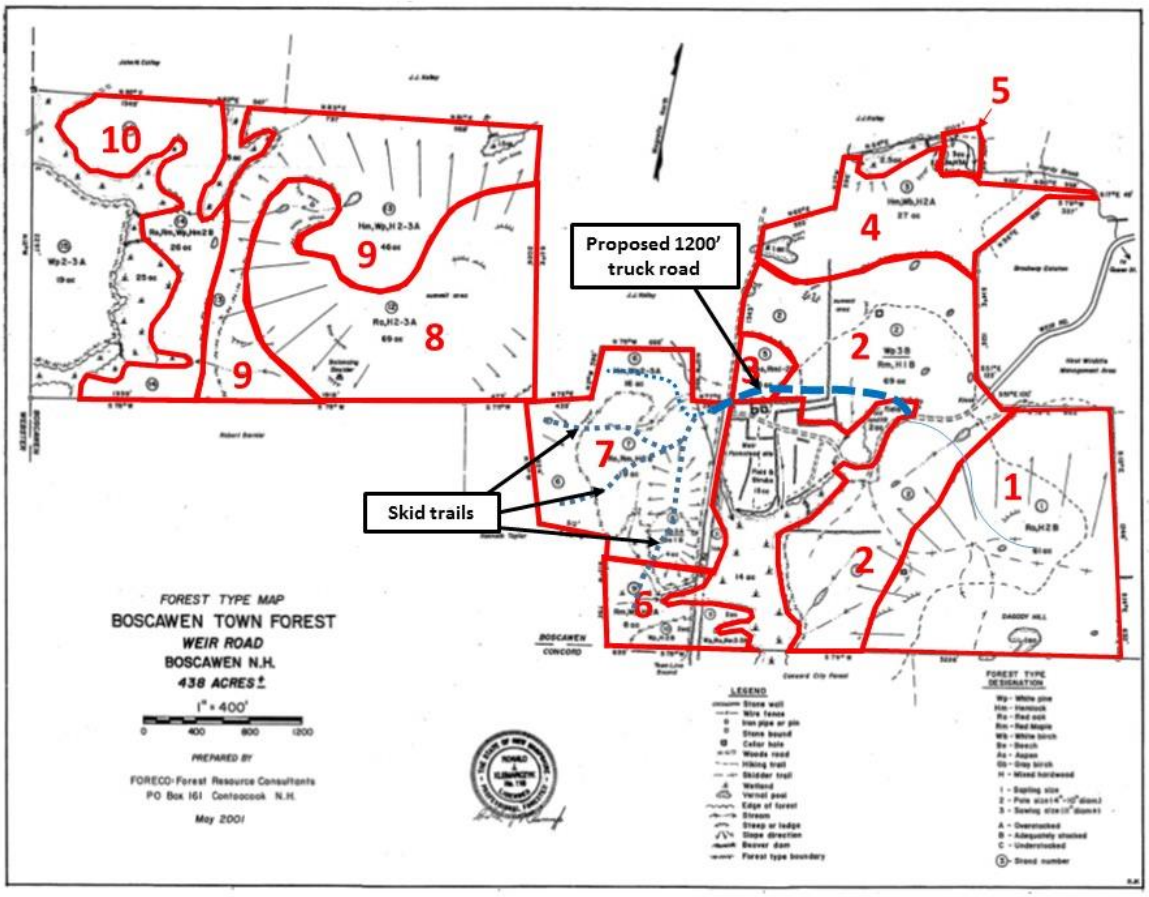


Figure 4. Location of proposed truck road and skid trails to access stands 6 and 7 of Boscawen Town Forest.

have indicated that the landowner is not receptive to this possibility. INRS has met with the landowner's representative and he indicates that the landowner would be receptive to allowing temporary use of a truck road that extends through his ownership from Corn Hill Road to a point very near the northwest corner of the Barnard Lot. This would allow truck access to stands 9 and 10, with efficient downhill skidding distances to a landing site. Some remuneration would be reasonable for use of the truck road, and restoration to its original condition is also expected when negotiating temporary rights of way.

INRS has also spoken to the owner of Parnassus LLC, Dr. Michael Radi. Dr. Radi is open to the possibility of negotiating a temporary access right-of-way across his property, to allow access to the Barnard Lot. This option is not ideal as it would require lengthy skidding distances to the proposed landing site in the Armstrong Lot. Nonetheless, a dialogue has been established with Dr. Radi that could lead to cooperative management possibilities at some point in the future.

Development of access to stands 6-10 is not required for several years as no management activity is proposed in these stands until 2019 and beyond. However, it may be prudent to consider development of the proposed truck road and landing in conjunction with proposed timber harvesting in the next two years, when gross revenues will be more than sufficient to cover the cost, and there may cost advantages to having the road construction done simultaneous with management activities.