

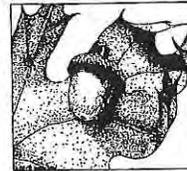
dcr



FOREST MANAGEMENT PLAN

Submitted to: Massachusetts Department of Conservation and Recreation
For enrollment in CH61/61A/61B and/or Forest Stewardship Program

(Williamsburg) 340-9557



CHECK-OFFS

(C) 068-9556

CH61 cert. <input type="checkbox"/>	CH61A cert. <input type="checkbox"/>	CH61B cert. <input type="checkbox"/>	STWSHP new <input checked="" type="checkbox"/>	C-S BEA <input checked="" type="checkbox"/>	Case No. (WH) 337.9558	Orig. Case No. -New
recert. <input type="checkbox"/>	recert. <input type="checkbox"/>	recert. <input type="checkbox"/>	renew <input type="checkbox"/>	Other <input type="checkbox"/>	Owner ID 503169	Add. Case No.
amend <input type="checkbox"/>	amend <input type="checkbox"/>	amend <input type="checkbox"/>	Green Cert <input checked="" type="checkbox"/>	Conservation Rest. <input type="checkbox"/>	Date Rec'd 6-25-12	Ecoregion 221 Ae
Plan Change: _____ to _____			CR Holder _____	Rare Sp. Hab. YES	Plan Period 2013-2022	Topo Name W-burg
						River Basin CT

COPY

OWNER, PROPERTY, and PREPARER INFORMATION

Property Owner(s) The City of Northampton, Department of Public Works,* "RYAN & W.-WHATELY"
Mailing Address 125 Locust Street, Northampton, MA, 01060 Phone (413) 587-1376

Property Location: Town(s) Conway Hatfield, Whately, Williamsburg Road(s) Conway Road**

Plan Preparer Michael Mauri, Forester Mass. Forester License # 161
Mailing Address 20 West Street, South Deerfield, MA 01373 Phone (413) 665-6829

RECORDS

Assessor's Map No.	Lot/Parcel No.	Deed Book	Deed Page	Total Acres	Ch61/61A 61B Excluded Acres	Ch61/61A 61B Certified Acres	Stewshp Excluded Acres	Stewshp Acres
SEE	NEXT	PAGE	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
TOTALS				-	-	-	-	-

Excluded Area Description(s) (if additional space needed, continue on separate paper)
None

HISTORY Year acquired see records Year management began unknown

Are boundaries blazed/painted? Yes No Partially

What treatments have been prescribed, but not carried out (last 10 years if plan is a recert.)?
stand no. N/A treatment _____ reason _____
(if additional space needed, continue on separate page)

Previous Management Practices (last 10 years)

Stand #	Cutting Plan #	Treatment	Yield	Value	Acres	Date
<u>N/A</u>						

Remarks: (if additional space needed, continue on separate page)
*Attention Nicole Sanford, Senior Environmental Scientist; **Conway Road, Williamsburg Road, and Grass Hill Road in Whately; Whately Road and Poplar Hill Road in Conway; Nash Hill Road and the Henhawk Trail in Williamsburg

Property Records: Ryan & West-Whately Reservoir Watersheds

TOWN	Assessor's Map	Lot/ Parcel	Deed Book	Deed Page	Year	Assessor-listed Acreage	CH 61/61A Excluded Acres	Ch 61/61A Certified Acres	Stwdshp/ Green-Cert Excluded Acres	Stwdshp/ Green-Cert Acres
Conway	416	17				84	84.0	0	0.0	84.00
Conway	419	2				30.8	30.8	0	0.0	30.80
Conway	419	8				105.7	105.7	0	0.0	105.70
Conway	419	3				44.18	44.2	0	0.0	44.18
Conway	417	12--12				77.01	77.0	0	0.0	77.01
Conway	419	6--6				199.5	199.5	0	0.0	199.50
Williamsburg	B	19				388.89	388.9	0	0.0	388.89
Williamsburg	B	24				14.9	14.9	0	0.0	14.90
Williamsburg	B	23				94.06	94.1	0	0.0	94.06
Williamsburg	B	35				57	57.0	0	0.0	57.00
Williamsburg	B	25				82	82.0	0	0.0	82.00
Williamsburg	B	36				32	32.0	0	0.0	32.00
Williamsburg	B	26				243	243.0	0	0.0	243.00
Williamsburg	B	27				14.9	14.9	0	0.0	14.90
Williamsburg	B	28				78	78.0	0	0.0	78.00
Whately	28	1				116.39	116.4	0	0.0	116.39
Whately	16	5				298.63	298.6	0	94.5	204.13
Whately	16	6				1.88	1.9	0	0.0	1.88
Whately	16	3				103.64	103.6	0	0.0	103.64
Whately	16	2				219.42	219.4	0	0.0	219.42
Whately	16	1				14.43	14.4	0	0.0	14.43
Tax Acreage Totals						2,300.33	2,300.33	0.00	94.5	2,205.83
Actual Totals Used						2,442.4	2,442.4	0.0	94.5	2,348.0

- 7 ac GR
2,341 ac stand 21
55L
8/6/12

Excluded from Forest Stewardship and Green Certification:

The Ryan Reservoir and the West-Whately Reservoir (part of Whately parcel 16-5), totaling about 94.5 acres combined, are excluded.

Deed Research/Clarification of Ownership Records

Some parcel record information could not be provided at this time. The City of Northampton Department of Public Works (DPW) is currently working with a title examiner and the City Solicitor to determine the correct book and page numbers for present day parcels owned by the City of Northampton. For purposes of the Forest Stewardship Plans and Green Certification, Northampton DPW requests that any outstanding deed research be included as a "Practice" in the Management Practices section of the Forest Stewardship Plans.

Status of Roads and Related Research

In some cases, the legal status (ownership and/or usage rights) of certain roads is uncertain. Northampton DPW will research and clarify these road issues as needed whenever these roads are needed for timber harvesting activities.

Roads that fall into this category for the Ryan & West-Whately watershed are:

1. the Henhawk Trail in Williamsburg and Conway
2. Dry Hill Road in Williamsburg
3. Grass Hill Road in Whately

Roads that may fall into this category for the Mountain Street watershed are:

1. Chestnut Mountain Road in Hatfield
-

Landowner Goals

Please **check** the column that best reflects the importance of the following goals:

Goal	Importance to Me			
	High	Medium	Low	Don't Know
Enhance the Quality/Quantity of Timber Products*	X			
Generate Immediate Income		X		
Generate Long Term Income	X			
Produce Firewood			X	
Defer or Defray Taxes			X	
Promote Biological Diversity	X			
Enhance Habitat for Birds		X		
Enhance Habitat for Small Animals		X		
Enhance Habitat for Large Animals		X		
Improve Access for Walking/Skiing/Recreation			X	
Maintain or Enhance Privacy			X	
Improve Hunting or Fishing			X	
Preserve or Improve Scenic Beauty			X	
Protect Water Quality	X			
Protect Unique/Special/ Cultural Areas	X			
Attain Green Certification	X			
Other:				

*This goal must be checked "HIGH" if you are interested in classifying your land under Chapter 61/61A.

In your own words, describe your goals for the property:

Promote and sustain a diverse, healthy and vigorous forest, and maintain associated infrastructure in good operating condition, so that the primary goal of water quality protection, and secondary goals of long-term timber revenue and habitat diversity are served.

Stewardship Purpose

By enrolling in the Forest Stewardship Program and following a Stewardship Plan, I understand that I will be joining with many other landowners across the state in a program that promotes ecologically responsible resource management through the following actions and values:

1. Managing sustainably for long-term forest health, productivity, diversity, and quality.
2. Conserving or enhancing water quality, wetlands, soil productivity, carbon sequestration, biodiversity, cultural, historical and aesthetic resources.
3. Following a strategy guided by well-founded silvicultural principles to improve timber quality and quantity when wood products are a goal.
4. Setting high standards for foresters, loggers and other operators as practices are implemented; and minimizing negative impacts.
5. Learning how woodlands benefit and affect surrounding communities, and cooperation with neighboring owners to accomplish mutual goals when practical.

Signature(s): Edward S. Huntley

Date: 6/25/12

Owner(s) (print) Edward S. Huntley
 (This page will be included with the completed plan.)

Combined Forest Stewardship Overview:
“Ryan Reservoir & West-Whatley Reservoir Watersheds”
and the “Mountain Street Reservoir” Watershed,
Land of the City of Northampton,
Department of Public Works,
Hatfield, Conway, Whately and Williamsburg, MA

Prepared by Michael Mauri, Licensed Forester

With

Bruce Spencer, Licensed Forester (private consultant);
Bob Bradbury, Licensed Forester (LandVest);
Molly Hale, M.S. Wildlife and Fisheries Conservation (private consultant);
and Chris Polatin, M.S. Conservation Biology (Polatin Ecological Services)

6/21/2012

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I. Introduction

The City of Northampton draws roughly 98% of its municipal water from a three-reservoir system formed by the Ryan, West-Whately and Mountain Street Reservoirs.

The total acreage of the watersheds cannot be exactly ascertained (with surveys lacking).

The estimated acreage of the Ryan & West-Whately watershed is 2,440 acres, more or less. Of this, about 94 acres is open water in the reservoirs, leaving about 2,346 acres of land to be covered in the Forest Stewardship Plan for the Ryan & West-Whately watershed.

The estimated acreage of the Mountain Street Reservoir watershed is 639 acres, more or less. Of this, about 69 acres is open water in the reservoir, leaving about 570 acres of land. Of this, the immediate grounds of the water treatment plant cover about 10.7 acres, leaving a total of about 559 acres to be covered in the Forest Stewardship Plan for the Mountain Street watershed.

The locations of these reservoirs and the approximate DPW property boundaries are shown on the attached Locus Maps.

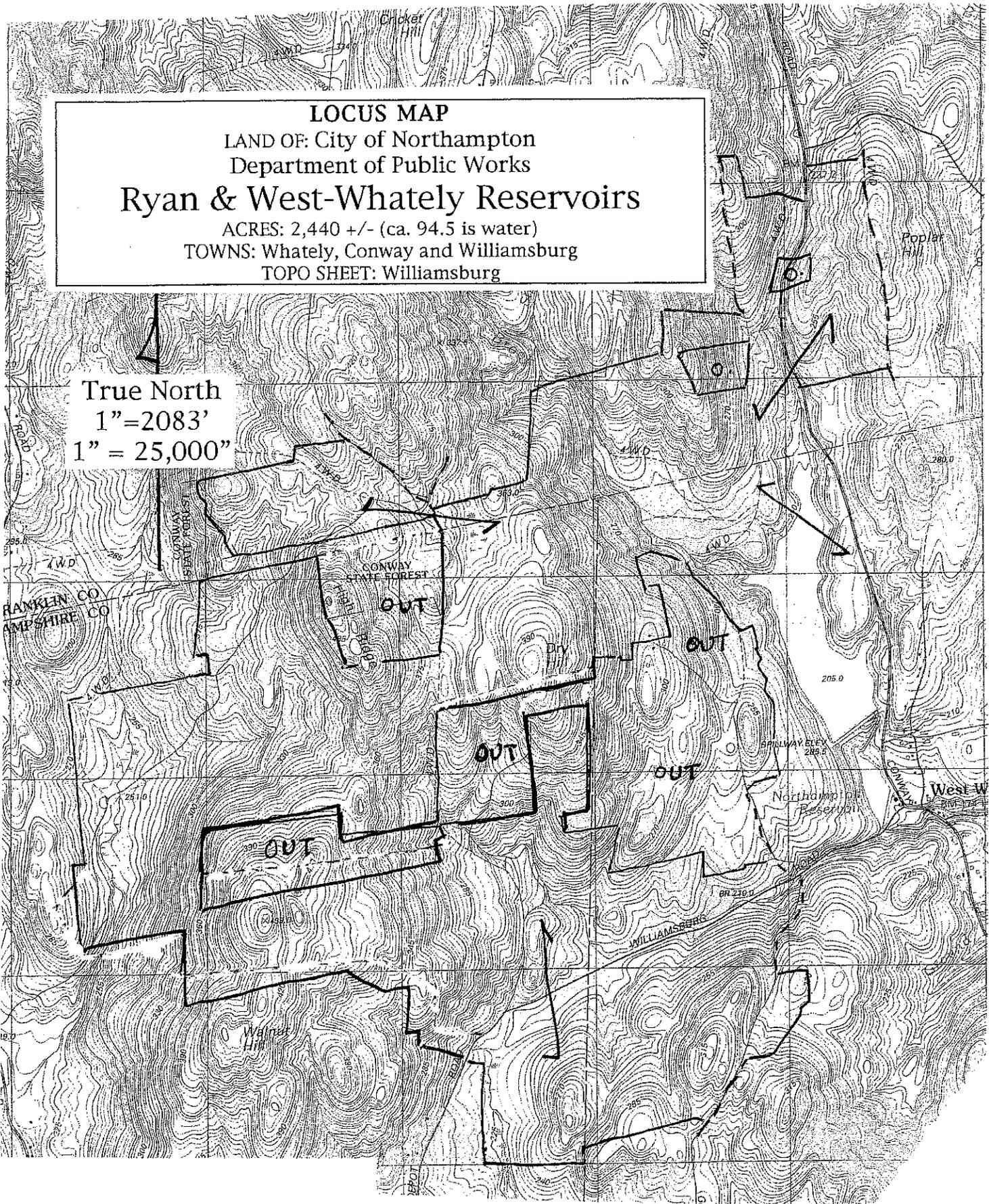
LOCUS MAP

LAND OF: City of Northampton
Department of Public Works

Ryan & West-Whately Reservoirs

ACRES: 2,440 +/- (ca. 94.5 is water)
TOWNS: Whately, Conway and Williamsburg
TOPO SHEET: Williamsburg

True North
1" = 2083'
1" = 25,000'



Acquisition of the land began in the late 1800's, and continues to this day

Raw water from Ryan Reservoir flows by gravity through approximately 16,000' of pipe (underneath Conway Road, Webber Road, Haydenville Road and Mountain Street) directly to the Water Treatment Plant. Raw water from the West-Whately Reservoir flows by gravity through approximately 10,000' of pipe before discharging into an open channel known as Borowski Brook, which flows (alongside Haydenville Road) into the Mountain Street Reservoir, where it mixes with water from the natural watershed of the Mountain Street Reservoir. From there, the water is pumped up to the Water Treatment Plant.

Ideal forest: The reservoirs are filled with water that drains out of the surrounding forested landscape. This land area, referred to as the "watershed", is largely covered with forest. The forested-land watershed plays an essential role in collecting, filtering, storing, and releasing water into the reservoirs through surface streams and subsurface flow. The condition of the forest affects the quality and amount of the water flowing into the reservoirs. For watershed purposes, the ideal forest condition is a diverse forest of vigorous, site-adapted native trees growing to mature size within a forest framework that is constantly regenerating with desirable new trees — in effect, a multi-aged forest of diverse, site-adapted species. This type of forest is considered to be the forest condition that will, over time, provide, sustainably, the highest-quality water. Accordingly, the objective of forest management on the watershed is to create and maintain this desired condition and, as necessary, identify threats to the desired condition and design effective responses to these threats.

The City of Northampton has been taking water from the three watersheds for over 100 years. Throughout this time, the forest, and the watershed land it occupies, have been effective in their function as suppliers of water to the reservoirs. Overall, the forest is still in a desirable condition, but exceptions exist and are expanding as, increasingly, a number of factors threaten to bring the forest into a less desirable condition. Chief among these factors are (1) an expected further decline and eventual loss of certain tree species (due to pests and disease), and (2) the accumulation of factors that aggressively interfere with the forest's ability to regenerate itself (e.g. aggressive growth of vines and over-browsing by herbivores). These factors are discussed in detail within the plan.

Purpose of this plan: This plan addresses the current condition of the watershed forest, and threats to this condition, and lists recommended management steps to maintain or work toward the ideal condition described above. Some of the forested land falls outside the physical watershed of the reservoirs. However, whether the land falls in or out of the watershed, all aspects of forest management described in this plan are intended to maintain, protect and enhance the watershed-protection functions of the forest.

Secondary goals of this plan include timber production and management of wildlife habitat.

The bulk of the work on this plan was carried out between May, 2011 and May, 2012.

Questions to be answered (“stewardship concerns”):

- (1) are there silvicultural treatments and other vegetation management treatments (e.g. invasive plant control) that can be implemented to maintain the watershed functions of the forest over time?
- (2) is road infrastructure maintained to provide ongoing access for monitoring and management while preventing sedimentation of waterways?
- (3) are there factors that threaten to compromise forest function (e.g. insect and plant pests) and, if so, how can these be addressed?
- 4) are boundaries adequately known and marked and posted with adequate signage at relevant access points to guide/restrict public access?
- (5) are prohibited or undesired uses of the watershed taking place, and, if so, how can these be resolved (e.g. unauthorized ATV riding)?
- (6) are outreach measures in place to facilitate public acceptance and cooperation as needed in order to be able to proceed with watershed management activity?

II. Watershed Focus

Water quality is the DPW’s main concern in all areas part of the actual reservoir watersheds, with the key objective being the avoidance of any sediment inflow into the reservoirs or their tributaries and, secondarily, the maintenance of a healthy watershed forest that will contribute the best possible water to the reservoirs. The major question to be addressed in this plan is how to best maintain the watershed functions of the forest (mainly filtration and storage) over time, and how to best protect the reservoir and its tributaries from preventable pollution, primarily in the form of sediment from erosion and/or excessive flow. Acreage outside the actual watershed will be managed according to these same concepts.

The following list of principles, taken from the Quabbin Reservoir Land Management Plan 2007-2017* has been incorporated into the development this forest management plan:

- (1) maintain, or, develop and maintain a vigorous forest with strong regenerative capability by fostering, through silvicultural approaches, a variety of site-adapted tree and shrub species in a range of age classes;
- (2) identify sub-watersheds and manage these individually (see Tables 1A & 1B);
- (3) avoid increasing water-yield/increases in sediments and nutrients by keeping harvesting to < 25% of forest cover (i.e < 25% of basal area) within a 10-year period within any given sub-watershed;
- (4) pay special attention to roads and trails (e.g. town roads and trails, logging roads, snowmobile and ATV trails, etc.) so that these (through erosion, failure of stream crossings, etc.) do not become contamination sources;

(5) avoid or minimize any harmful impacts to watershed soil (e.g. due to compaction or overland flow or excessive removal of woody material);

(6) be mindful of, and where possible prevent or counter-act, trends and processes that could curtail the desired functioning of the watershed forest (e.g. decline and mortality of overstory trees and loss of canopy diversity as well as factors that interfere with the regenerative capacity of the forest such as non-native invasive plants (e.g. oriental bittersweet) as well as native interfering factors such as excessive browse by deer and moose and excessive growth of native vines, shrubs and ferns.); and,

(7) develop and implement an outreach component to give the public the means to appreciate the role of the watershed forest and its condition and to become aware of the rationale for watershed forest management.

*This section is based on the current 10-year forest management plan for nearby Quabbin Reservoir (Quabbin Reservoir Watershed System: Section 3: Principles Guiding Watershed Management, Land Management Plan 2007-2017, and conversations with the author, Thom Kyker-Snowman).

Table 1A: List of Ryan & West-Whately Subwatersheds

Subwatersheds	Acreage
Avery Brook West	362
East. Branch Mill River (OUT)	534
Sanderson Brook	858
Ryan/W. Whately Shore.	171
Avery Brook E / Ryan Shore	196
Finney Brook	225
Total	2,440

Table 1B: List of Mountain Street Subwatersheds

Subwatersheds	Acreage
Mountain Street East	195
Mountain Street West	180
Beaver Brook (OUT)	72
Potash & Grass Hill Brooks (OUT)	192
Total	639

III. Landscape Context

The local pattern of land use: By virtue of its large size, the forested-land surrounding the Ryan & West-Whately Reservoir is an important feature of the local landscape. To the north, the landscape is almost entirely forested, with uses such as hiking, snowmobiling, hunting, logging and water supply. Much of this land is public — Conway State Forest — though there are private woodlots as well. To the east, west, and south, the landscape is forested as well, but the forest is partially fragmented by residential development, much of which has occurred during recent decades, interspersed with older, grass-based farms.

Though smaller in area than the Ryan & West-Whately watershed, the forested land around the Mountain Street Reservoir watershed is also an important feature of the local landscape. To the west and east, the landscape is almost entirely forested, with uses such as hiking, snowmobiling,

hunting, and logging. This land is in private ownership. To the north and south, the landscape is partly forested, partly devoted to grassland farming, and otherwise is in low-density residential use.

Topography: the land surrounding the Ryan & West-Whately Reservoir is primarily glaciated upland that is generally sloping, sometimes steeply. The glacial till soils are generally stony and often shallow to bedrock. Exceptions include sandy glacial outwash terraces on the east and northwest side of Ryan Reservoir. Low areas in the landscape tend to be occupied by muck soils or wetlands and streams. The highest point within the Ryan & West-Whately watershed is High Ridge, with an elevation of approximately 1,550'. Other major named peaks around the Ryan & West-Whately Reservoirs include Dry Hill, Poplar Hill, and the northern tip of Walnut Hill. The lowest point, at the West-Whately spillway, is about 611' elevation, about 950' below High Ridge.

The land surrounding the Mountain Street Reservoir is also primarily glaciated upland that is generally sloping, sometimes steeply. The glacial till soils are generally stony and sometimes shallow to bedrock or shallow to a hard layer. Exceptions include sandy glacial outwash soils on the southwest side of Mountain Street Reservoir. Low areas in the landscape tend to be occupied by muck soils or wetlands and streams. The highest point in this watershed is Chestnut Mountain, with an elevation of approximately 831'. The other major peak is Laurel Mountain, with an elevation of about 762'. The Mountain Street spillway, is about 462' in elevation, about 370' below Chestnut Mountain.

Unique cultural and physical features surrounding the Ryan & West-Whately Reservoir include (1) the reservoirs themselves — two open-water reservoirs with major feeder brooks including Avery Brook and Sanderson Brook, as well as (2) a number of major forest roads (Poplar Hill Road, Old Phinney Road, Waterworks Road, Dry Hill Road, Williamsburg Road, Old Williamsburg Road, the Henhawk Trail, Grass Hill Road, and Judd Lane); (3) a significant block of contiguous forest within a larger forested context; (4) historical features such as the remains of both the Williamsburg Dam as well as a large mill site on Avery Brook.

Unique cultural and physical features at the Mountain Street Reservoir include (1) the reservoir itself — a large, open water body fed by the surrounding landscape and by water supplied by the West-Whately Reservoir; as well as (2) a number of major forest roads (Chestnut Hill Road, Rocks Road, and Laurel Mountain Road); (3) a significant block of contiguous forest within a larger forested context; (4) historical features such as a number of cellar holes, stone walls, and other indicators of past land uses.

IV. The Forest: Species Forest Types, Timber, Habitat, History

Most areas of the three watersheds are covered by a tall, maturing, closed-canopy forest of mixed species between 70 and 110 years of age. Almost none of the forest is less than 40 years old, and there were very few areas with seedlings ("regeneration") that were free to grow. Scattered trees (mainly in old fence lines and in old pastures) may easily be 150-200 years old, but there are probably no trees that date from before European settlement of the area.

The overarching forest on the Ryan & West-Whately watershed is a mix of white pine, hemlock, red oak, and black and yellow birch. These 5 species make up about 74% of the total timber volume, with the following break down: white pine (33%), hemlock (18.6%), red oak (15.5%), and black and yellow birch (7%). Another 10% of the forest is a mix of red and sugar maple, beech, paper birch, white ash and black cherry, with small amounts of hickory (pignut and shagbark) and poplar (big-toothed aspen). Basswood, elm and red spruce occur as exceptions. White and black oaks, and black gum, were not found at all, though they may be present. The remaining 16% of the forest volume is made up of planted softwoods, almost all of which is red pine (14.6%), with small amounts of Norway spruce and Scots pine. Softwoods make up about 67.5% of the timber volume.

The forest surrounding the Mountain Street Reservoir watershed is dominated by the same species mix, with white pine, hemlock, red oak and other oaks, and black and yellow birch making up about 78% of the total timber volume. However, the distribution is more heavily weighted toward white pine, which makes up 62% of the total volume. All the other dominant species are not as abundant. Hemlock makes up only 5% of the total volume. Oaks make up only 7% of the volume, with 5% being red oak, and 2% including chestnut oak with a minor amount of white oak, black oak and scarlet oak. Black and yellow birch make up only 4% of the total. The balance is comprised of sugar maple (3%), black cherry (1%), white ash (2%) and pallet-grade hardwoods (4%) (red maple, hickory, beech, poplar, paper birch, etc.). As with the Ryan & West-Whately watershed there is a significant, and similar, inclusion of red pine (13%). Overall, the Mountain Street Reservoir watershed is more heavily weighted toward softwoods. Softwoods make up about 80% of the timber volume.

Most of the overstory trees (timber, firewood, pulp and non-commercial trees) were in the 8" to 20" diameter range. About 75% of the trees were between 8" and 14" in diameter, and another 20% of the trees were between 15" and 20" in diameter. Only about 5% of the trees were large, with 3% of the trees between 21" and 26", and only 2% of the trees ranged from 27" up to 50" or more.

Forest Products (timber, firewood and pulpwood): The forests of both watersheds are well-stocked with timber, firewood and pulpwood.

At the Ryan & West-Whately watershed, the timber volume on all acres is estimated at 13,437,000 board feet (about 3,000 truckloads), with an additional 23,276 cords of firewood and 20,657 cords of softwood pulp, with a total standing value of approximately \$2,070,000. Most of this value is concentrated in the white and red pine timber and in the red oak timber. For the entire watershed, the average value of the forest products was about \$882 per acre.

Most of the volume and value at the Ryan & West-Whately watershed was concentrated in the acreage (1,718.5 acres) that was suitable for silviculture. The timber volume on these acres was 10,937,496 board feet, with 18,344 cords of firewood and 18,942 cords of softwood pulp. The estimated total value was \$1,761,686, or about \$1,049 per acre. For practical purposes, this is the volume and value that could be considered potentially available for harvest if all trees were to be cut, but it is not a recommendation to actually go and harvest this volume and value.

At the Mountain Street watershed forest, the timber volume on all acres was estimated at 4,385,000 board feet (about 1,100 truckloads), with an additional 2,300 cords of firewood and 1,111 cords of softwood pulp, with a total standing value of approximately \$521,000. Most of this value (70%) is concentrated in the white and red pine timber. For the entire watershed, the average value of the forest products was about \$936 per acre.

At the Mountain Street watershed, only a small amount of the volume and value was concentrated in the acreage (24.6 acres) that was suitable for silviculture. The timber volume on these acres was 175,000 board feet, with 148 cords of firewood and 204 cords of softwood pulp. The estimated total value was \$20,254, or about \$823 per acre. For practical purposes, this is the volume and value that could be considered potentially available for harvest if all trees were to be cut, but it is not a recommendation to actually go and harvest this volume and value.

Habitat: large bodies of open water surrounded by contiguous, closed-canopy, maturing, tall conifer & oak-hardwood forest with limited but increasing rough-tree features, abundant oak mast, and scattered ledge exposures, with numerous vernal pools, various beaver ponds with affiliated marsh and shrub swamp, and numerous streams.

The general forested habitat on both watersheds is consistent with Western Massachusetts on the whole, and is distinguished mainly by consisting of a large, contiguous acreage that is not developed and presumably never will be. Like most of Massachusetts, this forest is re-growing from an earlier time when much of the forest was cleared — or at least clearcut — one or more times. The forest has grown into a medium age-range. What is lacking from a habitat perspective is both the very mature, and the very young ends of the age spectrum. These concerns can be addressed through management as follows:

- (1) provisions can be made for mature forest components (cavity trees, snags, downed woody debris, etc) to develop, both in silviculturally managed areas, and in set-aside/unmanaged areas.
- (2) Early successional (very young) habitat can be created either as a separate, dedicated practice, or incidentally in the course of normal silvicultural management.

A number of vernal pools were documented, some of which bore evidence of state-listed salamanders.

For each stand, habitat is discussed in greater detail in the Stand Descriptions section.

Major events shaping this forest: (forest-disturbance history): Like most of the forests of Southern New England, this forest has been shaped by both natural and human factors; these factors are intertwined to such a thorough extent that, in effect, they cannot be separated.

The possible uses of this land by native, pre-European people, and the uses of this land by these people after the onset of European fur trading and eventual trading-post and agricultural settlement, are not addressed in this plan. Direct European use of this land probably began with land clearing of the original (primary) forest by settlers, for purposes of farming, presumably in the late 18th/early 19th century (possibly beginning on Dry Hill). The better soils were cleared of stones as needed and tilled while the more rugged or wetter terrain was pastured with cattle and/or sheep, to a greater or lesser degree (all of which is evidenced by cellar holes, stone walls, barbed wire fence, and traces of narrow cart paths). Farming kept the natural tendency toward reforestation fully or partially at bay. In the mid 1800's much of this area was in pasture (or sometimes, on steep, fertile land, in sugar bushes) but beginning to see farm abandonment and an overall reduction in the intensity of farming use, which allowed the natural re-growth of forest to white pine (sometimes called old-field white pine). Some areas are still in old-field pine today. But others were cut off, usually by clearcutting, giving rise to oak-hardwood and hemlock forests. Sometimes these oak-hardwood and hemlock forests were cut off, giving rise to a new hardwood forest, often with less oak and hemlock and more birch, especially black birch. In a few instances, non-native softwoods were planted — by DPW — especially red pine, but also Norway spruce and Scots pine. Because all of this has occurred at various times in various places with varying degrees of intensity and consistency, the landscape-level forest is diverse.

The current trend seems to be a forest moving in a new direction, toward ever more black birch and beech (see discussion of forest health above).

Forestry has been practiced since the early days of the watershed. We do not have a detailed history of early forest management, but a 1988 report by Karl Davies, the previous forester for DPW, sheds some light. The softwood plantations in the early 1900's on old fields were intended to reduce soil erosion and reduce discoloration of the water from tannins in oak leaves. Chestnut, affected by the chestnut blight (an introduced pest) was cut heavily in the 1920's and 1930's, for fuelwood for the Water Department boiler. Later, other hardwoods were cut. This practice continued until about 1950, when the Water Department switched to oil. These early thinnings are credited with helping develop the large oaks in many places.

Most of the softwood plantations and some of the white pine was thinned (pulpwood) in the 1950's and early 1960's — interestingly, this practice faded when home freezers became popular and the need for barrel staves for salted meat evaporated (Fred Hunt, pers. Comm.). Some of the white pine was pruned at that time to develop clear (valuable) lumber, but thinnings were not carried out to take advantage of this.

The modern era of forest management began in 1981 on the Mountain Street watershed and in the mid 1980's at the Ryan watershed. By the late 1980's, an effort was underway to carry out improvement cuts, thinnings, and initial regeneration cuts across both watersheds. This work, consisting of numerous permitted harvests marked by Karl Davies and carried out by many different loggers under his supervision, continued until around 2000, when work was put on hold by DPW decision. Karl Davies passed away in 2003, and no further work has been carried out on the watershed. The general affect of this work was to reduce competition among overstory trees, refocus future growth on trees with good form and growth potential, and begin to develop understories of desirable seedlings.

Along with major changes caused by human activities, intentionally or not, a number of natural events have shaped and continue to shape the forest in a number of ways, including (1) the introduction of chestnut blight (described above), which effectively eliminated chestnut from the forest, and (2) various infestations of gypsy moths, most recently from 1979-1981, causing loss of vigor and mortality in hardwoods, and (3) the effects of storms, including the 1938 hurricane, but also including innumerable minor storms such as microbursts and ice storms. Another, more recent concern, is the Asian long-horned beetle: currently present only in the Worcester area — as far as we know — this insect is a major pest of red and sugar maple, and ash, but not oaks or hickories.

A number of other forest pests are discussed in the “Forest Health” section.

Stand Delineation: The forest was divided into numbered stands. For mapping and for tabular overviews, each stand is given a general type code, with more detailed discussion of forest composition provided in the individual Stand Descriptions. The main codes used are “WH” (white pine and mixed hardwoods), “WP” (nearly pure white pine), “HH” (hemlock and mixed hardwoods), “RP” (red pine plantation), “BB” (mixed hardwoods typically including red maple and sometimes sugar maple, black and yellow birch and sometimes paper birch, beech, and often white ash and black cherry and sometimes red oak), “OH” (red oak and mixed hardwoods), “RM” (red maple with yellow birch, white ash and elm, and sometimes with white pine and hemlock).

Sometimes there are notable inclusions of other forest types within a stand. These are sometimes shown on the map in brackets, and may include [WP] (white pine), [SM] sugar maple, [OR] (red oak), and [SS] (shrub swamp). The designation “GR” for the reservoir dam areas indicates a strong, but not exclusive, component of mowed grass.

The stands are listed in Tables 2A & 2B, with their approximate acreage. Each stand was given a name that is intended to help evoke a mental map of the stand's location and features. The subwatershed is also listed. The stands are also shown on the Stand Locator Map.

Table 2A: List of Stands by Name, Number, Acreage & Subwatershed: Ryan & West-Whately Reservoirs

Stand Name	Stand	Acres	Subwatershed
Conway State Forest East	1	58.9	Avery Brook W
Conway State Forest West	2	47.2	E. Branch Mill River (OUT)
Dry Hill North	3	166.4	Avery Brook W
High Ridge East	4	92.9	Sanderson Brook
Avery Brook West	5	137.0	Avery Brook W
High Ridge West	6	189.6	E. Branch Mill River (OUT)
Henhawk Trail Southwest	7	208.1	Sanderson Brook
Judd Lane	8	297.3	E. Branch Mill River (OUT)
Old Williamsburg Road	9	185.6	Sanderson Brook
Dry Hill South	10	52.4	Sanderson Brook
Grass Hill Road	11	277.4	Sanderson Brook
Nash Hill Road Swamp	12	41.3	Sanderson Brook
Dry Hill Road East	13	30.9	Ryan/W. Whately Shore.
Ryan & West-Whately West Shore	14	76.0	Ryan/W. Whately Shore.
Ryan North Red & White Pine	15	65.2	Avery Brook E / Ryan Shore
Ryan North Oak-Hemlock	16	130.3	Avery Brook E / Ryan Shore
Finney Brook	17	65.6	Finney Brook
Waterworks Road Northwest	18	50.9	Finney Brook
Conway Road Terrace	19	45.7	Ryan/W. Whately Shore.
Poplar Hill	20	108.3	Finney Brook
Ryan & West-Whately Dams	21	18.7	Ryan/W. Whately Shore.
Ryan & West-Whately Reservoirs		94.5	--
	Total	2440.3	

Table 2B: List of Stands by Name, Number, Acreage & Subwatershed: Mountain Street Reservoir

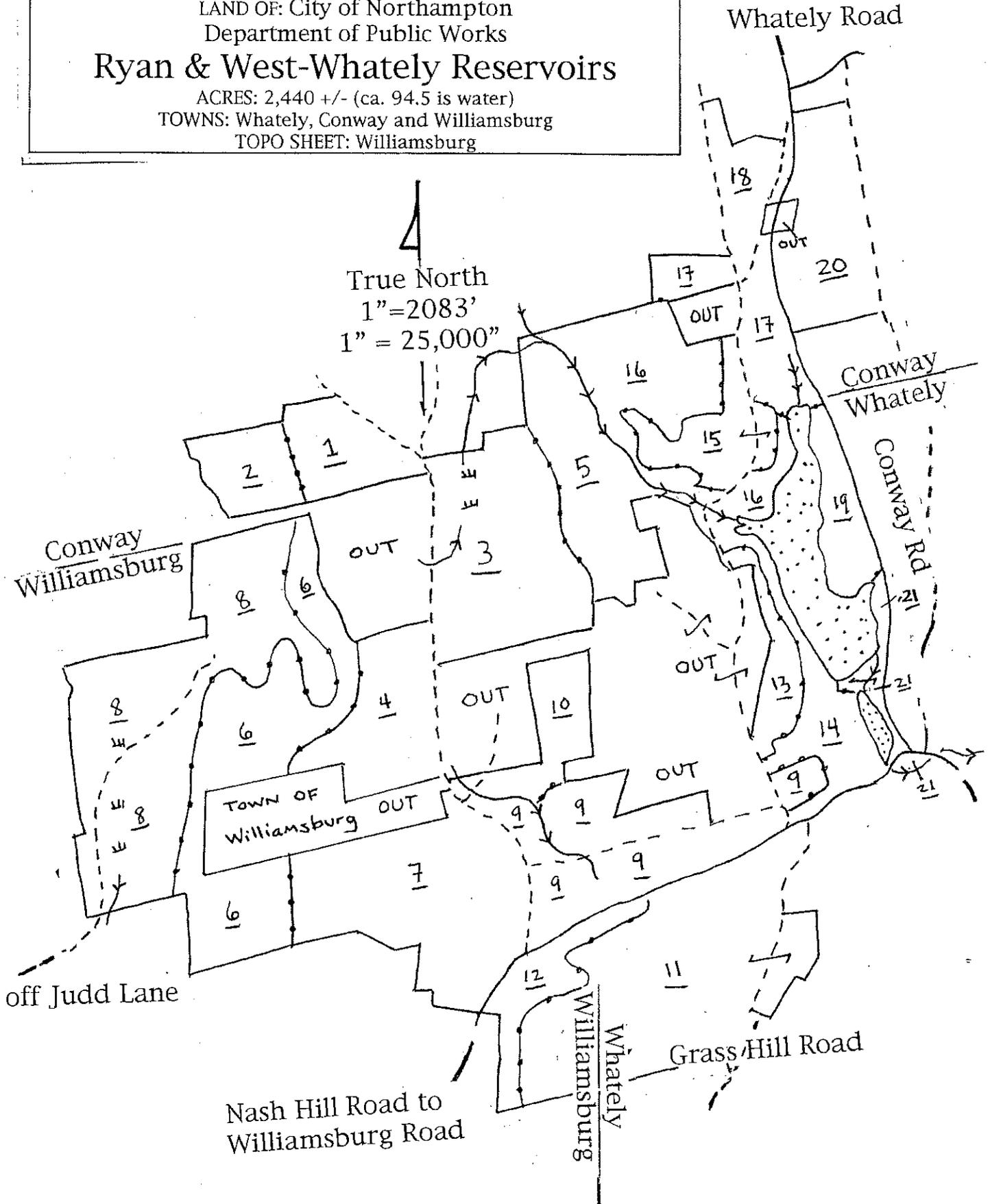
Stand Name	Stand	Acres	Subwatershed
Chestnut Mountain	1	151.3	Mountain Street East
Mountain Street East Shore	2	18.8	Mountain Street East
Rocks Road East	3	24.6	Mountain Street East
Mountain Street Reservoir Southwest	4	22.9	Mountain Street West
Mountain Street Dam	5	2.8	Beaver Brook (OUT)
Red Pine Plantation	6	15.3	Mountain Street West
Laurel Mountain Road	7	95.2	Mountain Street West
Old Orchard & Red Pine	8	33.7	Mountain Street West
Laurel Mountain West	9	47.7	Potash & Grass Hill Brooks (OUT)
Potash Brook	10	134.0	Potash & Grass Hill Brooks (OUT)
Mountain Street West Shore	11	12.7	Mountain Street West
Around Treatment Plant	12	10.7	Potash & Grass Hill Brooks (OUT)
Mountain Street Res.	13	69.2	Mountain Street Res.
	Total	638.9	

STAND LOCATOR MAP

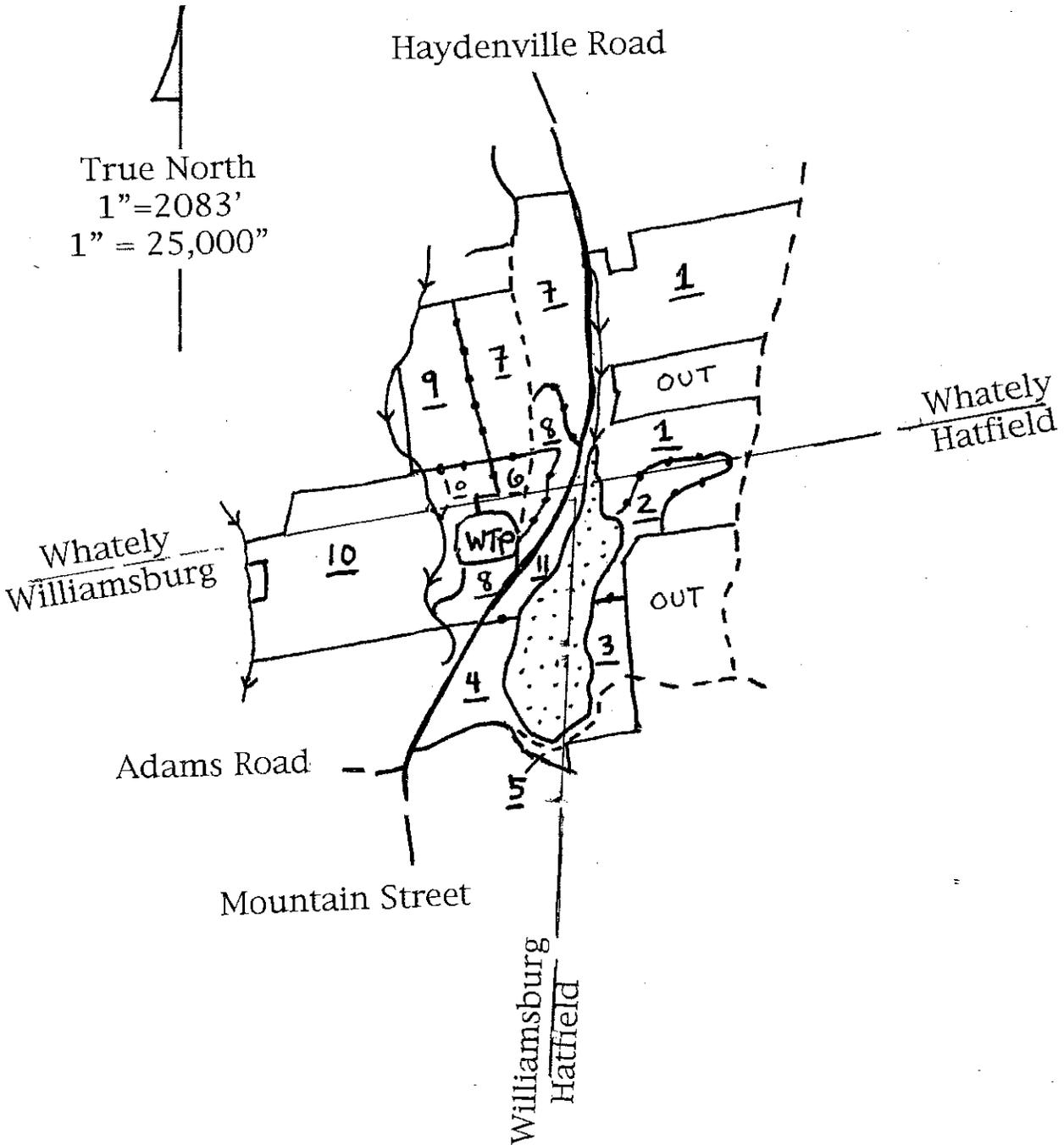
LAND OF: City of Northampton
Department of Public Works

Ryan & West-Whately Reservoirs

ACRES: 2,440 +/- (ca. 94.5 is water)
TOWNS: Whately, Conway and Williamsburg
TOPO SHEET: Williamsburg



STAND LOCATOR MAP
 LAND OF: City of Northampton
 Department of Public Works
Mountain Street Reservoir
 ACRES: 639 +/- (ca. 69.2 is water)
 TOWNS: Whately, Williamsburg and Hatfield
 TOPO SHEET: Williamsburg



V. Forest Health

The health of the forest in both the Ryan & West-Whately watershed and in the Mountain Street watershed is compromised by decline and mortality trends in some species on the one hand, but even more so by factors that are interfering with the forest's ability to regenerate itself to desirable species on the other hand. These are the major concerns raised by this plan.

Decline and mortality trends: Large numbers of red pine and hemlock are in declining health, a trend driven by introduced pests (such as Diplodia tip blight/canker, with secondary infestations of bark beetles as well as armillaria root-rot fungus on red pine, and a combination of hemlock woolly adelgid and elongate hemlock scale on hemlock). This trend is likely to continue. And though not detected at this time, an arrival of red pine scale could cause a dramatic decline and dieback of red pine within a period of only a few years.

White ash, already in decline, may soon be infested by an introduced pest as well (emerald ash borer) and is expected to suffer significant decline and mortality. Beech is generally infested with beech-bark disease, a disease which also includes an introduced component. Though overstory beech tend to become sickly, and many ultimately die, the disease does not tend to kill the root systems, from which beech has the ability to vigorously resprout. The sprouts can readily outcompete desirable seedlings of other species. The effect is that beech, an ever-increasing component of the forest, is unlikely to ever form large, healthy trees.

Taken together, red pine, hemlock, ash and beech, all of which are in poor health, comprise 33.5% of the timber volume on the Ryan & West-Whately watershed (Scots pine belongs in this group as well, but is present only to a minor degree), and about 19% of the timber volume on the Mountain Street watershed. Though beech is not an appreciable part of the timber volume in either watershed, it is, as explained above, likely to increase over time.

Interfering factors (over-browsing, wild grape vines, oriental bittersweet vines, etc.):

As serious as the above-mentioned decline and mortality trends are, a much more serious issue is that the current forest, with its strong component of long-lived white pine, oaks and mixed hardwoods, cannot replace itself in the face of ongoing disturbances. This is true both for infrequent major disturbances (e.g. major hurricanes or other storms) as well as in the long, ongoing course of numerous, inevitable accumulated disturbances at smaller scales (e.g. microbursts, ice storms, lightning strikes, decline and mortality of certain canopy species due to pests, etc.). Throughout both watershed forests there is an almost total lack of viable, desirable regeneration (i.e. healthy seedlings and saplings of desirable trees that could be released and form part of the overstory someday). Despite its abundance throughout the forest, seedlings of red oak were almost entirely lacking. Among the desirable hardwoods, only black birch was present to any appreciable degree. Viable white pine regeneration was found only on a scattered and limited basis.

Certainly, overstory shade is a contributing factor, and, normally, a silvicultural approach could be used to address a lack of seedlings by carrying out timber harvests that adjust light conditions in the overstory and influence the forest floor. However, this conventional approach is not expected to work in some areas, due to a combination of interfering factors that includes (1) excessive herbivore feeding (deer and moose), (2) aggressive growth of certain native

vegetation (primarily wild grapes, thick carpets of hayscented fern, as well as thickets of beech sprouts and thick understories of shrubby striped maple and sometimes witch hazel as well), and (3) aggressive growth of non-native invasive plants (primarily oriental bittersweet – a vine). These problems are much worse, which is to say more advanced, at the Mountain Street Reservoir, and this serves as a useful warning for the Ryan & West-Whately watersheds.

The aggregate effect of this set of interfering factors is that the forest is headed on a transitional course away from its strong mix of white pine, hemlock and red oak, along with maples, cherry, and certain other hardwoods, towards a very different forest that will be dominated by, at best, black birch, which is a desirable species, with abundant beech in some areas and large areas overrun with vines — native and non-native — and ferns. At worst, the black birch component will be minimal, and vines and ferns will dominate everywhere. This condition is not desirable from any perspective, whether it be water quality, timber, or habitat. The progressive decline of shade from hemlock and red pine will probably exacerbate these trends.

The major conclusion of this plan is that great care needs to be taken to steer away from this direction. A combination of passive and active steps outlined throughout this Stewardship Plan is designed to accomplish this.

Why? The essential feature of forest as a watershed cover is its ability to capture, slow, store, filter and gradually release rainfall and snowfall into the reservoir. This is best done by a vigorous forest of site-adapted trees with a tall canopy. Over time, as disturbances occur (e.g. microbursts, ice storms, tornadoes, hurricanes, but also pest and fire), the established trees will shed seed and young trees will become established. These young trees quickly take up any new growing space that is created. A general aim of watershed management is to have a significant reserve of young trees to act as a sort of insurance policy in the face of inevitable disturbance.

The current watershed forest finds itself in a condition lacking this essential reserve of young trees, and it may not be able to develop this reserve and, therefore, the forest is not as healthy as it may seem. If the forest could be frozen in time right now, everything would be fine. But, inevitably, over time, disturbances will tend to steer the forest away from this desirable condition, toward a less desirable condition that will be more difficult, and more expensive, to correct. Therefore, from a forest health perspective, a key objective embedded in this plan is to preserve the desirable attributes of this forest while trying to anticipate and counteract the negative trends. The resulting plan will necessarily try to limit any cutting of white pine or red oak (cutting these species should only occur where these pines or oaks are overcrowding each other). The plan will be very cautious in how and where new openings are made, trying to ensure that these areas can regenerate to desirable species. And the plan will be pro-active in identifying and curtailing the influence of interfering factors.

Non-native invasive plant species: To assess the extent and severity of non-native invasive vegetation, all stands were ranked using the following scheme (see below). Stands ranked 3, 4 or 5 were considered “not suitable” for silviculture. Non-native invasive plants detract from desirable watershed forest conditions by aggressively competing with desirable native vegetation, including tree seedlings. This is particularly true for oriental (i.e. asiatic) bittersweet, a vine that was commonly found across the watershed. This is also particularly

true for buckthorn (both European and glossy buckthorns, which, fortunately, were not widespread at all).

(1) ESSENTIALLY ABSENT (none observed or, if any, then extremely sparse; no, or minimal, invasive plant seed bank expected).

(2) MINOR AND READILY TREATABLE. Minor and readily treatable, and therefore still available for silviculture if treated; possible presence of localized invasive plant seed bank, but widespread invasive plant seed bank not expected).

— (stands ranked 3 or higher were considered not suitable for silviculture) —

(3) MODERATE TO SEVERE. Moderate to severe, and therefore cannot be considered available for silviculture within a 5-10 year period/until 5-10 years after receiving treatment and, under monitoring with follow-up treatment as needed until plants and seedbank are controlled, and being downgraded to (2) or (1).

(4) SEVERE. Severe infestation with no expectation of silviculture within 10 years even if treated.

(5) CANDIDATE FOR RESTORATION: the area no longer meets any criteria of a desirable watershed forest — the site is no longer dominated by desirable forest vegetation and/or there is no expectation that the site will be, or will continue to be, dominated by desirable forest vegetation within any foreseeable timeframe without complete intervention/restoration.

On the Ryan & West-Whately Reservoir watershed, non-native invasive plants were found in many, but not all, areas. In two isolated cases (in Stands 7 & 9) there were relatively small infestations needing restoration included within a larger stand with an overall lower ranking.

On the Mountain Street Reservoir watershed, non-native invasive plants were found in most areas. In one isolated case (Stand 1) there was a relatively small infestation needing restoration. However, all of Stand 8 was ranked as a candidate for restoration, and abutting Stands 6 & 11 were ranked “severe”. This combination of Stands 6, 8 & 11 is the largest contiguous area of severe, or worse, infestation on either watershed.

The results of the ranking of non-native invasive plant infestations are shown in Tables 3A & 3B. These results are also shown on the maps titled “MAP Showing Invasive Species Ranking” (one map for each watershed).

Table 3A: Ranking of Invasives by Stand: Ryan & West-Whately Reservoirs

Stand	Overall Invasives Rank 1 - 5	Acres Ranked 1	Acres Ranked 2	Acres Ranked 3	Acres Ranked 4	Acres Ranked 5
1	1	58.9	0.0	0.0	0.0	

2	1	47.2	0.0	0.0	0.0	
3	1	166.4	0.0	0.0	0.0	
4	1	92.9	0.0	0.0	0.0	
5	2	0.0	137.0	0.0	0.0	
6	1	189.6	0.0	0.0	0.0	
7	2	0.0	205.1	0.0	0.0	3
8	2	0.0	297.3	0.0	0.0	
9	2	0.0	176.9	0.0	0.0	8.7
10	2	0.0	52.4	0.0	0.0	
11	2	0.0	277.4	0.0	0.0	
12	2	0.0	41.3	0.0	0.0	
13	1	30.9	0.0	0.0	0.0	
14	3	0.0	0.0	76.0	0.0	
15	2	0.0	65.2	0.0	0.0	
16	1	130.3	0.0	0.0	0.0	
17	2	0.0	65.6	0.0	0.0	
18	1	50.9	0.0	0.0	0.0	
19	2	0.0	45.7	0.0	0.0	
20	1	108.3	0.0	0.0	0.0	
21	4	0.0	0.0	0.0	9.7	9
	Total	875.4	1363.9	76.0	9.7	20.7
	% of Total	37.3%	58.1%	3.2%	0.4%	0.9%

Overall, 37.3% of Ryan & West-Whately watershed acreage was ranked 1, and 58.1% was ranked 2, for a combined 95.5% considered to have no infestation or a scattered infestation. As explained above, stands ranked 1 or 2 could be considered for silvicultural operations.

3.6% of the Ryan & West-Whately watershed had a ranking of 3 or 4. A ranking of 5, indicating a need for restoration, occurred in two separate sections within larger stands, and covered the remaining 0.9% of the total acreage (about 20.7 acres).

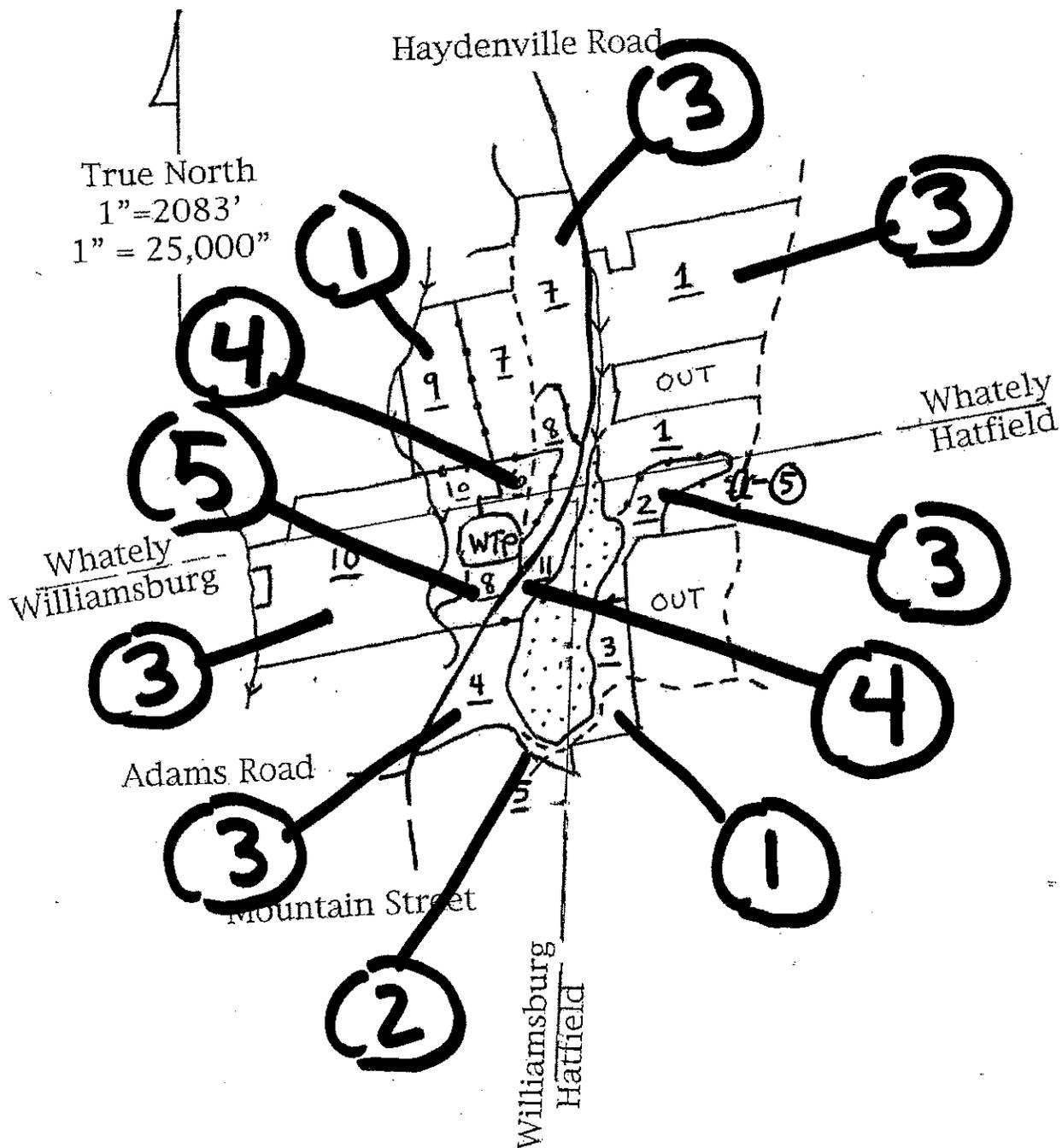
Table 3A: Ranking of Invasives by Stand: Mountain Street Reservoir

Stand	Overall Invasives Rank 1 - 5	Acres Ranked 1	Acres Ranked 2	Acres Ranked 3	Acres Ranked 4	Acres Ranked 5
1	3	0.0	0.0	150.8	0.0	0.5
2	3	0.0	0.0	18.8	0.0	0
3	1	24.6	0.0	0.0	0.0	0
4	3	0.0	0.0	22.9	0.0	0
5	2	0.0	2.8	0.0	0.0	0
6	4	0.0	0.0	0.0	15.3	0
7	3	0.0	0.0	95.2	0.0	0
8	5	0.0	0.0	0.0	0.0	33.7
9	1	47.7	0.0	0.0	0.0	0
10	3	0.0	0.0	134.0	0.0	0
11	4	0.0	0.0	0.0	12.7	0
	Total	72.3	2.8	421.7	28.0	34.2
	% of total	12.9%	0.5%	75.4%	5.0%	6.1%

Overall, 12.9% of the Mountain Street watershed acreage was ranked 1, and 0.5% was ranked 2, for a combined 13.4% considered to have no infestation or a scattered infestation. As explained above, stands ranked 1 or 2 could be considered for silvicultural operations.

Most of the Mountain Street watershed (80.4%, or about 449.7 acres) had a ranking of 3 or 4. A ranking of 5, indicating a need for restoration occurred throughout most of Stand 8, as well as in a 0.5-acre section of Stand 1, meaning that about 6.1% of the total acreage (about 34.2 acres) was in need of restoration.

MAP Showing Invasive Species Ranking
 LAND OF: City of Northampton
 Department of Public Works
Mountain Street Reservoir
 ACRES: 639 +/- (ca. 69.2 is water)
 TOWNS: Whately, Williamsburg and Hatfield
 TOPO SHEET: Williamsburg



VI. Silviculture and Timber Harvesting

Role of Silviculture: One of the key goals of watershed forest management is to have an abundance of large, healthy, dominant trees that can provide a tall, relatively stable forest canopy within which openings can be made and in which younger trees can flourish. At this writing, the trees that are most likely to fill this role over time are white pine and red oak, mixed with other hardwoods, which, together, can grow to very large size and reach advanced ages. Due to their declining health, hemlock, red pine, beech and white ash cannot be expected to provide this function. Red maple and black birch, which, along with the pines, hemlock, and red oak, are the most abundant trees, are second best to white pine and red oak (in terms of size, longevity and dominance). Sugar maple and yellow birch do play an important role, but typically only on the richest sites. Although Norway spruce, a non-native, has done very well here in small plantations, it would be risky to try to greatly expand the area covered by any planted tree. The upshot is that red oak and white pine are, at this writing, critical to the functioning of the watershed forest. Therefore, a top priority of the silviculture will be to develop and promote these species.

As noted above, there is little or no established regeneration of white pine or red oak throughout the watershed. The known interfering factors (including vines, ferns and herbivore browsing) are likely to make it very difficult to regenerate these species. This suggests very strongly that the best way to promote and develop white pine and red oak is to preserve the trees that are already established, in particular those that are well-formed and healthy. The silvicultural tool used to promote existing, well-established trees is thinning, which works by reducing competition for sunlight around the crowns of desired trees.

As a practical matter, since the timber value on the watershed is concentrated in the white pine and the red oak, it turns out that much of the timber value is in trees that we do not want to cut.

A parallel aim of watershed forest management is to have a diverse forest structure including areas of vigorously growing young trees. Due to the limiting effects of shade from overstory trees, in order to establish and grow tree seedlings it is usually necessary to make openings in the forest canopy to let in light to the forest floor. Sometimes this is best done in stages (using a shelterwood approach) and sometimes this is best done all at once (using a selection system to make openings, which can range from ¼ or less up to several acres). Both of these approaches can be used in creative ways, interspersed with small or large no-cut areas, to foster a structurally diverse, multi-aged forest.

Though an effort will almost always be made to regenerate white pine and red oak, or sugar maple or black cherry, the likelihood is that black and yellow birch and red maple will dominate these new regeneration layers, and the reality is that this will be entirely preferable to seeing these areas fill up with vines, ferns, beech or striped maple.

Overall, the value to be generated by recommended harvesting is incidental to the objectives of the cut, and is derived from the trees that are inherently less well-suited to maintaining a desirable watershed forest.

Suitability for Silviculture: Each stand was evaluated as to whether the goals of the plan could be furthered using silvicultural practices (e.g. logging/harvesting) to shape the forest in a beneficial way. Stands were assigned a “no” if they had excessive invasive species infestations (a ranking of 3 or greater, see below) or if the practical risk of soil damage and erosion was deemed significant enough such that no net benefit would occur with silvicultural practices (e.g. on steep, seepy ground and in the more remote locations).

About 1,718.5 acres (73.2%) of the Ryan & West-Whately watershed was considered suitable for silviculture. About 629.5 acres (26.8%) was not considered suitable.

About 24.6 acres (4%) of the Mountain Street watershed was considered suitable for silviculture. About 532.7 acres (96%) was not considered suitable.

Stands are shown in Tables 4A & 4B with a yes/no value indicating whether the stand was considered suitable for silvicultural activity at this time. The suitability for silviculture is shown in the maps entitled “MAP Showing Suitability for Silviculture”

Table 4A: Suitability of Stands for Silviculture: Ryan & West-Whately Reservoirs

Stand Name	Stand	Type	Acres	Suitable for silviculture? (Yes/No)	Total Yes	Total NO
Conway State Forest East	1	BB	58.9	YES	58.9	0.0
Conway State Forest West	2	BB	47.2	NO	0.0	47.2
Dry Hill North	3	WH	166.4	YES	166.4	0.0
High Ridge East	4	WH	92.9	YES	92.9	0.0
Avery Brook West	5	BB	137.0	NO	0.0	137.0
High Ridge West	6	HH	189.6	NO	0.0	189.6
Henhawk Trail Southwest	7	OH	208.1	YES	208.1	0.0
Judd Lane	8	HH	297.3	YES	297.3	0.0
Old Williamsburg Road	9	WH	185.6	YES	185.6	0.0
Dry Hill South	10	BB	52.4	NO	0.0	52.4
Grass Hill Road	11	WH	277.4	YES	277.4	0.0
Nash Hill Road Swamp	12	RM	41.3	NO	0.0	41.3
Dry Hill Road East	13	WH	30.9	YES	30.9	0.0
Ryan & West-Whately West Shore	14	BB	76.0	NO	0.0	76.0
Ryan North Red & White Pine	15	RP	65.2	YES	65.2	0.0
Ryan North Oak-Hemlock	16	HH	130.3	YES	130.3	0.0
Finney Brook	17	BB	65.6	NO	0.0	65.6
Waterworks Road Northwest	18	WH	50.9	YES	50.9	0.0
Conway Road Terrace	19	HH	45.7	YES	45.7	0.0
Poplar Hill	20	WH	108.3	YES	108.3	0.0
Ryan & West-Whately Dams	21	GR	18.7	NO	0.0	18.7
Ryan & West-Whately Reservoirs	23	WA	94.5	NO	0.0	94.5
	Total		2440.3		1,718.0	627.8
	Land		2345.8	% of forest	73%	27%

Table 4B: Suitability of Stands for Silviculture: Mountain Street Reservoir

Stand Name	Stand	Type	Acres	Suitable for silviculture? (Yes/No)	Total Yes	Total NO
Chestnut Mountain	1	WH	151.3	NO	0.0	151.3
Mountain Street East Shore	2	WH	18.8	NO	0.0	18.8
Rocks Road East	3	OH	24.6	YES	24.6	0.0
Mountain Street Reservoir Southwest	4	WP	22.9	NO	0.0	22.9
Mountain Street Dam	5	GR	2.8	NO	0.0	2.8
Red Pine Plantation	6	RP	15.3	NO	0.0	15.3
Laurel Mountain Road	7	WH	95.2	NO	0.0	95.2
Old Orchard & Red Pine	8	AO	33.7	NO	0.0	33.7
Laurel Mountain West	9	WH	47.7	NO	0.0	47.7
Potash Brook	10	WH	134.0	NO	0.0	134.0
Mountain Street West Shore	11	RP	12.7	NO	0.0	12.7
Around Treatment Plant	12	Non	10.7	NO		
Mountain Street Res.	13	WA	69.2	NO		
	Total		638.9		24.6	534.4
	Forest		559.0	% of forest	4%	96%

MAP Showing Suitability for Silviculture*

LAND OF: City of Northampton

Department of Public Works

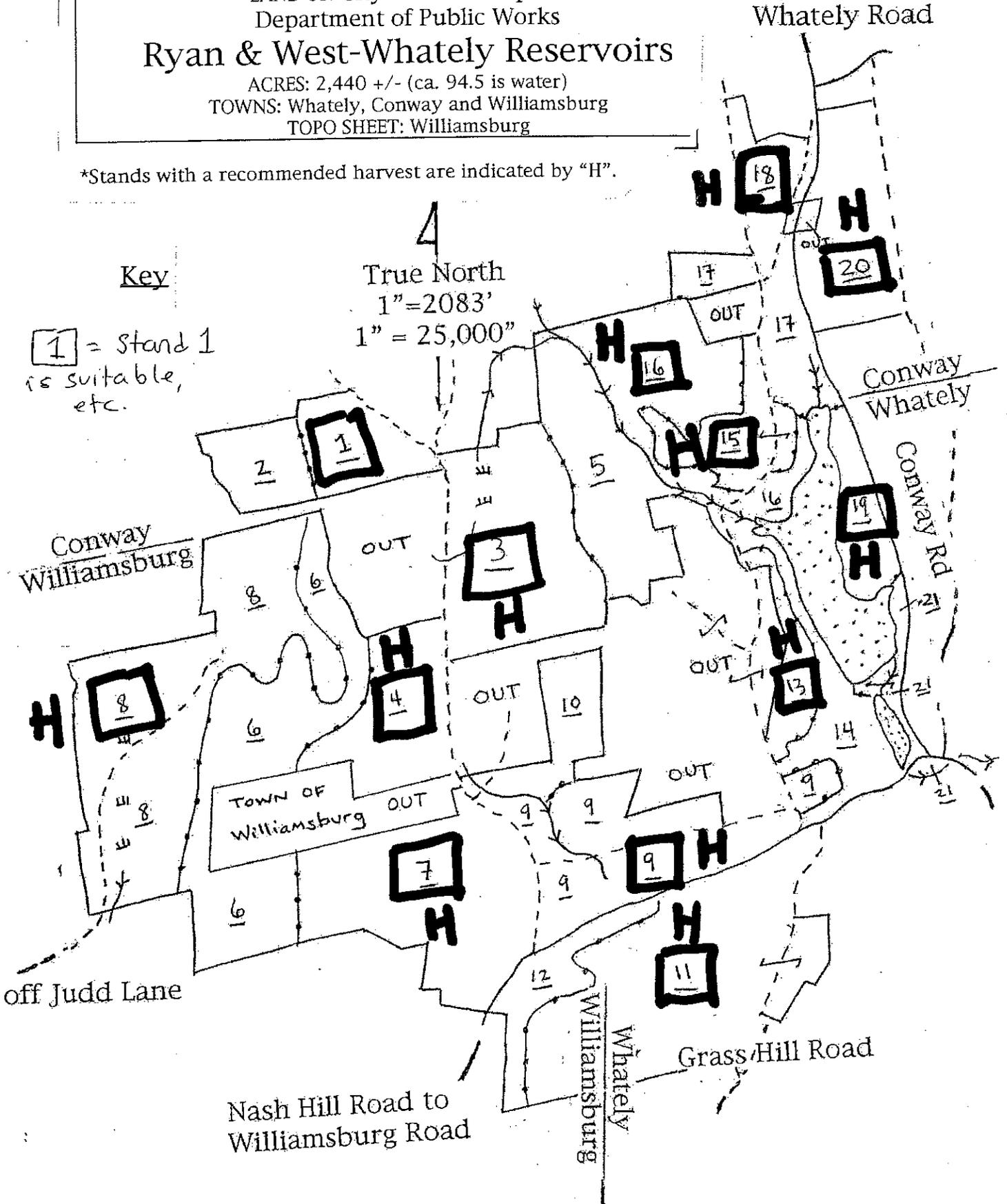
Ryan & West-Whately Reservoirs

ACRES: 2,440 +/- (ca. 94.5 is water)

TOWNS: Whately, Conway and Williamsburg

TOPO SHEET: Williamsburg

*Stands with a recommended harvest are indicated by "H".



Key

1 = Stand 1 is suitable, etc.

True North
1" = 2083'
1" = 25,000"

Conway
Williamsburg

Conway
Whately

CONWAY Rd

off Judd Lane

Nash Hill Road to
Williamsburg Road

Williamsburg
Whately

Grass Hill Road

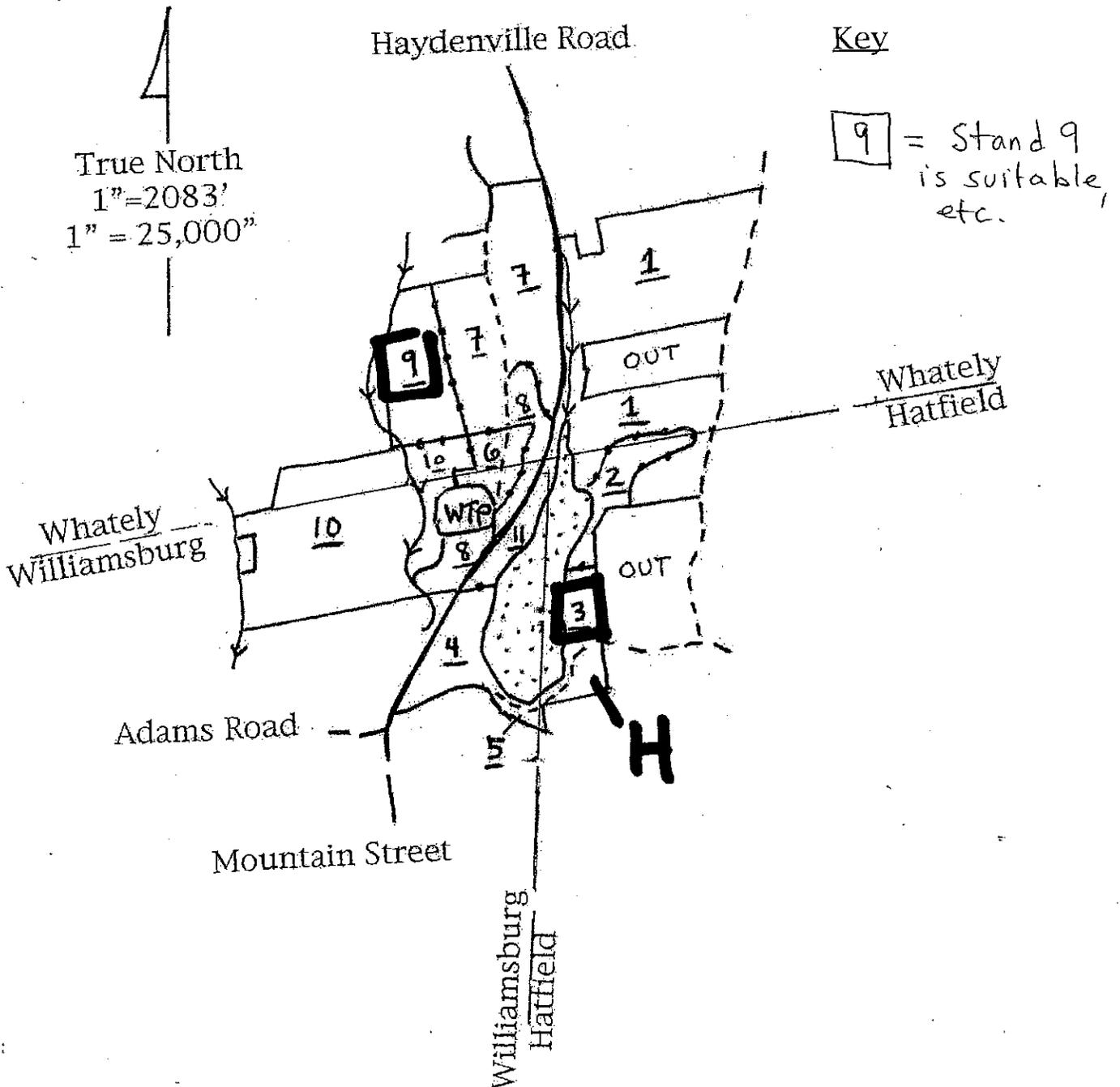
MAP Showing Suitability for Silviculture*

LAND OF: City of Northampton
Department of Public Works

Mountain Street Reservoir

ACRES: 639 +/- (ca. 69.2 is water)
TOWNS: Whately, Williamsburg and Hatfield
TOPO SHEET: Williamsburg

*Stands with a recommended harvest are indicated by "H".



Silvicultural Approach: The silvicultural approach used in this plan is designed to enhance the strengths of the current forest while avoiding an incremental degradation of future prospects for the forest, and therefore is necessarily conservative.

For the Ryan & West-Whately watershed, the actual harvest recommendations (presented in the Management Practices section) call for harvesting about 10% of the timber, 9% of the firewood and 9% of the pulpwood, which would be accomplished on about 33% of the acreage (782 acres). The estimated gross value of this harvesting is approximately \$140,000, which represents about 8% of the total forest products value in stands suitable for silviculture, or about 7% of the total value in all stands at the Ryan & West-Whately watershed. The work would be carried out in approximately 8 or more separately-permitted harvests.

Actual harvest recommendations at the Mountain Street watershed call for harvesting in only one stand. In this stand, on about 4% of the total DPW watershed acreage, about 1% of the total timber, 1% of the total firewood and 13% of the total pulpwood would be harvested. The estimated gross value of this harvesting is \$2,429, which represents about 0.5% of the total forest products value for the entire Mountain Street Reservoir watershed acreage. The work would be carried out in a single, DCR-permitted harvest.

Tables 5A & 5B lists all recommended harvesting for the period 2012-2022 at the Ryan & West-Whately and Mountain Street watersheds. This list shows *anticipated* harvests based on 2012 conditions. Actual harvesting recommendations may change if conditions change. Dollar amounts are not shown in this table.

Table 5A: Overview of Silviculture by Stand: Ryan & West-Whately Reservoirs

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
1	BB	None	0	0	0	0	0	N/A
2	BB	None	0	0	0	0	0	N/A
3	WH	selection	133	36	134	476	263	2012
4	WH	selection	46	28	34	142	50	2012
5	BB	None	0	0	0	0	0	N/A
6	HH	None	0	0	0	0	0	N/A
7	[RP]	Shelterwood	4	80	50	4	4	2017
7	OH	Selection	5	120	20	75	21	2017
8	HH	Shelterwood	30	50	50	30	90	2012
8	[BB]	Thinning	120	30	20	300	0	2017
9	[RP]	Shelterwood	8	80	100	8	8	2017
9	[WP]	Thinning	18	30	50	5	20	2012
10	BB	None	0	0	0	0	0	N/A
11	WH	selection	83	33	120	263	179	2012
12	RM	None	0	0	0	0	0	N/A
13	WH	selection	12	20	18	7	20	2012
14	BB	None	0	0	0	0	0	N/A
15	RP	selection	59	41	291	54	324	2012
16	HH	selection	98	32	162	264	232	2012
17	BB	None	0	0	0	0	0	N/A
18	WH	selection	41	40	46	156	43	2012
19	HH	shelterwood	27	65	75	147	149	2012
20	WH	shelterwood	97	32	177	248	397	2012
21	GR	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0	WA	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Totals 782 1,347 2,180 1,802

*Indicates earliest recommended timing. However, harvesting may be done at a subsequent time.

Table 5B: Overview of Silviculture by Stand: Mountain Street Reservoir

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year*
1	WH	None	0	0	0	0	0	N/A
2	WH	None	0	0	0	0	0	N/A
3	OH	selection	20	35	46	30	139	2012
4	WP	None	0	0	0	0	0	N/A
5	GR	None	0	0	0	0	0	N/A
6	RP	None	0	0	0	0	0	N/A
7	WH	None	0	0	0	0	0	N/A
8	AO	None	0	0	0	0	0	N/A
9	WH	None	0	0	0	0	0	N/A
10	WH	None	0	0	0	0	0	N/A
11	RP	None	0	0	0	0	0	N/A
12	Non	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13	WA	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	0		20		46	30	139	

*Indicates earliest recommended timing. However, harvesting may be done at a subsequent time.

Overview of Proposed Harvests: The silvicultural recommendations for the Ryan & West-Whately watershed listed in Table 5A would be implemented through 8 or more separate operations under separate permits to be obtained from DCR. These harvests can be done independently of each other, and may be done by separate logging operators or with different mixes of equipment. Details of each harvest are discussed in the relevant Management Practices sections. These harvests are listed in Table 5C.

The sole silvicultural recommendations for the Mountain Street watershed listed in Table 5B is discussed in the Management Practices section for Stand 3 (i.e. there is no Table 5D).

Table 5C: Proposed Harvests at the Ryan & West-Whately Watershed:

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
3	WH	selection	133	36	134	476	263	2012
4	WH	selection	46	28	34	142	50	2012
8	HH	Shelterwood	30	50	50	30	90	2012
9	[WP]	Thinning	18	30	50	5	20	2012
13	WH	selection	12	20	18	7	20	2012
11	WH	selection	83	33	120	263	179	2012
15	RP	selection	59	41	291	54	324	2012
16	HH	selection	98	32	162	264	232	2012
18	WH	selection	41	40	46	156	43	2012
19	HH	shelterwood	27	65	75	147	149	2012
20	WH	shelterwood	97	32	177	248	397	2012
7	[RP]	Shelterwood	4	80	50	4	4	2017
7	OH	Selection	5	120	20	75	21	2017
9	[RP]	Shelterwood	8	80	100	8	8	2017
8	[BB]	Thinning	120	30	20	300	0	2017
Totals			782		1,347	2,180	1,802	

VII. Treatments to Limit Interfering Factors: Interfering factors to be treated are divided into (1) treatments of interfering vegetation and (2) treatments of interfering wildlife activity (i.e. reduction of over-browsing).

Treatment of Interfering Vegetation: It is hard to imagine that interfering vegetation can be successfully controlled on a broad scale without the use of chemical herbicides. While mechanical methods (such as cutting, mowing, and hand-pulling) would be an important part of an overall approach (e.g. cutting large grape vines in a stand with good overstory shade), there is no good way, currently, to control the vegetation in question without the use of herbicides to some degree. The thought of using herbicides in a forested watershed raises, understandably, concerns about risks these may pose.

Discussion: Herbicide Use in a Forested Watershed Context: Healthy, diverse forests are an essential component of the natural system that collects, filters, stores, releases, and protects the water that enters the reservoirs of the Northampton DPW surface water supply system. Such highly functioning forest stands are considered to be the best possible watershed condition. Conversely, forests in poor condition cannot provide this same level of service. The objective of forest management on the watersheds is to maintain desirable forest conditions in all areas. As part of the overarching effort to maintain desirable forest conditions in these watersheds, it is necessary to limit (i.e. “control”) the negative impacts of undesirable vegetation. Throughout much of the Mountain Street watershed, and in parts of the Ryan & West-Whately watersheds, undesirable vegetation is significantly compromising the condition of the forest. In worst-case scenarios — of which there are several instances in the watersheds — the undesirable vegetation prevents DPW from having any tall forest overstory at all. These areas have been reduced to stands of dead or dying broken trees smothered by mats of bittersweet vine. Over time, these very negative worst-case impacts are expected to cover more land area as the undesirable vegetation continues to thrive.

The term “undesirable vegetation” can refer to either non-native invasive plants (e.g., oriental bittersweet vines) or interfering native vegetation (e.g., wild grape vines). Control measures can be passive (e.g., avoiding disturbance of the soil or the forest canopy, or maintaining shade) or active (e.g., cutting or crushing undesirable vegetation). These approaches, where applicable, are built into the Stewardship Plan on a stand-by-stand basis. However, these approaches alone may not be sufficient in many areas to achieve the desired level of reduction or control. In cases where these approaches are inadequate on their own, it may be necessary to add the use of chemical (e.g., herbicide) controls to the overall effort to limit the negative impacts of the undesirable vegetation.

Herbicide use for control of invasive and/or interfering vegetation in wetland resource areas is regulated under the Wetlands Protection Act, but unfortunately there is no single set of clear guidelines for herbicide use in upland watershed areas of surface water supplies in Massachusetts.

The Watershed Protection Act (WsPA) regulates land use and activities within critical areas of the Quabbin Reservoir, Ware River and Wachusett Reservoir watersheds for the purpose of protecting the quality of drinking water. However, this Act pertains only to locations within

these three watersheds. There are no guidelines for herbicide use in other public drinking water supply watersheds in the Commonwealth of Massachusetts

Regulations promulgated under the WsPA preclude "...the use or storage of pesticides or herbicides which carry a mobility rating as provided for by the United States Environmental Protection Agency or which have been determined by the Commonwealth using United States Environmental Protection Agency standards to pose a threat or potential threat to ground water." The WsPA does not prohibit the use of herbicides that are not shown to pose a threat or potential threat to ground water, and it also includes provisions for herbicide use by utilities and railroads conducting Right of Way maintenance activities to control undesirable vegetation.

These entities must follow Right of Way regulations, and are obliged to write a Vegetation Management Plan (VMP) and a Yearly Operational Plan (YOP) detailing their activities and the materials they will use, under the provisions of 333 CMR 11.00, which are administered by the Massachusetts Department of Agriculture (MDAR). Only those herbicides included on the Sensitive Area Materials List, all of which have low mobility ratings, may be used for ROW maintenance. Included on the list are glyphosate, triclopyr, Imazapyr and metsulfuron methyl, which have been widely used to control non-native invasive plants including those found in these watersheds.

In addition, model ROW plans developed by utility companies such as National Grid include setback distances from public surface water sources that preclude and/or restrict use of Sensitive Area-approved herbicides. The ROW plan prohibits herbicide use within 100' of reservoirs, while allowing use of only those herbicides for the Sensitive Area Materials List noted in the preceding paragraph. Of the stands currently under consideration for control of invasive and/or undesirable vegetation, only the shoreline portions of Stand 8 in the Mountain St. watershed would fall within 100' of the reservoir. Under the ROW protocol, only mechanical control methods would be use. Vegetation control in the other stands in both watersheds will occur either in upland areas, or in the vicinity of wetland resource areas, where they would be subject to the provisions of the Wetland Protection Act. Permits would need to be secured from the conservation commissions with jurisdiction in the respective towns where those stands are located.

With the exception of ROW operations, herbicides are not currently in use in the watersheds of the Quabbin/Ware River/Wachusett Reservoirs to manage non-native invasive vegetation. Apparently, this decision is based more on sensitivity to negative public perceptions about herbicide use in public water supply watersheds than on science-based assessments of risk.

In situations where there are no effective alternatives for controlling interfering vegetation (non-native invasive species such as oriental bittersweet or multiflora rose, and/or interfering native species such as wild grapes and hay-scented fern), we recommend that Northampton DPW allow the use of herbicides as part of a program to manage these species. In this manner, desirable vegetation that serves the overarching goal of watershed protection may be allowed to reestablish itself and to flourish.

As a framework to guide the usage of herbicides in Northampton DPW watershed forests, we recommend preparing and implementing a VMP in accordance with ROW standards. This VMP would meet the same standards as ROW maintenance VMP's developed for use within the watersheds of the Quabbin/Ware River/Wachusett Reservoirs. The VMP will be submitted with

Notice of Intent applications related to management activities and will stipulate use of only those herbicides on the Sensitive Area Materials List. We recommend using the setback protocol used by National Grid VMP (e.g. no herbicide use within 100' of the bank or a reservoir or tributary, and limited use in the area 100'-400' from the reservoir or tributary). Herbicide-based control will be recommended in situations where mechanical control (e.g. cutting), or mechanical control alone, is not expected to achieve the desired control. Actual treatments will be prescribed in detail, applied, and documented only by Licensed Pesticide Applicators working in conjunction with Northampton DPW, and will observe all recommended Best Management Practices.

There are separate challenges for each watershed. Because the infestation of undesirable vegetation is so advanced at the Mountain Street reservoir watershed, most of the needed effort will focus on "winning back", or restoring, the forest so that conventional management activities can resume eventually. In the Ryan & West-Whately watersheds, only a few areas are in need of restoration; the main challenge will be to work in ways that allow conventional forest management to proceed while simultaneously controlling any undesirable vegetation.

Treatment Recommendations based on Stand Ranking: treatments of interfering vegetation will be designed according to the degree of infestation. For each stand and situation, a specific prescription would be developed. The general approach to treatments is discussed below. Tables 6A & 6B indicate which stands are recommended for treatment within the next 10 years..

In Stands ranked 1, there is typically no need to treat interfering vegetation.

In Stands ranked 2 and scheduled for silvicultural activity, control of interfering vegetation is typically recommended as a condition of the harvest (i.e. recommended to occur, as a separate step to be done by separate contractors before, during, or right after the harvesting.) Without treatment of interfering vegetation, these harvests should not be pursued (because it would merely spur new growth in the interfering vegetation). A typical treatment for stands ranked 2 would be as follows:

- Winter, Year 1 (dormant season): cut-stump herbicide application to invasive plants and interfering vegetation. Garlon 4 Ultra in basal oil would be used. Various saws and clippers used as needed.
- Summer, Year 1: foliar herbicide application of triclopyr-based herbicide on low and resurgent vegetation (e.g. horizontal vines, resprouts, etc.). Use backpack sprayer.
- Summer, Year 2: follow-up foliar spray application.

For some Stands ranked 3 (none of these are slated for silvicultural treatment), especially where there is significant timber, treatments are recommended that would seek to reduce the Stand ranking to 2 so that harvesting could occur in the future (though probably beyond the 10-year time frame of this plan). A typical treatment for stands ranked 3 would be as follows:

- Winter, Year 1 (dormant season): cut-stump herbicide application to invasive plants and interfering vegetation. Various saws and clippers used as needed.

- Summer, Year 1: foliar herbicide application of triclopyr-based herbicide on low vegetation (e.g. horizontal vines). Mistblower and/or backpack sprayer would be used.
- Late Summer, Year 1: foliar herbicide application of glyphosate-based herbicide and imazapyr-based herbicide on low vegetation (e.g. horizontal vines) on low-growing vegetation.
- Summer, Year 2: follow-up foliar spray application.
- Summer, Year 3 follow-up foliar spray application.

For some Stands ranked 4 or 5, no active treatment is recommended at this time, unless the DPW wishes to be very ambitious and regain the ability to manage all DPW lands with normal silvicultural methods. The exceptions would be for included areas ranked 5 (i.e. in Ryan & West-Whately Stands 7 & 9, and in Mountain Street Stand 1). Control is recommended in these focused areas in order to prevent these areas from enlarging over time and from serving as a seed source to surrounding areas. A typical treatment for stands ranked 4 or 5 would be as follows:

- Winter, Year 1 (dormant season): cut-stump herbicide application to invasive plants and interfering vegetation. Various saws and clippers used as needed.
- Winter, Year 1 (6 weeks after previous treatment): if needed, using equipment as needed, create walkable access routes into the treatment area
- Summer, Year 1: foliar herbicide application of triclopyr-based herbicide on low vegetation (e.g. horizontal vines). Mistblower and/or backpack sprayer would be used.
- Late Summer, Year 1: foliar herbicide application of glyphosate-based herbicide and imazapyr-based herbicide on low vegetation (e.g. horizontal vines) on low-growing vegetation.
- Fall, Year 1 or early spring, Year 2: in Stands ranked 5, possible planting of new vegetation (e.g. Norway spruce to cast dense shade) to grow in combination with native vegetation.
- Summer, Year 2: follow-up foliar spray application.
- Summer, Year 3 follow-up foliar spray application.

Table 6A: Proposed Treatment of Interfering vegetation at the Ryan & West-Whately Watershed:

Stand	Stand Acres	Overall Invasives Rank 1 - 5	Acres Ranked 5	Treatment Recommended?	Acres to treat
1	58.9	1	0	NO	
2	47.2	1	0	NO	
3	166.4	1	0	NO	
4	92.9	1	0	NO	
5	137.0	2	0	NO	
6	189.6	1	0	NO	
7	208.1	2	3	YES	5
8	297.3	2	0	NO	
9	185.6	2	8.7	YES	10
10	52.4	2	0	NO	
11	277.4	2	0	NO	
12	41.3	2	0	NO	
13	30.9	1	0	NO	
14	76.0	3	0	NO	
15	65.2	2	0	YES	50.0
16	130.3	1	0	NO	
17	65.6	2	0	NO	
18	50.9	1	0	NO	
19	45.7	2	0	YES	2
20	108.3	1	0	NO	
21	18.7	4	9	YES	9
Total	2345.8		20.7		76.0

Table 6A: Proposed Treatment of Interfering vegetation at the Mountain Street Watershed:

Stand	Stand Acres	Overall Invasives Rank 1 - 5	Acres Ranked 5	Treatment Recommended?	Acres to treat
1	151.3	3	0.5	YES	1.0
2	18.8	3	0	NO	0.0
3	24.6	1	0	NO	0.0
4	22.9	3	0	YES	22.9
5	2.8	2	0	NO	0.0
6	15.3	4	0	YES	15.3
7	95.2	3	0	YES	95.2
8	33.7	5	33.7	NO	0.0
9	47.7	1	0	NO	0.0
10	134.0	3	0	YES	134.0
11	12.7	4	0	YES	12.7
Total	559.0		34.2		281.1

Reducing Over-Browsing: Browsing of deer and moose is contributing to an overall lack of desirable hardwood regeneration, including oaks, maples and black cherry. Moose hunting is prohibited by statute in Massachusetts. Allowing deer hunting would help reduce the browsing pressure exerted by deer on the desirable regeneration. This was tried, with success, at the Quabbin Reservoir. Specific recommendations about how to do this go beyond the scope of this plan. But, presumably, there would be sort of registry of hunters and some sort of supervision of the hunt, including parking and the use of off-road vehicles, and measures to protect public safety, perhaps in coordination with the Environmental Police. If, ever, hunting of moose became legal in Massachusetts, the hunt would be expanded to include these.

VIII. Impact on Nearby Protected Land and Local Economy

Role/Impact wrt. nearby Protected Lands: these include abutting MA Division of Fish & Wildlife land and abutting MA DCR state forest.

Water supply: The intention of this plan is to maintain and enhance the watershed benefits of this forest. No other drinking water supplies will be affected. No negative impact to any water supply is expected from following this plan.

Wildlife habitat: The anticipated uses should sustain or enhance a component of the current mature-forest habitats while adding a younger-growth dimension. There should be no near-term net effect on habitat on nearby protected land. Any success in controlling non-native invasive plant species will benefit abutting lands as well.

Recreation: Recreation is not permitted, other than authorized snowmobile trail use (for the Ryan & West-Whately watershed, on Waterworks and Old Phinney Roads, Old Williamsburg Road, the Henhawk Trail, and for the Mountain Street watershed on the west side of Laurel Mountain and on Chestnut Mountain Road). Residents of Williamsburg are specifically (by agreement between the City of Northampton and the Town of Williamsburg) allowed to walk on the Henhawk Trail. At the Ryan & West-Whately watershed, Williamsburg Road is a public highway, but with the bridge out at the eastern end of the road, this road is mainly used for recreation. At the Mountain Street watershed, Chestnut Mountain Road and Rocks Road are public ways and are used for recreation. No current or anticipated use of these roads is expected to affect water quality.

The between-property impact of any forest management: is expected to be essentially non-existent.

Role/Impact wrt. the local economy: The most important economic role of this forest is to supply water to the reservoirs. The value of the water produced by the water supply is much more significant than the value of any forest products. Income from forest products plays a secondary role, and harvesting is designed to shape watershed forest conditions rather than to meet economic goals. From a "woodlot perspective", this parcel is relatively large by Massachusetts standards, and can contribute positively to the local economy, providing work for foresters, loggers, truckers, and possibly local sawmills, firewood operations, and wood-chip-burning facilities (e.g. Cooley Dickinson Hospital). There has been no harvesting of timber on these lands over the last 10 years. Over the next ten years, the economic role played by timber will increase. Much of the volume that might be harvested is low-grade material, including firewood, softwood pulp, and potential chipwood.

Additionally, there are opportunities for specialists in invasive plant control to assist in regaining the ability to use this woodlot to produce forest products, and there may be opportunities for wildlife biologists to shape management.

IX. Summary of Management Recommendations

The City of Northampton DPW's primary goal for the forest is to ensure the forest's proper function as a watershed protection forest. Secondary goals include growing and harvesting timber for the purpose of revenue generation, and providing a diversity of wildlife habitat. The property's potential to achieve the landowner's goals is good, but the significant health concerns caused by the interfering factors identified in this plan will require DPW to maintain considerable attention and effort, over a long period of time, to ensure that this situation does not worsen.

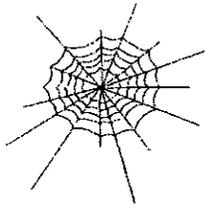
Working towards these goals, the main recommendations include:

1. Develop and follow a forest management plan approved by the MA Department of Conservation and Recreation (DCR) that incorporates the following elements:
 - a. A Forest Stewardship Plan (a comprehensive assessment and set of forest management considerations).
 - b. Green Certification: (involving third party verification by Smartwood, in conjunction with DCR, and ongoing monitoring of forest conditions by the landowner or its agent)
 - c. An outreach component to facilitate public awareness
2. Continue to clarify parcel deeds and status of roads.
3. Locate, mark (as needed) or re-mark boundaries with abutters and inspect these periodically.
4. Continue efforts to acquire or otherwise protect land within the watersheds.
5. Maintain roads and logging access in a condition that protects water bodies from sediment inflows and allows them to be re-used over the long term.
6. Use passive and active approaches to limit the spread of, and push back the negative effects of, interfering factors such as non-native invasive vines and shrubs, native plants such as wild grapes, beech, and hayscented fern, and overbrowsing by herbivores.
7. Conduct a limited set of silviculturally-based harvests designed to promote and maintain a diverse, mixed-age forest that is well suited to watershed protection (described above). By limiting cutting within each subwatershed to less than 25% of basal area within any 10-year period, these harvests will not increase run off into the reservoirs. (Exceptions to the anticipated course of harvesting could occur in response to events, such as severe storms or pest outbreaks, but this could be determined as needed.)
8. Continue to ensure that unwanted uses (e.g. ATV use) within the watershed are minimized.

9. Monitor watershed-forest conditions. This can be done as an ongoing, integrated effort involving the DPW Ranger (monitoring road conditions and any occurrence of prohibited uses) and forestry or ecological staff (monitoring general forest conditions on a periodic basis — possibly on a rolling, walk-through basis so that all areas are casually inspected within any 5-year period — and monitoring specific forest conditions in areas that have undergone Silvicultural or interfering vegetation control treatments). Irregular inspections could occur in the event of any major storms or pest outbreaks or other notable disturbances. One particular focus of monitoring should be the condition of red pine to detect as early as possible any sign of the red pine scale so that an accelerated response can be developed.
10. Consider developing a framework that allows for hunting of deer to help reduce over-browsing of desirable seedlings.
11. Design and implement a series of outreach products and/or efforts to help facilitate public awareness of watershed management activities.
12. Review this plan and the entire forest in 10 years (2022), evaluate successes and failures, new developments, etc., and use updated information to prepare a plan for the next 10 years of forest management.

Stewardship Issues

Massachusetts is a small state, but it contains a tremendous variety of ecosystems, plant and animal species, management challenges, and opportunities. This section of your plan will provide background information about the Massachusetts forest landscape as well as issues that might affect your land. **The Stand Descriptions and Management Practices sections of your plan will give more detailed property specific information on these subjects tailored to your management goals.**



Biodiversity: Biological diversity is, in part, a measure of the variety of plants and animals, the communities they form, and the ecological processes (such as water and nutrient cycling) that sustain them. With the recognition that each species has value, individually and as part of its natural community, maintaining biodiversity has become an important resource management goal.

While the biggest threat to biodiversity in Massachusetts is the loss of habitat to development, another threat is the introduction and spread of invasive non-native plants. Non-native invasives like European Buckthorn, Asiatic Bittersweet, and Japanese Honeysuckle spread quickly, crowding out or smothering native species and upsetting and dramatically altering ecosystem structure and function. Once established, invasives are difficult to control and even harder to eradicate. Therefore, vigilance and early intervention are paramount.

Another factor influencing biodiversity in Massachusetts concerns the amount and distribution of forest growth stages. Wildlife biologists have recommended that, for optimal wildlife habitat on a landscape scale, 5-15% of the forest should be in the seedling stage (less than 1" in diameter). Yet we currently have no more than 2-3% early successional stage seedling forest across the state. There is also a shortage of forest with large diameter trees (greater than 20"). See more about how you can manage your land with biodiversity in mind in the "Wildlife" section below. (Also refer to *Managing Forests to Enhance Wildlife Diversity in Massachusetts* and *A Guide to Invasive Plants in Massachusetts* in the binder pockets.)



Rare Species: Rare species include those that are **threatened** (abundant in parts of its range but declining in total numbers, those of **special concern** (any species that has suffered a decline that could threaten the species if left unchecked), and **endangered** (at immediate risk of extinction and probably cannot survive without direct human intervention). Some species are threatened or endangered globally, while others are common globally but rare in Massachusetts.

Of the 2,040 plant and animal species (not including insects) in Massachusetts, 424 are considered rare. About 100 of these rare species are known to occur in woodlands. Most of these are found in wooded wetlands, especially vernal pools. These temporary shallow pools dry up by late summer, but provide crucial breeding habitat for rare salamanders and a host of other unusual forest dwelling invertebrates. Although many species in Massachusetts are adapted to and thrive in recently disturbed forests, rare species are often very sensitive to any changes in their habitat

Indispensable to rare species protection is a set of maps maintained by the Division of Fisheries and Wildlife's Natural Heritage & Endangered Species Program (NHESP) that show current and historic locations of rare species and their habitats. The maps of your property will be compared to these rare

species maps and the result indicated on the upper right corner of the front page of the plan. Prior to any regulated timber harvest, if an occurrence does show on the map, the NHESP will recommend protective measures. Possible measures include restricting logging operations to frozen periods of the year, or keeping logging equipment out of sensitive areas. You might also use information from NHESP to consider implementing management activities to improve the habitat for these special species.



Riparian and Wetlands Areas: Riparian and wetland areas are transition areas between open water features (lakes, ponds, streams, and rivers) and the drier terrestrial ecosystems. More specifically, a **wetland** is an area that has hydric (wet) soils and a unique community of plants that are adapted to live in these wet soils. Wetlands may be adjacent to streams or ponds, or a wetland may be found isolated in an otherwise drier landscape. A **riparian area** is the transition zone between an open water feature and the uplands (see Figure 1). A riparian zone may contain wetlands, but also includes areas with somewhat better drained soils. It is easiest to think of riparian areas as the places where land and water meet.

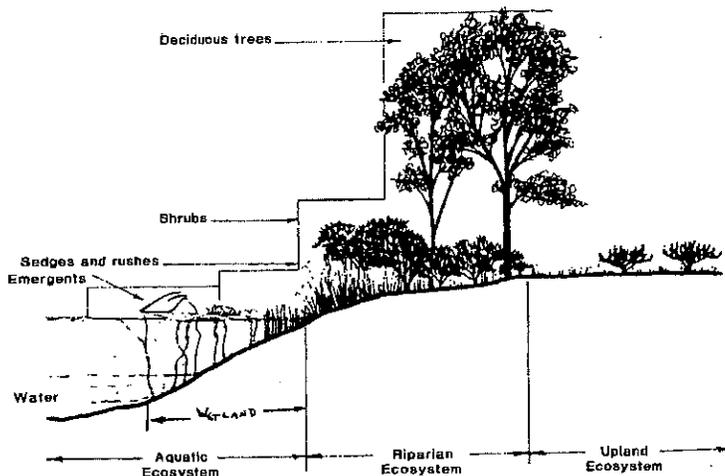


Figure 1: Example of a riparian zone.

The presence of water in riparian and wetland areas make these special places very important. Some of the functions and values that these areas provide are described below:

Filtration: Riparian zones capture and filter out sediment, chemicals and debris before they reach streams, rivers, lakes and drinking water supplies. This helps to keep our drinking water cleaner, and saves communities money by making the need for costly filtration much less likely.

Flood control: By storing water after rainstorms, these areas reduce downstream flooding. Like a sponge, wetland and riparian areas absorb stormwater, then release it slowly over time instead of in one flush.

Critical wildlife habitat: Many birds and mammals need riparian and wetland areas for all or part of their life cycles. These areas provide food and water, cover, and travel corridors. They are often the most important habitat feature in Massachusetts' forests.

Recreational opportunities: Our lakes, rivers, streams, and ponds are often focal points for recreation. We enjoy them when we boat, fish, swim, or just sit and enjoy the view.

In order to protect wetlands and riparian areas and to prevent soil erosion during timber harvesting activities, Massachusetts promotes the use of "Best Management Practices" or BMPs. Maintaining or reestablishing the protective vegetative layer and protecting critical areas are the two rules that underlie these common sense measures. DCR's Massachusetts Forestry Best Practices Manual (included with this plan) details both the legally required and voluntary specifications for log landings, skid trails, water bars, buffer strips, filter strips, harvest timing, and much more.

The two Massachusetts laws that regulate timber harvesting in and around wetlands and riparian areas are the Massachusetts Wetlands Protection Act (CH 131), and the Forest Cutting Practices Act (CH132). Among other things, CH132 requires the filing of a cutting plan and on-site inspection of a harvest operation by a DCR Service Forester to ensure that required BMPs are being followed when a commercial harvest exceeds 25,000 board feet or 50 cords (or combination thereof).



Soil and Water Quality: Forests provide a very effective natural buffer that holds soil in place and protects the purity of our water. The trees, understory vegetation, and the organic material on the forest floor reduce the impact of falling rain, and help to insure that soil will not be carried into our streams and waterways.

To maintain a supply of clean water, forests must be kept as healthy as possible. Forests with a diverse mixture of vigorous trees of different ages and species can better cope with periodic and unpredictable stress such as insect attacks or windstorms.

Timber harvesting must be conducted with the utmost care to ensure that erosion is minimized and that sediment does not enter streams or wetlands. Sediment causes turbidity which degrades water quality and can harm fish and other aquatic life. As long as Best Management Practices (BMPs) are implemented correctly, it is possible to undertake active forest management without harming water quality.



Forest Health: Like individual organisms, forests vary in their overall health. The health of a forest is affected by many factors including weather, soil, insects, diseases, air quality, and human activity. Forest owners do not usually focus on the health of a single tree, but are concerned about catastrophic events such as insect or disease outbreaks that affect so many individual trees that the whole forest community is impacted.

Like our own health, it is easier to prevent forest health problems than to cure them. This preventative approach usually involves two steps. First, it is desirable to maintain or encourage a wide diversity of tree species and age classes within the forest. This diversity makes a forest less susceptible to a single devastating health threat. Second, by thinning out weaker and less desirable trees, well-spaced healthy individual trees are assured enough water and light to thrive. These two steps will result in a forest of vigorously growing trees that is more resistant to environmental stress.



Fire: Most forests in Massachusetts are relatively resistant to catastrophic fire. Historically, Native Americans commonly burned certain forests to improve hunting grounds. In modern times, fires most often result from careless human actions. The risk of an unintentional and damaging fire in your woods could increase as a result of logging activity if the slash (tree tops, branches, and debris) is not treated correctly.

Adherence to the Massachusetts slash law minimizes this risk. Under the law, slash is to be removed from buffer areas near roads, boundaries, and critical areas and lopped close to the ground to speed decay. Well-maintained woods roads are always desirable to provide access should a fire occur.

Depending on the type of fire and the goals of the landowner, fire can also be considered as a management tool to favor certain species of plants and animals. Today the use of prescribed burning is largely restricted to the coast and islands, where it is used to maintain unique natural communities such as sandplain grasslands and pitch pine/scrub oak barrens. However, state land managers are also attempting to bring fire back to many of the fire-adapted communities found elsewhere around the state.



Wildlife Management: Enhancing the wildlife potential of a forested property is a common and important goal for many woodland owners. Sometimes actions can be taken to benefit a particular species of interest (e.g., put up Wood Duck nest boxes). In most cases, recommended management practices can benefit many species, and fall into

one of three broad strategies. These are **managing for diversity, protecting existing habitat, and enhancing existing habitat.**

Managing for Diversity – Many species of wildlife need a variety of plant communities to meet their lifecycle requirements. In general, a property that contains a diversity of habitats will support a more varied wildlife population. A thick area of brush and young trees might provide food and cover for grouse and cedar waxwing; a mature stand of oaks provides acorns for foraging deer and turkey; while an open field provides the right food and cover for cottontail rabbits and red fox. It is often possible to create these different habitats on your property through active management. The appropriate mix of habitat types will primarily depend on the composition of the surrounding landscape and your objectives. It may be a good idea to create a brushy area where early successional habitats are rare, but the same practice may be inappropriate in the area's last block of mature forest.

Protecting Existing Habitat – This strategy is commonly associated with managing for rare species or those species that require unique habitat features. These habitat features include vernal pools, springs and seeps, forested wetlands, rock outcrops, snags, den trees, and large blocks of unbroken forest. Some of these features are rare, and they provide the right mix of food, water, and shelter for a particular species or specialized community of wildlife. It is important to recognize their value and protect their function. This usually means not altering the feature and buffering the resource area from potential impacts.

Enhancing Existing Habitat – This strategy falls somewhere between the previous two. One way the wildlife value of a forest can be enhanced is by modifying its structure (number of canopy layers, average tree size, density). Thinning out undesirable trees from around large crowned mast (nut and fruit) trees will allow these trees to grow faster and produce more food. The faster growth will also accelerate the development of a more mature forest structure, which is important for some species. Creating small gaps or forest openings generates groups of seedlings and saplings that provide an additional layer of cover, food, and perch sites.

Each of these three strategies can be applied on a single property. For example, a landowner might want to increase the habitat diversity by reclaiming an old abandoned field. Elsewhere on the property, a stand of young hardwoods might be thinned to reduce competition, while a "no cut" buffer is set up around a vernal pool or other habitat feature. The overview, stand description and management practice sections of this plan will help you understand your woodland within the context of the surrounding landscape and the potential to diversify, protect or enhance wildlife habitat.



Wood Products: If managed wisely, forests can produce a periodic flow of wood products on a sustained basis. Stewardship encompasses finding ways to meet your current needs while protecting the forest's ecological integrity. In this way, you can harvest timber and generate income without compromising the opportunities of future generations.

Massachusetts forests grow many highly valued species (white pine, red oak, sugar maple, white ash, and black cherry) whose lumber is sold throughout the world. Other lower valued species (hemlock, birch, beech, red maple) are marketed locally or regionally, and become products like pallets, pulpwood, firewood, and lumber. These products and their associated value-added industries contribute between 200 and 300 million dollars annually to the Massachusetts economy.

By growing and selling wood products in a responsible way you are helping to our society's demand for these goods. Harvesting from sustainably managed woodlands – rather than from unmanaged or poorly managed forest – benefits the public in a multitude of ways. The sale of timber, pulpwood, and firewood also provides periodic income that you can reinvest in the property, increasing its value and helping you meet your long-term goals. Producing wood products helps defray the costs of owning woodland, and helps private landowners keep their forestland undeveloped.



Cultural Resources: Cultural resources are the places containing evidence of people who once lived in the area. Whether a Native American village from 1,700 years ago, or the remains of a farmstead from the 1800's, these features all tell important and interesting stories about the landscape, and should be protected from damage or loss.

Massachusetts has a long and diverse history of human habitation and use. Native American tribes first took advantage of the natural bounty of this area over 10,000 years ago. Many of these villages were located along the coasts and rivers of the state. The interior woodlands were also used for hunting, traveling, and temporary camps. Signs of these activities are difficult to find in today's forests. They were obscured by the dramatic landscape impacts brought by European settlers as they swept over the area in the 17th and 18th centuries.

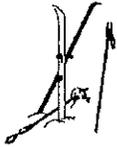
By the middle 1800's, more than 70% of the forests of Massachusetts had been cleared for crops and pastureland. Houses, barns, wells, fences, mills, and roads were all constructed as woodlands were converted for agricultural production. But when the Erie Canal connected the Midwest with the eastern cities, New England farms were abandoned for the more productive land in the Ohio River valley, and the landscape began to revert to forest. Many of the abandoned buildings were disassembled and moved, but the supporting stonework and other changes to the landscape can be easily seen today.

One particularly ubiquitous legacy of this period is stone walls. Most were constructed between 1810 and 1840 as stone fences (wooden fence rails had become scarce) to enclose sheep within pastures, or to

exclude them from croplands and hayfields. Clues to their purpose are found in their construction. Walls that surrounded pasture areas were comprised mostly of large stones, while walls abutting former cropland accumulated many small stones as farmers cleared rocks turned up by their plows. Other cultural features to look for include cellar holes, wells, old roads and even old trash dumps.

History of Natural Disturbance:

As noted above, the mid 19th century was the height of forestland clearing for agriculture and pasturing. The availability of richer, more productive farmland in the Midwest resulted in farm abandonment and subsequent regrowth of white pine, chestnut, and mixed hardwoods including red oak. In the early 20th century these stands, particularly white pine, were cut to supply the wood container industry. Farm activity on the newly cleared land was truncated by World Wars I and II and brought about another wave of farm abandonment and regrowth. Natural disturbances since 1900 include the Chestnut blight of 1900-1908, the hurricane of 1938, the Gypsy Moth outbreak of 1980-1982, wind events, and ice damage, most notably in December 2008.



Recreation and Aesthetic Considerations: Recreational opportunities and aesthetic quality are the most important values for many forest landowners, and represent valid goals in and of themselves. Removing interfering vegetation can open a vista or highlight a beautiful tree, for example. When a landowner's goals include timber, thoughtful forest management can be used to accomplish silvicultural objectives while also reaching recreational and/or aesthetic objectives. For example, logging trails might be designed to provide a network of cross-country ski trails that lead through a variety of habitats and reveal points of interest.

If aesthetics is a concern and you are planning a timber harvest, obtain a copy of this excellent booklet: *A Guide to Logging Aesthetics: Practical Tips for Loggers, Foresters & Landowners*, by Geoffrey T. Jones, 1993. (Available from the Northeast Regional Agricultural Engineering Service, (607) 255-7654, for \$7). Work closely with your consultant to make sure the aesthetic standards you want are included in the contract and that the logger selected to do the job executes it properly. The time you take to plan ahead of the job will reward you and your family many times over with a fuller enjoyment of your forest, now and well into the future.

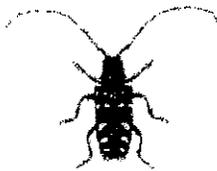


Invasive Species Management: Invasive species pose immediate and long-term threats to the woodlands of MA. Defined as a non-native species whose introduction does or is likely to cause economic or environmental harm or harm to human, animal, or plant health, invasives are well-adapted to a variety of environmental conditions, out-compete more desirable native species, and often create monocultures devoid of biological diversity. The websites of the Invasive Plant Atlas of New England, www.nbi-nin.ciesin.columbia.edu/ipane, and the New England Wildflower Society,

www.newfs.org are excellent sources of information regarding the identification and management of invasive plants. Some of the common invasive plants found in MA are listed below.

- Oriental Bittersweet (*Celastrus orbiculata*)
- Glossy Buckthorn (*Frangula alnus*)
- Multiflora Rose (*Rosa multiflora*)
- Japanese Barberry (*Berberis thunbergii*)
- Japanese Knotweed (*Fallopia japonica*)
- Autumn Olive (*Eleaagnus umbellata*)

Early detection and the initiation of control methods soon after detection are critical to suppressing the spread of invasive species. Selective application of the proper herbicide is often the most effective control method. See the next section for information on the use of chemicals in forest management activities.



Asian Longhorned Beetle

Pesticide Use

Pesticides such as herbicides, insecticides, fungicides, and rodenticides are used to control “pests”. A pest is any mammal, bird, invertebrate, plant, fungi, bacteria or virus deemed injurious to humans and/or other mammals, birds, plants, etc. The most common forest management use of a pesticide by woodland owners is the application of herbicide to combat invasive species. MA DCR suggests using a management system(s) that promotes the development and adoption of environmentally friendly no-chemical methods of pest management that strives to avoid the use of chemical pesticides. If chemicals are used, proper equipment and training should be utilized to minimize health and environmental risks. In Massachusetts, the application of pesticides is regulated by the MA Pesticide Control Board. For more information, contact MA Department of Agricultural Resources (MDAR), Pesticide Bureau at (617) 626-1776

Please refer to FSC Pesticides Policy: Guidance on Implementation (FSC-GUI30-001 Version 2-0 EN, May 5, 2007) for information on chemicals banned from use on MA Private Lands Group Certification member properties.

This is your Stewardship Plan. It is based on the goals that you have identified. The final success of your Stewardship Plan will be determined first, by how well you are able to identify and define your goals, and second, by the support you find and the resources you commit to implement each step.

It can be helpful and enjoyable to visit other properties to sample the range of management activities and see the accomplishments of others. This may help you visualize the outcome of alternative management decisions and can either stimulate new ideas or confirm your own personal philosophies. Don't hesitate to express your thoughts, concerns, and ideas. Keep asking questions! Please be involved and enjoy the fact that you are the steward of a very special place.



STAND DESCRIPTIONS

Notes Applying to All Stands

Stand Objectives: For all stands, the objectives are Forest Stewardship & Green Certification

Volume Growth Rate: For all stands, stewardship-plan growth rates were based on the DCR/USFS Forest-Inventory-and-Analysis published average rate of 162 board feet per acre per year. If any adjustments were made to this figure, it was discussed in the specific stand description.

Are there slopes greater than 30%? Yes. These occur to a limited extent on the west face of High Ridge and also along the western boundary of Stand 1. No logging is recommended for these areas, and there is no indication of erosion.

Is this soil highly erodible? No.

Protection from fire: No evidence of wildfire. The main threat of wildfire is careless, unauthorized recreational use. In case of a fire, the well-established road network will provide essential access, and can also serve as a firebreak.

Field method for volume per acre: for stands 2, 5, 6, 10, 14, 12, and 17, a nested point-sampling cruise was conducted using a BAF-10 prism for "count trees" and a BAF-40 prism for volume trees (diameter and height) (see "Using a large-angle gauge to select trees for measurement in variable plot sampling", Marshall, Lles and Bell, *Canadian Journal of Forest Research* 34: 840-845 (2004)). See also: "Is BAF 10 a Good Choice for Point Sampling, Wiant, Yandle and Andreas, *Journal of Forestry*, pp. 23 & 24, June, 1984. Product volumes are calculated in an Excel spreadsheet using formulas published in Mawson and Rivers.

In Stands 1, 3, 4, 7, 8, 9, 11, 13, 15, 16, 18, 19 and 20, a standard point-sampling cruise was conducted using a BAF-20 prism for "count trees". Data from these points was processed with proprietary software developed by LandVest.

No timber was measured in Stand 21.

Field method for site index: Published Soil Survey data for Franklin and Hampshire Counties interpreted with qualitative adjustments for tree vigor

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Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

and in-stand features. These are discussed for each stand under the "Soils" heading.

Standard Procedure for Invasive Inspections: stand-level recommendations may refer to "standard procedure" for invasive inspections. These procedures are listed below:

Standard procedure for invasive inspections for stands ranked 1 or 2: If vehicle entry or gaps caused by logging, wind, or grape pulldown occurs in this stand it should be inspected within 2 years and any invasive plants should be pulled. If they are seed-bearing they should be bagged and removed to a landfill. If logging or major blowdowns occur on adjacent stands but not on this one, the inspection should occur within 5 years. If on any inspection, invasives are found, then repeat inspections should occur every year or two thereafter until no invasives are found, at which point the inspections can be less frequent.

Standard procedure for invasive treatments for stands ranked 3: In addition to the procedure for stands ranked 1 or 2, efforts to remove invasives should be made even before the canopy is opened. After the initial removal treatment, the treated areas and areas surrounding them should be inspected every year for at least 5 years.

For Stands ranked 4 or 5: avoid any further disturbance or vehicle entry; develop a specific plan to regain control/use of the site.

STAND DESCRIPTIONS

Overview of Stand Descriptions:

Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	Volume growth rate (Mbf/yr)
1	BB	58.9	10.9	103	1.3	13.7	1.1	60 OR	9.5
2	BB	47.2	13.5	118	5.5	11.0	0.4	60 OR	7.6
3	WH	166.4	13.0	145	4.0	14.3	7.9	65 WP	27.0
4	WH	92.9	12.3	111	2.9	12.3	4.3	60 OR	15.0
5	BB	137.0	11.2	89	4.8	5.1	3.1	65 SM	22.2
6	HH	189.6	10.1	123	3.1	6.9	6.2	60 OR	30.7
7	OH	208.1	12.3	122	4.2	14.6	4.3	65 OR	33.7
8	HH	297.3	12.2	115	6.1	10.5	18.0	65 OR	48.2
9	WH	185.6	14.1	157	10.6	7.7	16.5	70 WP	30.1
10	BB	52.4	11.0	84	3.3	6.8	1.4	60 OR	8.5
11	WH	277.4	13.9	132	5.8	12.7	8.6	65 WP	44.9
12	RM	41.3	10.4	27	1.3	2.2	0.4	55 RM	1.0
13	WH	30.9	12.5	80	5.7	2.4	6.6	70 WP	5.0
14	BB	76.0	12.7	82	3.4	5.7	2.0	70 WP	12.3
15	RP	65.2	14.4	163	19.9	3.7	22.1	70 RP	0.0
16	HH	130.3	12.5	127	6.6	10.8	9.5	65 WP	0.0
17	BB	65.6	12.6	147	10.0	9.5	2.5	58 BB	10.6
18	WH	50.9	14.3	113	3.2	10.9	3.1	65 WP	8.2
19	HH	45.7	15.0	185	7.8	15.3	15.5	70 WP	7.4
20	WH	108.3	12.9	108	6.0	8.5	13.6	65 WP	17.5
21	GR	18.7	N/A	N/A	N/A	N/A	N/A	N/A	0.0
	WA	94.5							
Total		2440.3							340
Forest		2345.8							

Reservoir(s) Ryan & West-Whately Town(s) Conway, Whately & Williamsburg

Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
1	BB	58.9	10.9	103	1.3	13.7	1.1	60 OR	9.5

Stand Name: Conway State Forest East

Watershed / Sub-watershed: Ryan Reservoir / Avery Brook West

Special water quality concerns (for stands within a reservoir watershed):
avoid introduction of sediment into any stream draining into Avery Brook.

Silvicultural Status (options are "suitable" or "not suitable"): suitable

Overstory: Forest Type and Condition: With very little white pine or sugar maple, and with only a small amount of red oak, this is a mix of black and yellow birch, and paper birch, red maple, white ash, beech, and hemlock. Typical sizes range from 8" to 14", and less commonly up to 18" or 19" for hardwoods, and rarely up to 26" or more (in residual white pines). Quality is generally poor, causing much of the timber-sized trees to be counted as cordwood. Though there is potential for the black and yellow birch to grow timber over time, along with the red oak, the beech is expected to continue to be plagued by beech bark disease, the hemlock is expected to succumb to either the hemlock woolly adelgid or the hemlock elongate scale, or both, and the ash is, at this writing, expected to suffer greatly with the anticipated arrival of the emerald ash borer. All of these pests are introduced and not native to the area.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: essentially lacking. Beech is abundant, with hemlock in places. Sugar maple is scattered throughout, but, as a preferred browse tree, and with heavy competition from beech and striped maple, it has little chance of thriving. There may be a black cherry seed bank that could be triggered in the event of a heavy disturbance.

Interfering native vegetation: This stand is mostly clear of hay-scented fern and New York fern, but there are a few areas of light to moderate growth of these ferns. Witch hazel presence is spotty. Grapevines were not observed in this stand. In some parts beech forms a dense midstory.

Other native understory vegetation (species and distribution): Ground vegetation is virtually absent with the exception of a small amount of regeneration of beech and striped maple.

Reservoir(s) Ryan & West-Whately Town(s) Conway, Whately & Williamsburg

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STAND DESCRIPTIONS

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. No invasive plants were observed in this stand and no significant seed sources for invasives are known from surrounding stands on nearby land. However, there is some possibility that the Phragmites in the wetland in Stand 21 could seed into the wetlands in this stand. This wetland is about 1000 ft. from the nearest wetland in Stand 1.

Soils (type, moisture, drainage and productivity): The soils are listed as Westminster and Shelburne.

Westminster extremely rocky loam is a droughty and shallow soil formed in glacial material derived from gray mica schist that contains impure limestone. Soil depth is about 18 inches to dark gray-schist bedrock. The shallow bedrock prevents deep rooting, and trees may not be windfirm (or may be uprooted in heavy ice or wet snow if the ground is not frozen — sometimes whole groups of trees can peel away in a clump and leave bare, exposed bedrock, a situation made more likely by grape or bittersweet vines climbing in trees).

For tree growth purposes: Site index on this Westminster for northern hardwoods is 46-51; site index for upland oaks is 55-64; site index for white pine is 60-69.

For logging purposes: On Westminster, erosion and gulying in woods roads and logging roads is a serious risk on this soil, and durable water diversions are needed to prevent this. This soil is slow to dry out in spring or after periods of heavy rain. Logging should be designed to go across slopes as much as possible.

The **Shelburne** extremely stony loam is a well-drained loam formed in compact glacial deposits derived mainly of dark-gray schistose material and impure limestone, with a hardpan at about 24". This soil has good moisture retention.

For tree growth purposes: Good Site indices of 52-57 for northern hardwoods, 55 and up for red oak, 60-69 for white pine.

For logging purposes: Due to their moisture-holding capacity, erosion and gulying are a risk, and it is important to design roads so as to not concentrate water.

STAND DESCRIPTIONS

Habitat:

General Habitat: The stand consists of a closed canopy, mostly deciduous forest with some areas where hemlock and to a lesser degree white pine are also present. The most common hardwoods in the canopy are red maple, black birch and beech, accompanied by yellow birch, ash, and white birch. Red oak is present but not very common. The size class for the hardwoods and hemlocks is mostly small sawtimber with a minor component reaching slightly larger sizes. The white pines reach into a larger range, up to about 26" dbh. Most of the beech <12" dbh looks healthy but most of beech >12" dbh looks diseased. There are still enough large, adequately healthy beeches to provide lots of mast but how fast the blight will progress in these trees is unknown. The midstory is dense throughout, with beech ubiquitous and supplemented by lesser amounts of hemlock, striped and sugar maple and witch hazel. In general the shrub layer is light to none. Mountain laurel is present throughout the stand but only in low densities. The remaining species of the sparse shrub layer are deciduous with beech and witch hazel. Ground vegetation is virtually absent, so no new tree regeneration is occurring except for some beech here and there. The lack of regeneration other than beech is likely due to browsing by cervids (deer and moose). Comparing moose to deer sign in this stand, deer impact seems to be greater and more recent. The beeches are used for feeding by black bears, evidenced by claw marks on the trees (bears climb beech trees to get beech nuts).

The few large cavity trees observed here were about 18" dbh. They were formed by woodpecker holes in diseased beech, so are not likely to remain standing for long. Snags were likewise mostly dead beech and were mostly <12" dbh.

Do wetlands occupy more than 10% of this stand?: No, but there are two shrub wetlands in the stand. One is in the southeast corner, along a slow stream. The other is along the middle of the boundary with Stand 2, and flows west into Stand 2. These wetlands are shrub dominated with spicebush, yellow birch, red maple, winterberry, hobblebush, and cinnamon fern. They have some open water that is flowing through. Mossy hummocks are present but not robust enough to provide habitat for 4-toed salamanders. These wetlands would be suitable habitat for the northern waterthrush and other shrub nesters.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes, 2 vernal pools were found in the stand—vernal pools 19 and 37. VP19, in the center of the stand, had evidence of breeding by wood frogs, spotted salamanders and possible Jefferson salamanders. VP 37, along the southern boundary with the Conway State Forest, was only observed in the fall so its biological significance could not be assessed.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.):
Keep larger beech as long as they remain healthy. A jumble of large boulders at

STAND DESCRIPTIONS

waypoint 87-02 provides a nice potential denning/nesting area for porcupines and turkey vultures. It is probably too small for use for denning by bobcats.

Special risks to habitat: Loss of beech due to beech blight. Lack of regeneration due to deer and possibly moose browsing.

Desired habitat modifications (options will vary, including "none"): In anticipation of worsening effects of beech blight, increase diversity of hard mast sources by encouraging the few oaks in this stand to grow bigger. Coarse woody debris is meager, but will likely increase as beech blight topples trees.

Historical/archaeological/contemporary: Major snowmobile route along the northern boundary of this stand.

Management history: no evidence of recent management

Desired future condition: Mixed-species, mixed-age stand that is relatively free of invasive vegetation.

Recommended Management for the next 10 years: No management recommended at this time. Though this stand is "suitable" for silviculture (invasives ranking =1), there is not much that can be reasonably accomplished at this time. This is due to a combination of (1) a prevalence of beech and the need to control it if any cutting is done, (2) the great distance to this stand, and (3) the economic challenge of harvesting primarily firewood over such a distance.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

STAND DESCRIPTIONS

Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
2	BB	47.2	13.5	118	5.5	11.0	0.4	60 OR	7.6

Stand Name: Conway State Forest West

Watershed / Sub-watershed: East Branch of the Mill River (out of watershed) / no subwatershed

Special water quality concerns (for stands within a reservoir watershed):
N/A

Silvicultural Status (options are "suitable" or "not suitable"): not suitable

Overstory: Forest Type and Condition: A variable mix of red oak and northern hardwood types, often of timber size. Especially in the western end, red oak sometimes occurs in concentrations, but its timber quality is often poor. The poor quality is probably a reflection of the shallow depth to bedrock (on the tops of knolls) and the greater exposure to wind and ice. There are also concentrated pockets of sugar maple, with red oak and black cherry, that suggest possibly a sugar bush long ago. The sugar maples also have low-quality timber, on the whole, and are presumably affected by the same factors as the red oak, but with the addition of damage from the sugar maple borer (a native stem-boring beetle). In the northeast section of this stand (east of the vernal pool that straddles the northern boundary), the forest is dominated by tall, vigorous, old-field white pine of average quality. The central area of the stand, around the cellar hole, is dominated by very rough beech (which is infested with beech bark disease) mixed with red oak and red maple. Just south of here, on DCR land, there are numerous very large, rough, beech trees. Yellow birch, white ash and red maple are more abundant in the wet, low area around the headwaters of the stream that drains through Stand 8 to the south. Hemlock occurs on a scattered basis as a midstory tree, and in a mid-story concentration in the northwest corner.

Overall, due to the rough quality, much of the potential timber volume was assigned to cordwood.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: same as Stand 1.

Interfering native vegetation: A small area of dense hay-scented fern is on and near the summit in the northwest corner. Along the stream in the southwest corner

Stand Descriptions Page 8

Reservoir(s) Ryan & West-Whately Town(s) Conway, Whately & Williamsburg

Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

there are about 12 grapevines about 1-2" wide, but otherwise grapevines were not observed in the stand. Other potentially interfering vegetation such as witch hazel, striped maple and laurel were not present in significant amounts. However, beech is abundant.

Other native understory vegetation (species and distribution): Virtually absent.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. No invasive species were observed in this stand.

Soils (type, moisture, drainage and productivity): The soils are listed as Westminster, Colrain, and shallow muck.

See Stand 1 above for a description of Westminster.

The Colrain stony, or very stony, fine sandy loam is a well-drained soil formed in glacial deposits derived principally from dark gray schistose material and impure limestone. With moderate to rapid permeability and fairly high moisture-holding capacity, this soil can produce good yields of timber. Site indices or 58 or greater for northern hardwoods, 65 or greater for upland oaks, 70 or greater for white pine, and 70 or greater for red pine. (The site indices for Woodbridge are listed as: 67 for white pine, 72 for northern red oak, and 65 for sugar maple)

For tree growth purposes: Colrain is excellent, with elevated fertility in lower-slope positions, and diminished fertility at tops of slopes.

For logging purposes: Due to their moisture-holding capacity, and the slow drainage through the hard substratum, Colrain soils cannot be operated during wet times of the year; this becomes more critical in swales and along the bottom of slopes. Conditions must be dry or frozen to avoid excessive rutting, compaction, and root damage, or tops and poles must be laid down to form a mat in certain places.

Shallow muck is concentrated at the headwaters of the stream flowing south off the property. This area is well-suited to the growth of yellow birch and red maple, but not suited to logging. If there were any logging to be done here, the key would be to work during very dry or frozen times and limit activity to crossing from high ground back to highground.

STAND DESCRIPTIONS

Habitat:

General Habitat: The closed canopy of this stand is mostly a mix of hardwoods: red maple, black birch, beech, sugar maple, red oak and black cherry. There is less hemlock than in Stand 1 and only a handful of white pines. The canopy trees are in the small to large sawtimber size class, with some white pines reaching 26", some oaks reaching 22", and some black cherry reaching 18". There are also numerous beeches large enough to be climbed by bears for beechnuts. Some of the beech trees appear to be healthy, some are blighted. There is a nearly ubiquitous dense midstory of beech along with hemlock midstory in patches. The result is a virtually absent shrub and ground layer. The exception is at and near the summit in the northwest corner where there is a dense cover of hay-scented fern and grass. Near this summit there is some oak and cherry regeneration but all is less than about 1 foot high.

The few large cavity trees observed here were about 16" dbh. They were formed by woodpecker holes in diseased beech, so are not likely to remain standing for long. Snags were likewise mostly dead beech and were mostly <12" dbh. They were even less abundant than in Stand 1.

Do wetlands occupy more than 10% of this stand?: No. The only wetland is a first order stream that cuts from east to west through the stand, originating from a shrub wetland in Stand 1. It tumbles over 1 to 3 foot rocks, alternating pools with short drops.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes, one. Vernal pool 20 is a large vernal pool with breeding wood frogs and spotted salamanders.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.):
None.

Special risks to habitat: Loss of beech due to beech blight. Lack of regeneration due to deer and possibly moose browsing.

Desired habitat modifications (options will vary, including "none"): In anticipation of worsening effects of beech blight, increase diversity of hard mast sources by encouraging any oaks in this stand to grow bigger. Coarse woody debris is meager, but will likely increase as beech blight topples trees.

Historical/archaeological/contemporary: cellar hole (see Forest Stand and Boundary Map) and an old, faint road passing by that is used minimally as an ATV & snowmobile trail.

Management history: no evidence of recent management

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Reservoir(s) Ryan & West-Whately Town(s) Conway, Whately & Williamsburg

Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

Desired future condition: Mixed-species, mixed-age stand that is relatively free of invasive vegetation and not dominated by beech.

Recommended Management for the next 10 years: No management recommended at this time.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

Reservoir(s) Ryan & West-Whately Town(s) Conway, Whately & Williamsburg

Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
3	WH	166.4	13.0	145	4.0	14.3	7.9	65 WP	27.0

Stand Name: Dry Hill North

Watershed / Sub-watershed: Ryan Reservoir / Avery Brook West

Special water quality concerns (for stands within a reservoir watershed):
avoid introduction of sediment into any stream draining into Avery Brook.

Silvicultural Status (options are "suitable" or "not suitable"): suitable

Overstory: Forest Type and Condition: This stand has a variable mix of forest types that often includes hemlock (in hemlock-hardwood mixes) in the western half of the stand, but is essentially an old-field white pine stand or a post old-field pine stand. The variations are not due to site as much as to differential timing of pasture abandonment and subsequent logging. The hardwoods are typically black, yellow and paper birch, red maple, white ash and, notably, black cherry, with less sugar maple. Red oak is uncommon. There is also a marsh and beaver pond on the northern boundary. The bulk of the volume is in large poles and small sawtimber trees. Vigor is mostly constrained by overcrowding within the stand, though pests and storms (wind and ice) have played a role in some cases (see microburst sections below), and decreasing soil depth toward the top of Dry Hill plays a role as well.

The northwestern part of the stand is atypical in being much older, and taller, with many large trees, some as large as 40" (pine), and many hemlocks 25" or more. There is a small knoll overlooking the marsh, and essentially no regeneration in the dense shade of this section. The exception is along the western shoreline of the marsh where, apparently, a microburst several years ago blew down many large hemlocks (typically uprooting them), creating a huge jumble. Birches, red maple, hemlock and pin cherry have responded by growing here from seed (or from pre-existing hemlock seedlings). Though it may be possible to salvage *some* of the timber here, this blowdown is providing habitat structure that is more or less unique (in scale) at this time on the watershed. These trees should be left in place.

In the southwest corner there is a ledgy knoll with a concentration of tall, large hemlock that is mostly dead, with the cause of death seeming to be a combination of microburst effects (snapped tops) and pest effects — presumably hemlock woolly adelgid and elongate scale. As in the previous section, though there may be a possibility of salvaging

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some of the timber, I recommend leaving it all as is, or doing a limited amount of harvesting, so that there remain many tall snags and lots of large debris on the ground. The expectation is that this will regenerate in the same manner as above.

The central part of the stand is a combination of smaller-sized hemlock (a lot of which is pulpwood) and hardwoods and white pine timber and pulp. About half of the pine timber was quite rough and was assigned to pulpwood. The hardwoods are mainly birches, red maple, and ash, with surprising amounts of black cherry. The hardwoods are typically tall poles 6"-10" in diameter, and many are very promising. From the old-field pine stumps in these sections, it is apparent that the abandoned-field pine was "cut off", probably about 40 years ago or so. Under the hemlock there is no regeneration or other vegetation, but under the pine there is a mix that includes mountain laurel. Promoting the better hardwoods, especially black cherry, and the better pines should be the goal here.

Higher up on Dry Hill, pine and cherry become prevalent, with black birch and red maple. Though the cherry often is poorly-formed (due to soil and weather effects of the hill) (as are the other trees), the trees often have large crowns and are vigorous. And in some cases, e.g. in swales, tree size and quality improves remarkably, with cherries up to 25" or more. Promoting cherry should be the goal here, not primarily for timber, but for the seed source.

Black cherry, though not common anywhere else on the watershed forest, is noticeably abundant in this area, which includes parts of this stand, Stand 4, and part of the abutting private parcel.

In the northeastern section, the mix of white pine and cherry continues, on seemingly wetter ground, with abundant white ash, and, on the slope down to the marsh, there is also red oak, sugar maple and beech. Trees in this section are generally timber-sized. With the expected arrival of the emerald ash borer, it is worth considering including ash in any harvesting in this stand.

The marsh is not forested, though trees have grown here (and would, on this muck soil) if it were not for beavers. Beaver flooding has killed the trees (mostly red maples and white pines) that were growing here, on about 4 or 5 acres, but has created tremendous habitat diversity, with two heron nests (active, spring, 2012) in dead pines. Beavers are still active here.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory:
There are scattered, small areas of head-high white pine seedlings in the central part of the stand, and birches, red maple and hemlock are becoming established in micro-burst impact areas. Generally, though, desirable regeneration is lacking. A good black cherry seed bank can be presumed, though. With deer and moose browse being considerable, it will be difficult to regenerate any desirable hardwoods. An understory of tall cherry

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seedlings, observed in 2003 (see "Special Risks to Habitat", below) has vanished (though shading most likely contributed to this).

Interfering native vegetation: Hay-scented fern was abundant, mostly along the east side of the stand. In some areas, notably on Dry Hill and in the ash grove in the northeast corner of the stand, it was extremely dense. Tall, moderately dense mountain laurel was growing in patches, but not over a large area. One tangle of large grapevines was encountered but grapevines were not a widespread occurrence. Witch hazel and striped maple were only present in insignificant numbers.

Other native understory vegetation (species and distribution): In much of the stand dense shade created by hemlocks in the canopy or the midstory leaves little light for understory vegetation. Interspersed in the hemlock are more open deciduous patches where, if not covered with hay-scented fern, have sparse vegetation such as raspberry, blackberry, brambles, Christmas fern, clubmosses, lowbush blueberry, and wintergreen.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. Except for *Phragmites*, which is restricted to the wetland, invasive plants were virtually absent. Only one medium barberry shrub was encountered in the stand, in the southwest section.

Of the parcels neighboring this stand, private land lies to the south and east and Conway State Forest lies to the north. These areas were not inspected but they appear to consist of closed canopy forest generally lacking roads, so there probably are few if any invasives in them. To the east is Stand 5. This stand is mostly free of invasives but does have a low density of barberry and bittersweet that could act as seed sources.

Soils (type, moisture, drainage and productivity): The soils are listed as Charlton stony and very stony fine sandy loams, with small inclusions of Gloucester. The large, mapped wetland is listed as Freetown muck. Charlton is a deep, well-drained glacial till that is not shallow to bedrock and does not have a shallow restrictive layer. Moisture holding capacity is moderate. The Gloucester inclusions are also deep but are somewhat excessively drained and therefore droughty.

For tree growth purposes: Good. The Charlton site index for both red oak and white pine is 65. Site indices for the Gloucester are 5' less than for the Charlton, a reflection of droughtiness. The muck, occupying a low place in the landscape that is impacted by beavers, is not really suited for tree longevity, though, without beavers, red maple and white pine will grow well here.

For logging purposes: Although the Charlton needs to be dry or frozen like most other soils, it is not a problematic soil with lots of minor streams and seeps. The muck is not suitable for logging.

General Habitat: A hemlock- black birch mix predominates in much of this stand. Other hardwoods co-occurring in the hemlock sections are yellow birch, red maple, red

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oak, hop hornbeam, black cherry, and white birch. Among this hemlock-hardwood forest of sawtimber size (up to 21" dbh) are some gaps of less than an acre where pole sized hardwoods and a more open canopy occur. The pole-sized trees are typically white, yellow and black birch and red maple. Red oak is present only in low numbers.

Other more discrete sub-stands add variety to Stand 3. The NE section has a lot of white ash, including a grove on the hilltop with many nice ashes in the 18-22" range. Dry Hill is distinct in consisting of only red maple and black cherry in the canopy, and a one-acre white pine stand in the 14-21" range is along the south boundary of Stand 3.

Along the southwest edge of the wetland is a 2-acre zone where most of the hemlock overstory has been uprooted or blown down. Here there is dense hemlock 5 to 15 ft. high and a tangle of raspberry and seedlings of black birch and red maple. The latter three species are heavily browsed. There are grapevines in some of the trees, both standing and fallen, but unlike grapevine pulldowns in other parts of the NDPW property where the forest is in an undesirable condition, this one has no bittersweet and is an example of desirable vegetation following a canopy opening.

On average, both the midstory and shrub layers were light, but where they were present, there was often visible a distinct browse line at 7 to 8 ft. high, indicating heavy feeding by either deer or moose. This browse line was visible on hemlocks and even beech and black birch. There was very little ground vegetation besides hay-scented fern and laurel, and what few seedlings there were of red oak and black cherry were all being browsed. Striped maple shrubs were also heavily browsed but only the past years' growth. This year's new twigs had not yet been browsed. This could indicate that the browsing occurs mostly in winter.

Ice storm damage was evident in broken tops of many deciduous trees in the stand and the broken tops on the ground, making it slower going through some parts of the stand. Except for the aforementioned blowdown area in the SW corner, the amount of coarse woody debris was fairly low. Live cavity trees and snags over 12" dbh were also sparse except in the northwest corner.

Do wetlands occupy more than 10% of this stand?: No, but a 5 to 6 acre beaver-augmented wetland is in the north end of the stand. It is fed from the southwest (flowing across the Henhawk Trail off land now or formerly of Krawczyk) and drains to the north ultimately flowing into Avery Brook and then the Ryan reservoir.

One-third to one-half of this wetland is overrun with *Phragmites australis* (subspecies *australis*), an invasive aquatic species which, based on the presence of smaller *Phragmites* plants in a zone up to 100 ft. from the main establishment, appears to be spreading into the open water that remains. The presence of non-native *Phragmites* diminishes habitat quality of the wetland because its high stem density and height make it less desirable for nesting by wetland birds that would otherwise use cattails. The wetland does perform a very important habitat function as a rookery for great blue herons. There are two heron nests situated on the limbs of a dead tree at the water's edge. However, because the nests are located pretty far out on limbs which look fairly

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brittle, it may not be much longer that this tree can support the nests. When this happens, it remains to be seen whether the herons will build new nests in the same wetland. Other animals whose presence has been documented in the wetland include otter, mink, Canada goose, wood ducks, red-shouldered hawks, grackles, and tree swallows. The presence of dead snags in the wetland, including many with cavities, is an important habitat feature providing nest sites for wood ducks, tree swallows and others, and hunting perches for flycatchers, kingbirds and kingfishers.

Were vernal pools identified/mapped for this stand? (if "yes", how many): No.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): The wetland and a zone at least 100 ft around it should be undisturbed to protect the heron rookery and a red-shouldered hawk nest that is very likely to be present since a pair of red-shouldered hawks was observed here during breeding season, and they typically nest at the edges of wetlands. Substantial visual cover (tall, dense vegetation) should be preserved within sight of the heron nests.

In the blowdown area (SW corner) many upturned roots, and much coarse woody debris, along with the current growth of dense shrubby hemlock make this a potentially attractive area for animals such as saw-whet owls, winter wrens, phoebes, bobcats, and possibly bears for denning.

Special risks to habitat: (1) Lack of regeneration due to deer and possibly moose browsing. This contrasts with the findings of a 2003 DPW report prepared by Wildlife Biologist Molly Hale in one part of the stand (the red maple-cherry section). In that reportshe noted considerable regeneration of black cherry at least 4 feet high. (2) Spread of *Phragmites* into more of the wetland.

Desired habitat modifications (options will vary, including "none"): (1) Reduce browsing pressure by cervids and (2) attempt to control ferns to re-establish tree regeneration.

Historical/archaeological/contemporary: various stone walls and wire fence runs indicating past use for agriculture; a long though not heavily used ATV trail connecting the Henhawk Trail all the way through to an old logging bridge over Avery Brook (and now that the bridge is totally washed out, perhaps the trail is falling into dis-use); a small number of capped, shallow wells gravity-feeding water to the cottages at the top of Dry Hill Extension.

Management history: no evidence of recent management though in some areas it is obvious from the large number of old-field pine stumps that a heavy cut of old-field pine was done (about 40 years ago), giving rise to nice groups of hardwood poles.

STAND DESCRIPTIONS

Desired future condition: Mixed-species, mixed-age stand that is relatively free of invasive vegetation (and not overrun by hayscented fern) with a strong component of black cherry.

Recommended Management for the next 10 years: Group selection techniques to thin around and promote black cherry and any other well-formed hardwoods while making new, small openings in areas lacking well-formed trees; retain microburst section and also standing-dead/standing-dying section of hemlock as important, mature-forest structural elements.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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STAND DESCRIPTIONS

Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
4	WH	92.9	12.3	111	2.9	12.3	4.3	60 OR	15.0

Stand Name: High Ridge East

Watershed / Sub-watershed: West-Whately / Sanderson Brook

Special water quality concerns (for stands within a reservoir watershed):
avoid introduction of sediment into any stream draining into Sanderson Brook.

Silvicultural Status (options are "suitable" or "not suitable"): suitable

Overstory: Forest Type and Condition: Mixed old-field pine-hardwood forest with large pole and timber-sized trees on a moist site. In general, most trees are 8" to 16" diameter, but well-formed hardwoods can reach 22". Scattered relic trees (hemlock, ash) reach sizes of 32" or more, and old sugar maples reaching 40" or more. White ash, black, white, and yellow birch, black cherry, and red and sugar maple are common. White pine and red oak are also prevalent, but in a patchy distribution, with sizes to 28" or more. Shagbark hickory is present to a small degree in the southern end, on the mid-slope. Tree quality varies from very good in some of the lower landscape positions with deep, well-watered soil, to scraggly and poor at top-slope positions with shallow, droughty soil. On the whole, the pine is of poor quality for timber due to its open growth-form. The hardwoods run about 50-50 between acceptable timber quality and poor-quality pallet grade. The pallet-grade was lumped in with the firewood. As in Stand 3, there is an above-average abundance of black cherry, which should be favored. Ice damage is prevalent on the upper-slope areas, usually just causing broken branches, but sometimes peeling whole groups of trees off of the shallow ledge. In general, the upper slope is not a stable and productive environment for timber, but the lower slope is. On the whole, the ash is in poor health. The reasons for this are not known, but it is a regional trend.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: essentially lacking, though there are scattered areas with promising (large) sugar maple seedlings. Moose browse is heavy throughout. Presumably there is a good black cherry seed bank.

Interfering native vegetation: Hay-scented fern forms a carpet in the southwest corner (west of the ridge). Moving east and then north from this area, some small to

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large patches of this fern are present, but elsewhere in the stand it is generally light. Grapevines are not a significant presence except in a few isolated spots.

Other native understory vegetation (species and distribution): An unidentified grass was abundant in this stand, creating an extensive carpet in some areas. Other native species include evergreen woodfern, Christmas fern, wild sarsaparilla, brambles, and princess pine, but generally these were all sparse.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. The only invasives seen in this stand were some small Japanese barberry bushes and just a few very small bittersweet vines, both in the vicinity of the main stream. Even a blowdown gap near the top of the ridge had no invasives. There is a small scattering of bittersweet along the southern boundary that should be controlled if any nearby logging is planned.

Soils (type, moisture, drainage and productivity): The predominant soil type is listed as Charlton-Hollis-Rock outcrop complex, a variable glacial till soil including both deeper, well-drained pockets, and shallow, poorly drained pockets, as well as shallow, droughty pockets, with about 10% of the surface in ledge outcrops. Boulder fields tend to occur at the toe of slopes. As such, tree growth is good, but variable. Moisture-holding capacity is moderate, and trees are subject to windthrow. Site index for red oak is 65, for white pine also 65, 60 for shagbark hickory, and 55 for red maple.

For tree growth purposes: In most places, moisture is adequate, good or excellent for tree growth. Exceptions are on steep sides and on the top of High Ridge, where soil is very shallow to bedrock and trees are prone to "peeling off" in groups with ice storms (especially if there are grapes in the tops).

For logging purposes: Most areas of the stand can be worked, but this should only happen when conditions are quite dry or frozen. An ATV trail, starting off the Henhawk Trail (starting actually on the Town of Williamsburg parcel), winds up through and over High Ridge toward Stands 6 & 8. This is actually an old logging and farm road, and could be improved for logging purposes.

General Habitat: This is a moist, mostly hardwood stand with ash, black, white, and yellow birch, black cherry, and red and sugar maple as the most common overstory species. White pine and red oak are also prevalent, but in a patchy distribution. The canopy is closed but in some areas is close to only 70% closure. Overstory tree size is generally 10 to 21" dbh. The midstory ranges from light to dense, consisting mostly of hemlock and beech plus striped maple, red maple, sugar maple, and red oak. A barred owl was flushed from its roosting perch in the hemlock midstory. The shrub layer is light and deciduous.

On the ground, much of the northern 1/3 of the stand is carpeted with a low grass, creating a savannah-like appearance. Hayscented fern tends to be mostly present in the southern 1/3 of the stand in the places that lack a hemlock midstory. The northern part

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of this stand has better regeneration than most other areas of the NDPW property, with white pine 8-10 ft. high, and unbrowsed red oak, black cherry, white birch and red maple up to 2 ft. high.

Although older moose sign was found, moose or deer sign made within the past year was absent. Many tree tops were on the ground due to an ice storm, but larger woody debris was still on the low side, mostly consisting of fallen white birches.

Do wetlands occupy more than 10% of this stand? No. A small stream (the upper part of Sanderson Brook) runs north to south close to the Henhawk Trail and there are seepy areas elsewhere, especially in the southern half.

Were vernal pools identified/mapped for this stand? (if "yes", how many): No.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): This stand has a higher than average number of live cavity trees, in part because of the large ashes here. These should be retained because they provide essential denning and nesting functions. A few ledges are present near the top of the ridge but they do not provide significant wildlife habitat or house unique plant communities. Because they add special habitat functions, at least some of the coniferous trees in this stand should be retained including most of the white pines and some of the hemlock midstory.

Special risks to habitat: If heavy cutting is done on the private property abutting to the north, it could create a foothold for bittersweet and multiflora rose, which could then spread to this stand.

Desired habitat modifications (options will vary, including "none"): With so few invasives present, now is the time to do a thorough search and hand pull any that are found. This should be fairly easy since they were all found in the zone near the stream.

Historical/archaeological/contemporary: cellar hole (alongside the Henhawk Trail) with a nearby concentration of stone walls (possibly some of these are outbuilding foundations); stone walls around much of the stand; a section of the High Ridge hiking trail with a view of UMass; an old farming/logging road that now serves as an ATV/snowmobile trail connecting the Henhawk Trail back over to Judd Lane.

Management history: no evidence of recent management.

Desired future condition: Mixed-species, mixed-age stand that is relatively free of invasive vegetation (and not overrun by hayscented fern) with a strong component of red oak and black cherry and other long-lived hardwoods with an inclusion of tall white pine.

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Recommended Management for the next 10 years: Group selection techniques to thin around and promote well-formed (or at least large-crowned) hardwoods while making new, small openings in areas lacking desirable trees.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	Volume growth rate (Mbf/yr)
5	BB	137.0	11.2	89	4.8	5.1	3.1	65 SM	22.2

Stand Name: Avery Brook West

Watershed / Sub-watershed: Ryan Reservoir / Avery Brook West

Special water quality concerns (for stands within a reservoir watershed): avoid introduction of sediment into any stream draining into Avery Brook or directly into Avery Brook; avoid using old logging access (2 washed out bridges across Avery Brook that link to skid roads going across steep slopes); consider stabilizing these old skid roads if an opportunity presents itself.

Silvicultural Status (options are "suitable" or "not suitable"): not suitable (due to steep seepy slope down to Avery Brook, the need to cross Avery Brook, and the profusion of grapes in the southern section).

Overstory: Forest Type and Condition: There are two main forest types, each occupying about half of the area. The northern part is a mature northern hardwood, with many timber-sized trees, especially sugar maple and black birch, with red oak, red maple, beech, yellow birch, white ash and limited amounts of basswood and bitternut hickory. Overall the stand is vigorous and, mainly due to thinning around 1990, is not overcrowded. The sugar maple is often the most noticeable tree, with many large, well-formed individuals. Quite possibly, though, these trees were tapped long ago and therefore may contain defect. Along the western edge, there are scattered red oaks that are exceptionally large and well-formed, up to 35" or more. In the northern end of this stand there tends to be a thick hemlock midstory and small timber-sized black and yellow birch, and lots of residual, rotten beech on the ground. This is a beautiful stand of timber overall, and if it were not in such a precarious location, it would make sense to carry out a thinning to keep selected trees vigorous. This run of forest includes everything north of the Conway town line, and south to the East-West wall, and then on the eastern side of the north-south wire fence on the Williamsburg-Whately line, about halfway down.

The rest of the stand is much younger, with much less sugar maple and oak, and much more black and yellow birch, with paper birch, red maple, white ash and black cherry, and hemlock, generally of large sapling to large pole size, with larger relic trees typically in fence lines. These trees are largely overrun with grapes, which almost seem to be the plant that is most-suited to growing on this wetter, rich soil. If given a chance, trees do grow well, and old. One fence-line yellow birch was 40" — the largest one seen anywhere on the watershed. Basswoods as large as 28" were noted. With the profusion of vines it is likely that future storms will continue the current trend of trees being

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broken off or bent over, and the only hope to manage this section would be to keep the grape vines at bay. However, any disturbance is likely to create opportunities for invasive plants — these (e.g. bittersweet, multiflora rose, barberry, etc.) would thrive with these soil conditions. The best approach would be to aggressively cut grape vines and hope that the trees can survive and provide the necessary shade to keep grapes and invasives in check over time.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: essentially lacking. This is not a problem at this time in the northern part. In the southern part, with grapes and abundant witch hazel, there is no real way for desirable tree regeneration to become established.

Interfering native vegetation: Grapevine is the most serious problem in this stand. It occurs as 1 to 4" thick vines to some degree in nearly all sections, and in many areas is abundant in the treetops. There are not many pull-downs yet, but, unless the grapevines are cut, there will be more pull-downs in the near future. The grapevines are worse in the southern half.

Hay-scented fern is also a problem in the southern half, especially along the top half of the slope. In these areas it ranges from light coverage to dense extensive carpets. Its success here could have been enhanced by openings in the canopy due to ice storm damage.

Witch hazel and striped maple are present in the midstory and shrub layers but are not significant elements. Judging by the branching pattern of the striped maples they have been heavily browsed for at least the past 4 years

Other native understory vegetation (species and distribution): Besides hay-scented fern the shrub and ground layers are both light. Where present, the ground layer consists of not much more than a variety of ferns, including maidenhair and Christmas fern

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 2. Considering the potential for pull-downs by grape, it is fortunate that bittersweet is very sparse in this stand. No patches were found and only 8 individual plants of small size were counted along the survey route. These were present more or less in the same area as the hay-scented fern, along the top half of the slope. They are small enough that they could be hand-pulled but might be hard to spot. A notable exception is the occurrence of bittersweet thickets in spots along Avery Brook where skid trails (after crossing the brook), followed old woods roads up and across the seepy slope. These concentrations of bittersweet are mixed with grape vines, and could serve as seed and propagule sources for further spread. Slightly more Japanese barberry was present, but still at a low density. 14 small to large plants were counted along the survey route. They were in the same general area as the

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bittersweet and also along the southern boundary where it is wetter. No significant seed sources for invasive plants are known from nearby sections of surrounding stands.

Soils (type, moisture, drainage and productivity): A combination of productive soils, predominantly Colrain and Shelburne stony or extremely stony loams or fine sandy loams.

The Colrain stony, or very stony, fine sandy loam is a well-drained soil formed in glacial deposits derived principally from dark gray schistose material and impure limestone. With moderate to rapid permeability and fairly high moisture-holding capacity, this soil can produce good yields of timber. Site indices or 58 or greater for northern hardwoods, 65 or greater for upland oaks, 70 or greater for white pine, and 70 or greater for red pine. (The site indices for Woodbridge are listed as: 67 for white pine, 72 for northern red oak, and 65 for sugar maple)

For tree growth purposes: Colrain is excellent, with elevated fertility in lower-slope positions, and diminished fertility at tops of slopes.

For logging purposes: Due to their moisture-holding capacity, and the slow drainage through the hard substratum, Colrain soils cannot be operated during wet times of the year; this becomes more critical in swales and along the bottom of slopes. Conditions must be dry or frozen to avoid excessive rutting, compaction, and root damage, or tops and poles must be laid down to form a mat in certain places.

The Shelburne extremely stony loam, a well-drained loam formed in compact glacial deposits derived mainly of dark-gray schistose material and impure limestone, with a hardpan at about 24". This soil has good moisture retention.

For tree growth purposes: Good Site indices of 52-57 for northern hardwoods, 55 and up for red oak, 60-69 for white pine, and 60-70+ for red pine.

For logging purposes: Due to their moisture-holding capacity, erosion and gullyng are a risk, and it is important to design roads so as to not concentrate water.

General Habitat: This is a moderately steep east-facing slope with a canopy consisting primarily of sugar maple, black birch, bitternut hickory and ash from 5-21" dbh. Oak is not present throughout, but does occur in concentrations (including along the northwestern boundary, where the land is flatter, and some oaks are 35" or more). The trees are not especially large or high quality except for some nice sugar maples near the northwest corner. The canopy is generally closed, but is more open in the south half due partly to ice storm damage and grape pull-downs. Hemlock in the canopy and midstory is patchy, being absent in some sections and a significant associate in others. The hemlock foliage is thin in some sections, indicating elongate hemlock scale or woolly adelgid. A beech midstory is consistent throughout the stand and is denser in the northern half.

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Some borderline rich mesic patches containing maidenhair and other ferns were found in the northern half. Elsewhere the ground vegetation was sparse in the north and moderate to dense with hay-scented fern in the south.

There is practically no regeneration between 1 ft. tall and midstory height.

Do wetlands occupy more than 10% of this stand? No. Numerous intermittent streams flow east into Avery Brook, creating moist drainages with muddy soils used for foraging by woodcock.

Were vernal pools identified/mapped for this stand? (if "yes", how many): No.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.):
Coarse woody debris is sparse to moderate.

Special risks to habitat: Risk of grape pulldown, but not a big problem unless bittersweet gets further established.

Desired habitat modifications (options will vary, including "none"): Control bittersweet in old, lower-slope skid roads before this becomes more widespread.

Historical/archaeological/contemporary: old logging roads cutting (literally, there was some road-cutting into the hill) across the steep slope up from Avery Brook; various stone and wire fences; a granite post marking the tri-town corner (Williamsburg, Whately, and Conway) with various dates hand-chiseled into the post presumably to show when the selectmen inspected the corner. A cursory examination found about 7 or 8 dates ranging from 1810 to 1900.

This stand includes an elaborate mill site on Avery Brook, with considerable stone work. Not much was learned about this mill, though a local historian maintains that this mill was the farthest upstream of 7 or 8 West Brook "mill privileges", as they were once called.

Management history: logging in the late 1980's under DPW's previous forester Karl Davies.

Desired future condition: Mixed-species, mixed-age stand that is relatively free of invasive vegetation and not choked with grapes with a strong component of sugar maple and other long-lived hardwoods.

Recommended Management for the next 10 years: No silviculture (harvesting) is recommended but any cutting of grape vines will be beneficial.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
6	HH	189.6	10.1	123	3.1	6.9	6.2	60 OR	30.7

Stand Name: High Ridge West

Watershed / Sub-watershed: East Branch of the Mill River (out of the watershed) / no subwatershed

Special water quality concerns (for stands within a reservoir watershed):
None, out of watershed.

Silvicultural Status (options are "suitable" or "not suitable"): not suitable due to steep, often seepy terrain.

Overstory: Forest Type and Condition: This stand is meant to capture which includes most of silviculturally NOT-suitable land lying to the west of (outside of) the Ryan/West-Whately watershed. The general trend throughout this stand is hemlock and hardwoods, especially black birch and red maple, with red oak, yellow birch, sugar maple, paper birch and black cherry occurring in many, but not all, areas. White pine is generally absent altogether, except near the top of High Ridge itself.

Although this stand is classified as NOT-suitable for silviculture due to steep, seepy terrain, there was no part of this stand that did not show evidence of past harvesting, and, prior to that, of past agricultural clearing and past sugaring. This is not a pristine area. But with modern equipment and modern expectations of weather conditions and logging-job outcome, there is no practical way to access and manage most of this area.

There are two main sections to this stand: south, and north of the Town of Williamsburg Parcel. There is a narrow connecting strip running along the westerly line of the Town of Williamsburg parcel which includes steep, seepy land that is not practical to manage.

South of the Town of Williamsburg Parcel, most area is a steep slope dominated by hemlock and northern hardwoods, mainly black birch, beech, red maple, often of timber size. Scattered within this mix are much older, larger rougher sugar maples suggesting past use as a pastured sugarbush. There is also a tremendous, very rough old red oak. Where past logging >30 years up crawled up the slope, openings were made that filled in with hardwood seedlings - today these are small poles - of black and yellow birch, black cherry, and red oak. The moist soil is well-suited to grapes also, and these have established themselves in the tops of most of the small poles, constraining long-term prospects. Most of the understory is open due to hemlock shade. Though there are timber-sized trees, especially hemlock, black birch and red maple, these are often rough, and may have even more defect inside than is evident.

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At the top of this steep slope the forest changes to patches of very rough, old-field hemlock, sometimes in tight groups, interspersed mainly with red oak, paper birch, red maple and black cherry. The red oak ranges from large poles, to large, spreading-crowned trees. The other hardwoods do not become as large. In swales, where moisture is better, the tree quality appears good. Toward the tops of knolls, where the soil becomes extremely thin, the forest takes on a somewhat dwarfish stature, and tree quality declines. A traditional hiking trail crosses over the peak, passing by a rock cairn.

North of the Town of Williamsburg Parcel, the trend of hemlock and northern hardwoods continues, sometimes with abundant sugar maple, and often with yellow birch. There are residual stumps from large, old sugar maples cut long ago, and it seems that this area was once a sugarbush. That could explain the existing of the narrow "lower trail" (see map), which, though often wet throughout the year, accesses this area nicely and seems to exhibit evidence of old stonework that is in keeping with the construction of an ox cart trail (that has since been used by logging equipment over the last 50-70 years. Some of the sugar maples are surprisingly well-formed timber trees. But many trees are rough, especially the yellow birches and scattered and sometimes dense hemlock. Especially downhill from the lower trail, grapes are taking their toll, too, pulling down trees and creating a "late-successional" effect. In many places you can see how grapes followed the path of past logging, taking advantage of rich, wet soil and sunlight.

Stand 6 also is designed to include a growing beaver pond (see map) in an area that traditionally is a blend of red maple, hemlock and shrubs.

The remainder of Stand 6 follows the western face of High Ridge and includes all the land that is very steep or just too wet. Red oak is common here, with paper birch and black birch and some black cherry, and is generally mixed with hemlock. White pine occurs along the upper reaches of the slope, along the eastern boundary with DCR and Krawczyk. Pine generally runs right along the actual ridgeline, sometimes in thick groves.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Generally lacking due to overstory shade. Some areas do occur with large saplings in the wake of cutting > 30 years ago, though grapevines tend to be present here as well, limiting potential long-term growth.

Interfering native vegetation: Hayscented fern is mostly limited to the area west and north of the two summits at the western end of Stand 7 (south of the Town of Williamsburg in-held lot). In this area the fern density ranges from a carpet to moderate sized patches. These are all primarily deciduous sections with more sun than the hemlock belt that borders them to the west. Beech brush is dense beneath beech seed trees but does not occupy a large portion of the stand. It is heavier in the south part of the stand.

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Grapevines can be found throughout, with significant grapevines in lower slopes and seeps were surrounding and south of the wetland/beaver pond. Two to three inch wide grapevines were present here at a moderate to significant density.

Other native understory vegetation (species and distribution): See General Habitat section below. Poison ivy was present only in the wetlands.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. No invasive plants were observed in this stand or nearby in adjacent stands.

Soils (type, moisture, drainage and productivity): The soil is a version of Paxton very fine sandy loam that is rocky and has slopes of 15% - 25%. Paxton is a deep, well-drained glacial till soil found in upland positions. It has, however, at a depth of roughly 20", a firm substratum with slow or very slow permeability, which causes the soil to remain wet (due to a perched water table) for parts of the spring and fall (traditionally) and after prolonged rains.

For tree growth purposes: Good overall, with a site index for red oak is 65, and 75 for sugar maple. On the very steep approaches to the ridge, however, soil depth decreases and moisture availability does as well. Risk of windthrow or pulldowns is elevated on wetter lower slopes.

For logging purposes: Challenging due to steep slopes and the difficulty of managing run-off/controlling erosion and the difficulty of carefully managing tree-fall and skidding to avoid damage to residual trees. The presence of grapes in tree tops makes logging all the more difficult.

General Habitat: Most of this closed canopy stand has hemlock in the canopy and/or midstory. Mixed with the hemlock are red oak and black birch. There is virtually no white pine except on the west-facing flank of High Ledge. About ¼ of the stand is pure deciduous forest, consisting of beech (mix of healthy and diseased), red oak, black cherry, sugar and red maples, and in the moister areas yellow birch and ash. In these sections there is no hemlock in the midstory.

Where occasional canopy gaps occur, they tend to be filling in with mostly beech. Most of the beech in the overstory appears to still be healthy. If these trees are infected with blight, it is minimal at this point.

As in Stand 7, the red oaks here are of good quality and large, generally 20-24" dbh. Other tree species are smaller, mostly in the 10 to 15" range. One exception is in the far north part of the stand where most of the trees are white birch, red maple and black birch in the 4 to 8" size and 1 to 4" diameter beech. Another exception is the hemlocks north of the Town of Williamsburg parcel, many of which reach 26" or more. Both the red oak and beech here are abundant sources of hard mast.

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Most hemlock areas have virtually no shrub layer except for a dense laurel belt along the west slope of High Ledge. In the area of large hemlocks north of the Williamsburg inholding there is more ground vegetation due to gaps from dead or thinning hemlocks. Here can be found New York and Christmas ferns, maple-leaf viburnum, and wild sarsaparilla.

In deciduous areas where beech is in the canopy, there is lots of beech regeneration, sometimes dense. In the talus areas there is a little more ground and shrub vegetation than elsewhere, including elderberry, mountain maple, gooseberry, polypody and marginal wood ferns, whorled wood aster, bindweed and Virginia creeper. Perhaps the talus makes this area hard to reach by deer and moose, explaining the greater amount of ground and shrub vegetation.

There was both old and fresh moose sign in this stand. Fresh moose sign was present in Stand 8 too, so it is likely that the wetland there is currently the center of activity for at least one moose. Very little deer tracks or scat were found in this stand.

Do wetlands occupy more than 10% of this stand?: No. West of High Ridge, forming the headwaters of a stream that flows west, is a several acre-sized wooded swamp with standing water (this is now a beaver pond). Its vegetation consists of hemlock and yellow birch in the overstory, winterberry in the shrub layer, and cinnamon fern and sphagnum moss on the ground. Although a small recent beaver dam was at the swamp's outlet, the establishment of long-term wetland vegetation indicates that this wetland existed before beavers came and expanded it. The wetland itself is probably too small, shrubby and shallow to support beaver.

Were vernal pools identified/mapped for this stand? (if "yes", how many): VP 1 straddles this stand and Stand 7. VP 29 is a large vernal pool on abutting private land on High Ridge, about 200 ft. from this stand. Both pools had evidence of breeding by spotted salamanders and wood frogs. VP 2 is a large vernal pool in stand 7 about 475 ft. from this stand.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): This stand has several interesting features related to its rocky character. North of the summit in the south section there is much bare exposed flat ledge where the trees are only 30-50 ft. high and the ground layer is dense with hay-scented fern, lowbush blueberry, moss and lichens. It has the look of a place that was burned, but no evidence of fire was found. The west slope of High Ridge has steep, sloping bare rock ledges including some porcupine dens. Several areas of large talus were found along the steep slopes in the southern and northern halves of the stand. The holes between the rocks are big enough for porcupine dens and turkey vulture nests, and are also isolated enough to provide denning opportunities for bobcat. All three of these rocky areas could serve as basking areas for snakes, though they are not extensive enough to serve as major hibernacula.

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Special risks to habitat: The hemlock north of the Town of Williamsburg parcel has thin foliage due either to hemlock scale or adelgid—it could not be determined which, but either one is a serious threat to the existence of hemlocks in this forest.

Desired habitat modifications (options will vary, including “none”): None.
Retain as mature forest.

Historical/archaeological/contemporary: (1) the “lower road” (see map) may be an old sugar bush cart path; (2) there are stone walls and wire fence throughout the stand, indicating past agricultural use; (3) An unimposing but well-established traditional trail follows, generally, the High Ridge ridgeline (the trail was not mapped for this project). This trail crosses back and forth between Stand 6 and Stand 4. Within Stand 6, just where the trail crosses off DPW onto land now or formerly of Krawczyk, there is a bronze plaque set in a large stone by a local hiking club (approx. date 1920).

Management history: Past cutting (> 30 years ago) removed large, old sugar maples as well as trees of any species.

Desired future condition: (See Introductory section above for an overview) maintain this type, free of invasives plants.

Recommended Management for the next 10 years: None.

Growth Rate Method and Volume (see “Notes applying to all stands” above):
DCR/Green-cert.

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Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
7	OH	208.1	12.3	122	4.2	14.6	4.3	65 OR	34.4

Stand Name: Henhawk Trail Southwest

Watershed / Sub-watershed: West-Whately / Sanderson Brook

Special water quality concerns (for stands within a reservoir watershed): avoid introduction of sediment into any tributaries of Beaver Brook or Sanderson Brook — the main risk of this comes from potential blockage of culverts under Williamsburg Road and from (currently unmaintained) stream crossings on the Henhawk Trail.

Silvicultural Status (options are "suitable" or "not suitable"): suitable, but with caution due to elevated soil moisture (i.e. wetter soil) in many places as well as a localized infestation of bittersweet (see below) and the more widespread presence and risk of grapes.

Overstory: Forest Type and Condition: With a few notable exceptions (see below), this is a red oak stand, though never a pure one. The eastern half of this stand may have had a wide-ranging sugarbush at one time (based on the current presence as well as remnants of sugar maple). This large, diverse stand occupies the generally well-watered, often seepy, east-facing and south-facing slope of a "massif" that runs westward to Walnut Hill (which is off the property) and is characterized mainly by a widespread run of timber-sized red oak, with black birch and hemlock — sometimes in the overstory but often in midstory positions — with notable increases in yellow birch, white ash, sugar maple and red maple, sometimes shagbark hickory, and rarely bitternut hickory and basswood, in areas of elevated moisture, such as along streams and poorly-drained or toe-of-slope areas. In some cases, beech and sometimes shagbark hickory become more noticeable on drier hilltops. White pine occurs on a scattered basis.

The red oak is generally vigorous and well-formed, and certainly of sawlog-quality, though veneer quality trees were uncommon. Past thinning (ca. 1990 in the hardwood section and about 1994 in the softwood plantations, see below) has left trees generally with room to grow.

The hemlock at hilltop positions shows advanced stages of decline. Both elongate hemlock scale and hemlock woolly adelgid were observed. Many trees are dead and have already fallen over; in some cases, where the ledge is right below the surface, hemlocks have peeled off roots and all. This is probably due to ice & snow loading and has nothing to do with the aforementioned insects. The general trend seems to be the loss of hemlock from this stand, however, leaving scattered white pine and the planted conifers

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as the only softwoods. And of these, only the Norway spruce seems viable for the long term. The one exception noted was a small pocket of native red spruce (maybe 10 trees) at the wet toe of a slope. Single red spruce are scattered throughout the upper reaches of the stand. This species is not expected to benefit from global climate change at this southern end of its climate range, and is not expected to ever be more than an exception throughout this watershed.

Complete exceptions to this general, native overstory, are three plantations, 2 of Norway spruce (Norway spruce north and Norway spruce south) and one of red pine.

The southern Norway spruce section (along Williamsburg Road, about 3 acres) has a vigorous and well-spaced overstory. The understory, following cutting ca. 20 years ago, regenerated to tall black birch saplings. But these were filled with grapes (and some bittersweet) as well. A recent event (possibly the 2008 ice storm) caused widespread pull-downs in the understory, such that it is largely bent over and not viable. This section needs attention so that it can re-regenerate to viable seedlings (see below).

The red pine section (about 4 acres) appears more vigorous than other red pine (e.g. more vigorous than red pine in Stand 15), but only slightly so. Under this widely-spaced overstory there is a scattered understory of tall saplings, mostly black birch. And at the toe of the slope, grapes are a serious problem, with one major pulldown, and others, due to the large vines, waiting to happen.

The northern Norway spruce stand, along the Henhawk Trail (about 8.5 acres) is also vigorous (Norway spruce appears much more vigorous than red pine across the entire watershed). These vigorous, well-spaced trees have a tall understory of black birch saplings that could be released in small groups. However, the lower section of this section is overrun with bittersweet, with large, climbing vines and pulldowns. No silviculture should be done in any of this spruce section until the bittersweet (and co-occurring grapes) are controlled.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Often lacking altogether throughout the main parts of the stand, with scattered exceptions of tall black birch saplings and sometimes small black birch poles. Rarely, there are small red oak poles with black birch and cherry. Red spruce seedlings are (surprisingly) scattered throughout, though these may never amount to anything. Essentially, though, this stand does not have widespread, viable, desirable regeneration in place. It is noteworthy that although red oaks abound in the overstory, there are no oak seedlings. If any were created in the wake of earlier harvesting (1994), these have long since been browsed off and/or shaded out.

Interfering native vegetation: Hay-scented fern is dense in the far western side of the stand and light to moderate in the rest of the stand. Witch hazel is a major component of the midstory on the lower half of the east-facing slope. Grapevines are a potential problem in this same zone, especially toward the south side of the stand,

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where it, combined with bittersweet, has covered some canopy gaps. Otherwise, grapes are, or could be, a spotty problem (with minor pull-downs here and there) wherever moisture is elevated.

Other native understory vegetation (species and distribution): Other ground vegetation is very sparse but includes evergreen woodfern, maple-leaf viburnum, Christmas fern, and beechdrops.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 2. Bittersweet is essentially limited to an area within about 500 ft. from the Henhawk parking area, and in a concentration noted below. In this zone there are several dense patches up to 1000 sq. ft. mostly caused by grape pulldowns. There is also a patch right in front of the parking area. The two flat, seepy parts of the stand also have a few some small shrubs of barberry. The rest of the stand is free of invasives, including a sunny blowdown gap in the middle of the stand.

In the northern Norway spruce section west of the Henhawk Trail there is a concentration of bittersweet. On its own, this small area would be ranked 5. Some of these vines (along with poison ivy) are well established on the trunks and lower crowns of a number of tall Norway spruce, creating a scenario that is poised to rapidly become much worse. If there is ever a storm that knocks these trees down (or if there was any logging). A serious bittersweet seed source is nearby in stand 9 where there is a large pulldown of dense bittersweet. In addition to the barberry and bittersweet there is a sprinkling of medium sized shrubs of multiflora rose and at least one euonymus. These are also limited to the southern section. On its own, this small area would be ranked 5.

Soils (type, moisture, drainage and productivity): The predominant soil type is listed as Charlton-Hollis-Rock outcrop complex, a variable glacial till soil including both deeper, well-drained pockets, and shallow, poorly drained pockets, as well as shallow, droughty pockets, with about 10% of the surface in ledge outcrops. As such, tree growth is variable. Moisture-holding capacity is moderate, and trees are subject to windthrow. Site index for red oak is 65, for white pine also 65, 60 for shagbark hickory, and 55 for red maple.

This stand also includes a small area of Merrimac (site of the southern spruce plantation). Merrimac is a deep, somewhat excessively drained soil formed in glacial outwash deposits that is well suited to management (see Stand 9 for more details about this soil).

For tree growth purposes: In most places, moisture is adequate, good or excellent for tree growth. Exceptions are on a few side-knobs with shallow soil,

For logging purposes: Most areas of the stand can be worked, but this should only happen when conditions are quite dry or frozen. A main skid trail, starting off the Henhawk Trail, winds up through. When I see where they have gone in the past, I can only wish for the type of frozen winter that once was more common.

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General Habitat: In this mostly closed canopy stand, high quality red oak is ubiquitous and generally 20-26" dbh, with specimens up to 30" not uncommon. Beech, ash, black birch and red maple are other hardwood associates and tend to run in the 10-20" dbh size range. Beeches, some healthy, some not, are notable in the east part of the stand on both sides of the Henhawk Trail. Between the oak and the beech, this stand is an excellent source of hard mast.

White pine from 20-24" dbh is a minor feature, limited to some north-south bands in the middle of the stand. Hemlock is a significant presence in the canopy or midstory in most parts of the stand, but the foliage of many of the larger hemlocks is looking thin due to the elongate hemlock scale insect which was found on a couple of hemlock twigs that had fallen to the ground.

A 10-20 ft. high midstory of witch hazel and beech is dense in some areas. The other most common midstory species are sugar maple, red maple and black birch.

Because of the closed canopy and moderate to dense midstory, the shrub and ground layers are nearly empty. Exceptions are the dense hay-scented fern in the western 1/3 of the stand and some areas of moderately dense laurel in the flatter area west of the steep slope.

A 3-acre hickory-hop hornbeam stand is located along a very rocky steep hillside near the property corner about 1000 ft. west of the foot of the Henhawk Trail. This unique community has ground vegetation dominated by sedges, with polypody fern, currant, wild leeks, wild oats, evergreen woodfern, Christmas fern, and aster. Blue cohosh and bloodroot were present in a wet rocky ravine that was in this same area.

At least one sunny gap, where several hemlocks have blown down, is located near the top of the steep ridge. This stand is deficient both in live cavity trees and snags over 10 inches diameter. Coarse wood debris is also sparse except in the few blowdown areas and in the wetlands.

Little deer or moose browse or other sign of these animals was observed, but regeneration was very low, perhaps due to the shade from the hemlocks (or perhaps due to past browsing). However, in spring, 2012, moose sign, in the form of droppings, became abundant, and there were repeated sightings of two moose together.

Do wetlands occupy more than 10% of this stand?: No. Two relatively flat areas are seepy and have wetland vegetation. The first is just west of the top of the ridge and the other is north and northwest of the northern Norway spruce section. *Numerous* seasonal streams drain the hillside.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes, VP 1 straddles Stand 7 and Stand 6; VP 2 is about 500 ft. inside the western boundary of stand 7; VPs 3, 4, 5, and 6 are east of the Henhawk Trail, with VP 3 alongside W-W Road. Rare species were not observed in any of these pools, but spotted salamanders

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were breeding in all of them. Because Jefferson salamanders are using other vernal pools nearby in Stand 9, it is possible that they use these pools too, even though they were not found this year. An inadvertently constructed vernal pool is at the western edge of the northern spruce section (a small stream was dammed to make a small pond, perhaps for cattle long ago).

Are NHESP layers indicated for this stand? (if "yes", describe) Yes, polygons for Estimated Habitat and Priority Habitat extend up to 500 ft. west of the Henhawk Trail. These are the same polygons that cover part of Stands 9, 12, and 11.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): The hickory hop hornbeam community should be left undisturbed. Some large oaks should be allowed retained as mast producers and as future cavity trees and coarse woody material.

Special risks to habitat: None noted other than the risk of letting bittersweet spread.

Desired habitat modifications (options will vary, including "none"): Create more large snags, possibly by girdling, and retain defective large trees that have the potential to form cavities.

Historical/archaeological/contemporary: (1) parking area for the Henhawk Trail with info kiosk. This road from long ago (the actual legal status is under research, but it is a discontinued road) is now used as a hiking and snowmobiling trail. Residents of Williamsburg have special permission from the City of Northampton to use this trail for hiking. There are open questions as to what rights the owners of in-held properties have to use vehicles on this road. The road is, in places, saturated, and it is only the large amount of stone that has been added over the years that holds this road together; (2) many stone walls; (3) the softwood plantations themselves are cultural artifacts; (4) a tiny, dug pond — purpose unknown — behind a stone dam at just west of the log landing on Nash Hill Road

Management history: Various thinnings (ca. 1990 in the hardwood section and about 1994 in the softwood plantations) and of course the original setting of the softwood plantations.

Desired future condition: (See Introductory section above for an overview) A forest with a strong and widespread red oak component complemented by hickory and a mix of other hardwoods, with scattered white pine, and Norway spruce plantations vigorous and with a viable understory. The red pine stand would be converted to hardwoods.

Recommended Management for the next 10 years: (1) prepare red pine section for regeneration (treat grapes, flush cut hardwoods), monitor, and possibly go forward with overstory removal of all red pine; (2) in southern spruce section, control grapes and bittersweet and, ideally, flush cut hardwood saplings to allow re-sprouting; monitor and follow-up control of grapes and bittersweet to ensure establishment of new, viable

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understory from sprouts and seedlings; (3) in northern spruce section, control of grapes and bittersweet in concentrated area along Henhawk Trail and also do search and control throughout the section, but leave viable hardwood saplings in place; monitor and follow-up control of grapes and bittersweet; (4) in scattered sections accessible from the main skid trail (see map), create small openings to attempt to establish areas of young growth that are free to grow (in part to test the response of moose and deer). The siting of openings would be on drier ground, in order to reduce the risk of grapes, and further would be sited where beech is not prevalent, in order to minimize any beech resprouting. Any existing, undesirable vegetation would be cut in conjunction with the harvest (just before, as part of, or, if need be after).

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	Volume growth rate (Mbf/yr)
8	HH	297.3	12.2	115	6.1	10.5	18.0	65 OR	48.2

Stand Name: Judd Lane

Watershed / Sub-watershed: East Branch of the Mill River (out of the watershed) / no subwatershed

Special water quality concerns (for stands within a reservoir watershed):
N/A

Silvicultural Status (options are "suitable" or "not suitable"): suitable (except in the wetland complex bordering the East Branch of the Mill River)

Overstory: Forest Type and Condition: This diverse stand is comprised of a number of distinct sub-stands that are grouped together here to form a large, single, silviculturally-suitable management unit lying to the west of (outside of) the Ryan/West-Whately watershed. No run off from this parcel enters the drinking water system. It is paired (on the stand map) with Stand 6, which includes most of the remaining, silviculturally not-suitable land lying to the west of (outside of) the Ryan/West-Whately watershed.

West of the East Branch of the Mill River (about 53 acres), the forest is usually comprised of either tall hemlocks or tall white pines, with hemlocks being more abundant on the south side of the large vernal pool and short, East-West stone wall, and white pine being more abundant to the north of this. The hemlock occurs in a mix with northern hardwoods – yellow birch, black birch, sugar maple, black cherry and red oak – all of which range from large pole-size to sawtimber size. Some boundary trees, especially hemlocks, are quite large (30" and up). The rich soil and presence of sugar maple suggests that, at an earlier time, there were large sugar maples here that were probably tapped (in a pasture setting). The last cutting here was in 1999. This was a first cut in a shelterwood system. If any seedlings did become established following the cut, they are no longer present (if so, then this is due to shade and browsing). A cut within the next 10 years would be a good follow up, attempting, again, to establish a new understory. Both adelgid and scale are present in this stand, and though the trees still look vigorous, this will probably change for the worse over the next 10 years. In harvesting around the dam, watchman's cellar hole, historic plaque, spillway, and the old roads, special care should be taken to protect these features and to make the logging have a neat appearance. This may be a situation where whole-tree chipping would be particularly appropriate.

North of the short East-West stone wall, where pine is more dominant, the soil is more gravelly and more suited to white pine. The quality of the pine is variable, with rougher

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trees reflecting a more open growth form. With the gravelly soil, there is a possibility of regenerating more pine, and releasing pine seedlings that are already established. This would be the purpose of irregular shelterwood cutting recommended here.

There are some included areas of wetland in this section. These are shown on the map as wetlands and seasonal streams. Red maple, yellow birch, ash and winterberry are abundant in these areas, with a minor hemlock component. These areas are too wet for logging. The old logging road crosses soft ground and the seasonal stream to head toward the northern boundary. This mucky crossing would need to be stabilized, or an alternate crossing chosen, so that a large, mucky mess is avoided.

The central part of this stand (about 23 acres) is a diverse landscape of alternating wetlands and rapidly flowing stream following the course of East Branch of the Mill River, and following back up some of the tributaries. The wetlands are primarily shrub-swamp, dominated by speckled alder, and shifting beaver ponds. The stream can be fast-flowing, with gravel banks and cobble beds. This is the core of what was once the 100+ acre Williamsburg Reservoir.

There are two crossings of the river (see map). The southern crossing is a rotten timber bridge which access about 77 acres. The west bank is firm, well-drained natural gravel, but the east bank sits at the foot of a long, seepy slope on rich soil that is currently gullying (about 1 foot deep) due to normal run off combined ATV use. It will be difficult to restore this crossing to a useable condition. (The best way to access these 77 acres might be to come in from the southern abutter, using the significant woods road that connects these properties).

The northern crossing was a culvert, but that is completely blown-out now. This crossing accesses about 141 acres. Both approaches to the crossing are high, firm banks of gravel, however, which run along some sort of esker. This crossing would be relatively easy to make useable again. On the USGS topo map, this is the crossing that is part of the long road heading to High Ridge.

On the east side of the river, hemlock is again abundant, sometimes dominant, in a mix mainly with black birch, but also with red maple, paper birch, yellow birch, red oak, and sugar maple. The sugar maple seed source seems to be scattered large old sugar maples that were probably tapped pasture trees in their day. There may have been quite a few at one time, but a general logging-off of sugar maple (sometime in the 1950's - 1970's) would have taken these (more about this below). A central feature of this section is the "lower road" (see map), which seems to be an old agricultural or logging road, possibly used at one time to access a wide-reaching sugar bush. Though there are various seasonal streams and wet spots, the lower road is generally suitable for logging use - provided that protective measures are taken. As the lower road continues on into Stand 6, it becomes narrower, steeper, and wetter, and looks even more like an old cart road going into a sugar bush.

The hemlock occurs in timber and pulp size; most of the hardwoods are large poles or small sawtimber. The hemlock vigor is still good, but, as in other areas, this is not

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expected to hold. With this soil, the potential is here to grow high-quality hardwoods from existing trees and from regeneration, including black birch. Logging in 1999 began the process of establishing new seedlings, but with mixed results. Some sections have 10-20' tall black birch saplings that are free to grow, whereas other areas been heavily browsed. Surprisingly, honeysuckle (an invasive) followed in the wake of the cuttings, and is fairly abundant in the lower portions of the stand, where moisture is better. Grapes and bittersweet, though present only to a limited extent, could seriously infest these lower slopes as well.

The eastern limits of this stand follow a subjective cut-off point at which the ground simply becomes too steep for normal Silvicultural work. These steep areas are relegated to Stand 6.

All things being equal, the difficulties presented by this section (access, browsing, honeysuckle and the potential for vines) make this section a low priority for work in the next 10 years. However, periodic monitoring is recommended to re-evaluate the health of hemlocks and the development of unwanted factors.

Next to the river, an area partially enclosed by a stone wall (about 11 acres) is a distinct section. The elevation of this flat, gravelly soil undulates close to the height of the water table so that well-drained, upland areas are interspersed with wet swales and seasonal streams. The overstory was cut heavily in 1999, and what remains is a brushy, savannah-like mix of white pine, hemlock, even a few native spruce, with red oak and other hardwoods. Throughout this section, where it is not too wet, there is an abundance of white pine seedlings, 5'-10' tall, mixed with black birch where moisture is better. The understory is loaded with invasive honeysuckle, as well as a mix of grasses and forbs. Moose and deer have heavily browsed the hardwoods, though apparently they don't prefer honeysuckle. It would be nice to restore this area by controlling the honeysuckle, with the aim of establishing a new white pine overstory. This could be done in a way that transitions through early-successional habitat. However, this has to be a low priority at this time. The access issues are the same as for the previous section.

The remaining, and largest section of this stand is accessed by the northern crossing, and follows the "upper road", reaching into areas that are, generally, neither too steep nor too wet for practical management. This entire area was cut off in a heavy cut about 50 years ago — part of which may have been a specific targeting of sugar maple. The result is that there is an abundance of hardwoods — especially black birch, red oak, black cherry, red maple, sugar maple and paper birch — ranging from pole to timber size. In wetter areas (which are more the exception here) there is more red maple, yellow birch and white ash. Hickory (pignut) is rare. Some of the red oak grew from stump sprouts. Most of the other hardwoods grew from seed. Clearly, this all took place before deer became abundant, and (as we know) before moose had re-appeared. Hemlock occurs in many areas, but sometimes altogether lacking. Pine is almost entirely absent. The hardwoods tend to occur in strong localized "runs"; i.e. one section will have a notable abundance of black cherry, the next section will be predominantly red oak, etc. All in all this is one of the better areas of promising hardwood timber and is, to a forester's eye,

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begging for a thinning. A thinning would remove firewood in a way that gave well-formed remaining trees more growing space. These trees would be behind to approach maturity in 20-30 years. Concurrently, any grape vines would be cut. Grapes are not abundant throughout, but do occur in a concentration along parts of the upper road. Establishing regeneration would not be a goal of this cut. Though rehabilitating the northern crossing will be an extra step for any loggers doing this week, the bigger challenge will be the great distance to cover — the back of this stand is almost a mile in from the crossing. The crossing itself is a half-mile in from the main landing, though perhaps the older, smaller landing right next to the crossing could be used. The problem with the great distance to cover is not the terrain itself — this is not bad — but the amount of time to go back and forth, the quality of the timber (or whether there even is any timber) and also the cost of fuel. Perceived acceptable skidding distances are closely linked to the current cost of diesel, but generally anything over 2,000-2,500' is considered far. Nonetheless, it is not out of the question that conditions that could make this work possible could fall into place. Given the considerable long-term benefit (of growing high-quality hardwoods), we should be attentive to an opportunity to do this job.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Mostly lacking, with the notable exceptions of white pine in some of the gravelly areas, and black birch in some of the richer soils, both as described above.

Interfering native vegetation: Grapevines were found growing at three isolated sites in this stand. They were at the far north end, where there were several grapevines 1-3" wide; at a wet area in the middle of the east part of the stand where the 1-3" wide vines were numerous; and along one portion of the slope in the southern part of the stand where a few small grapevines were seen.

Other potentially interfering native vegetation was only present in minor amounts. Hay-scented fern is very dense in the logged parcel west of this stand but is absent from most of this stand, and, along the west boundary, is present only in light to moderate amounts. This could change if the canopy is opened though. Striped maple and witch hazel are present only rarely in the understory. Along one section of the slope in the southeast part of the stand there are some dense patches of beech brush.

Poison ivy was virtually absent from this stand.

Other native understory vegetation (species and distribution): See description under General Habitat.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 2. A large portion of the stand is essentially free of invasives. This portion includes the whole western upland, and east of

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the big wetland includes the whole northern half and the southern half east of the main woods road.

Virtually all the invasives were found near the wetland or in pockets of moist soil. The area with the most invasives was the heavily logged flat area just east of the big wetland. Here bush honeysuckle was present in at least one large (1000 sf) patch and infrequent but large individual shrubs (these were much more frequent on the lower slope). This area also had glossy buckthorn in scattered individual small shrubs and at least one small patch of seedlings, and infrequent individual medium shrubs of barberry. Along the trails skirting the west side of the wetland were several small patches of honeysuckle and individual plants of glossy buckthorn, multiflora rose and barberry. The only upland locations where non-native invasive plants were found were a half dozen small barberry shrubs near a wet area in the north part of the stand, a single barberry near a stream in the west part of the stand, and 2 bittersweet seedlings in the extreme southeast corner of the stand. The lack of bittersweet in this stand is very unusual compared to all the other stands. Overall, even in the area where invasives were present, they were not dominating the native vegetation.

The private lands to the west of this stand, and also to the south, has been recently logged with significant opening of the canopy. If invasives take hold here, they could become a seed source for this stand. Stand 6, just to the east of this stand, is essentially free of invasives.

Soils (type, moisture, drainage and productivity): Not surprisingly, there are a range of soils in this stand. This reflects both the large stand size, but also the variable topography. The upper landscape areas are glacial till soils, whereas the river area is a blend of glacial outwashes and mucks. Overall tree fertility is good, except where drainage is very poor in the central wetland and various intake areas. Accessibility is good, but seasonally limited, west of the East Branch of the Mill River because the main trail, though improved over time, generally does not have a deep, gravelly base. This changes the north crossing, which follows a gravelly, esker-like formation before turning back to glacial till soil. The bulk of land on the east side (>99% of the area) is a till soil with the expectation being limited windows of adequately dry or frozen ground.

West of the East Branch of the Mill River, the more common soils are Paxton very fine sandy loam, Sudbury fine sandy loam, Amostown fine sandy loam, Haven very fine sandy loam, and Woodbridge very stony fine sandy loam. Paxton soils are deep, well-drained soils on glaciated uplands with a site index for white pine of 66; other site indices are 65 for red oak and 75 for sugar maple. Amostown soils are deep, moderately well-drained soils on glacial outwash with a site index for white pine of 75. Haven soils are deep, well-drained soils on glacial outwash, with a site index for white pine of 75. Sudbury is a deep, moderately well-drained soil (also) on glacial outwash with a site index for white pine of 60. Woodbridge is deep, moderately well-drained soil on glaciated uplands with a site index for white pine of 67. A general white pine site index of 70 could be used for this grouping. Hardwood site indices will be higher on the till soils than on the outwash soils.

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The central wetland soils are a mix of Ridgebury very stony fine sandy loam, and Freetown muck. Ridgebury is a poorly drained soil formed in compact glacial deposits of granite, gneiss and quartzite; formed in depressions, this soil has a high water table and takes on water from the surrounding landscape and is typically wet 7-9 months out of the year. (Of course, with beavers, these soils may be permanently flooded, and may, over time, develop deep muck layers — pers. Obs.). A site index of 60-69 for white pine, but, of course, with recurrent beaver flooding a possibility, trees may not reach an advanced age. Freetown muck is very poorly drained and typically has a depth of 60" or more of decomposed organic material. For reasons of flooding and high water tables, difficult access for equipment, and the ongoing disruptions of beavers and storm surges, this area is not suited for growing or harvesting timber.

East of the East Branch of the Mill River, with the exception of a narrow corridor of Woodbridge (see above), the soils tend to be Paxton very fine sandy loam in the southwestern area and otherwise Charlton-Hollis rocky fine sandy loams. Site indices for Paxton are 65 for red oak and 75 for sugar maple. The Charlton-Hollis soil is a blend of deeper, well-drained till and shallower, somewhat excessively drained till, on terrain with considerable variation in drainage and moisture-holding regimes. For the Charlton-Hollis, the site index for red oak is 65, 60 for shagbark hickory, and 55 for red maple. A site index of 65 would be a good representation of this soil. Overall, for all soils in this stand, an average site index of 65 for red oak will be used.

General Habitat: The key feature of this stand is an extensive wetland that bisects it running north-south (see below). The uplands are a hemlock-deciduous mix with two distinctive sub-areas.

Abutting the east of the big wetland a 100 ft. wide limited-cut zone separating the wetland from an area of roughly 30 acres that was heavily logged about 30 years ago leaving a canopy that is still less than 30% closed. Bordered on the west by the main trail, this is on a flat terrace that is interlaced with pockets of wetlands. The principal canopy trees are hemlock, ash, and red oak with a light hemlock midstory and a dense shrub layer consisting of black birch, beech, hemlock and white pine. The ground layer here is dense, with cinnamon fern, evergreen woodfern, prickly dewberry, goldenrod, laurel, New York fern, arrowwood (some of which is large, with leg-thick stems), raspberry, meadowsweet and regeneration of red oak, red maple, and aspen.

The rest of the stand, both east of the cut area and west of the big wetland, is a closed canopy of hemlock, red oak, black and yellow birch, red and sugar maple with a little ash, white pine and black cherry. A strong beech component is present along the southeast slope. Only one small area—east and west of the main stream—has a significant presence of white pines. Here the pines are large and of high quality, with good pine regeneration below (probably reflecting a strong sandy-gravel component in the soil). The canopy trees are large pole to small sawtimber in size with the oaks and pines generally in large sawtimber.

The midstory varies in density throughout the stand, and is dominated by hemlock with some black birch. The shrub layer is absent at about half the points sampled but where

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present it is generally deciduous or mixed, consisting mostly of beech, black birch and hemlock. Laurel is scarce in this stand.

Do wetlands occupy more than 10% of this stand?: Yes (just about). An extensive wetland runs north-south through the whole stand. This was once a reservoir that was drained when the dam broke in the infamous flood of 1874 in which many people died. Remnants of the old dam are still present at the south end of the stand. This third order stream now shows a mosaic of past and present beaver activity, with smooth flows, riffles, and pools in the main channel as well as in the floodplain. The wetland is dominated by shrubs, principally alder. Many bird species are attracted to the wetland for feeding or nesting. Some of these include wood duck, great blue heron, kingfisher, flycatcher, common yellowthroat, red-shouldered hawk, tree swallow, swamp sparrow and grackle. Several species of snakes, turtles, salamanders and frogs also are likely inhabitants. Mammals that are likely to use this wetland include moose, beaver, otter, mink, rabbits and snowshoe hare, raccoon, and water shrew. Old and fresh moose sign was found throughout the whole lower elevation part of this stand.

Several permanent and intermittent streams feed this wetland from the east. Two streams are shown on the topo map. Both are large enough for otters to use as a travel corridor, and the chirping of otters was heard at the stream in the far north section.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes, one. VP 26 is a very small vernal pool located just north of the large opening near the bridge. It contained wood frog tadpoles and spotted salamander eggs. VP 27 is the pond just west of the main trail west of the wetland. It is unlikely to be a vernal pool because it contained fish up to 4" long. VP 28 is unlikely because it is so close to the stream and no obligates were seen in it.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): Upturned roots in the lowland west of the main wetland and near the stream at the far north end of the stand provide essential nesting habitat for winter wrens. The old log landing is a sunny open area with patches of exposed soil that would make a good egg-laying site for painted and snapping turtles. The amount of coarse woody debris was slightly inadequate except in the logged areas.

Special risks to habitat: None, other than potential spread of invasives and grapes

Desired habitat modifications (options will vary, including "none"): Selective cutting could take place here to promote regeneration.

Historical/archaeological/contemporary: (1) The remains of the Williamsburg Reservoir dam, with the watchman's cabin cellar hole and spillway, constitute an important local history site, as commemorated by a plaque put in place by the Williamsburg Historical Commission. In a nutshell, the 100+ acre reservoir (for water power in the town of Williamsburg below) failed catastrophically in 1874. The

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tremendous wall of water and debris tore through town, destroying homes and factories and burying Florence Meadow in 6 feet of wreckage, killing almost 150 people.

Management history: Logging (shelterwood cutting) in 1999, shortly after acquisition by DPW. Prior to that there was heavy widespread logging in (estimated) the 1950's — with heavy cutting of sugar maple — and concentrated logging in a limited area perhaps 30 years ago.

Desired future condition: Variable for each section (overstory section above), but, in general, this should be a mixed-species forest that meets the following criteria: (1) free of invasive plants, (2) not over-browsed, (3) not over-run with interfering native vegetation, and (4) well-formed trees have room to grow.

Recommended Management for the next 10 years: Shelterwood cutting in the western section and thinning in the northeast section, with grape-vine control along the upper road. Repair the northern crossing for temporary logging purposes, but figure out how to prevent ATV use. In general, limit ATV access to this property. Continue re-marking of boundaries (begin in 4/2012).

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	Volume growth rate (Mbf/yr)
9	WH	185.6	14.1	157	10.6	7.7	16.5	70 WP	30.1

Stand Name: Old Williamsburg Road

Watershed / Sub-watershed: West-Whately / Sanderson Brook

Special water quality concerns (for stands within a reservoir watershed): avoid introduction of sediment into Sanderson Brook and any tributaries — the main risk of this comes from potential blockage of culverts under Williamsburg Road and from stream crossings on Old Williamsburg Road.

Silvicultural Status (options are "suitable" or "not suitable"): suitable on parts of the stand that are not wet

Overstory: Forest Type and Condition: As suggested by the diversity of soil types listed below, this diverse stand is really a patchwork of native and planted stands, a mix in which conifers (white pine, Scots pine, red pine, Norway spruce and hemlock) are more abundant than hardwoods (red oak, with beech, and in some areas sugar maple, red maple, black cherry, black and yellow birch, and paper birch. Unifying features of this are (1) they are all centered around Old Williamsburg Road and (2) the overstories are maturing or mature. On the whole, this is a great stand of timber.

Some of the main sections include:

(1) Most notably, the tall, nearly pure section of white pine timber at the eastern end of the stand is impressive. Past thinnings have kept these trees from becoming stagnant though they are ready to be thinned again.

(2) a run of red pine along the Henhawk Trail and also on the hill to the north. This red pine exhibits the same lack of vigor as other red pine, such as that in Stand 15. The lack of vigor is not due to neglect; the red pine has been thinned. In some areas, the red pine blends in to a run of Scots pine that has grown to timber size but does not look vigorous or viable for the long term. On drier soils, both the red and Scots pine could be cut off and converted to native hardwoods (provided that the understory is prepped for this). The red pine along Sanderson Brook, perhaps due to better moisture, may be slightly more vigorous and viable and should be allowed to continue occupying the site for at least 10 more years while grapes and invasives are brought under control.

(3) One alarming section of red pine (ca. 8 acres) has mostly fallen down or been pulled down by grapes and bittersweet and is completely overrun with these vines. This area is not functional anymore as a forest and will require significant restoration efforts if it is

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to function as a forest again and, just as importantly, if it is not to serve as a seed source for surrounding areas. This is truly a worst-case scenario.

(4) On the hillside north of Old Williamsburg Road there is an impressive stand of Norway spruce with excellent form and vigor, mixed with unimpressive Scots pine and impressive white pine. If anything at all was to be done here, it would be a light thinning of subdominant trees just to maintain overstory vigor.

(5) Just east of the Norway spruce there is a run of red pine. Crown condition and apparent vigor is typical of red pine here. The closed canopy is perhaps serving as a buffer to the spread of invasives from the major pull-down area. In order, to make use of the shade, nothing should be done here until the nearby vines situation is under control, other than control of vines and scattered invasives throughout.

(6) Red oak is scattered throughout in areas not dominated by pines, sometimes with beech, and sometimes with hemlock. Generally, the red oak is well formed and definitely of timber size. Main areas of red oak are on and along the esker in the southwest corner of the stand, and in a moist area on the north side of Old Williamsburg Road, along the boundary with Bean (some of these oaks are quite large).

(7) Especially on the north side of Old Williamsburg Road, in the general vicinity of Sanderson Brook and along the toe of the slope of the central hill, sugar maple is common, sometimes as older trees, and sometimes as large saplings, large poles, and small timber trees. The sugar maple is found here probably because of two factors: the historic use of the land (cellar holes, etc.), which would have favored sugar maples, and the seasonally-elevated moisture levels where it is found (as opposed to swampier areas described below, which are too wet for sugar maple). The sugar maple is not dominant, but is a strong component of a mix that includes yellow and black birch, and paper birch, red maple, ash, black cherry, and also red oak. Within this mix there are — occasionally — large, inspiring, well-formed timber trees of every species illustrating the potential of these sites. Unfortunately, grape vines like these sites as well, and are well established, with stems sometimes thigh-thick. The grapes should be controlled, as well as any scattered bittersweet, and other invasives, which also like these sites. To a limited extent, where accessible without going onto very wet ground, thinning out firewood would help established, dominant trees maintain good vigor into the future.

(8) On the south side of Old Williamsburg Road, along Sanderson Brook as well as along feeder brooks, the terrain blocks and redirects drainage and also flattens out and dips in ways that slow drainage and cause extended saturation throughout the growing season, favoring hummocky beds of sphagnum moss and cinnamon fern with a scraggly, somewhat dwarfish overstory of red maple, yellow birch, hemlock and sometimes ash and elm. These areas are not suited to silviculture.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory:
Essentially lacking in every area of the stand, with the following exceptions. These

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exceptions occur under certain tall conifer overstories that were thinned. The regeneration is in the form of tall, often rather stringy, hardwood saplings, mainly black birch but also sugar maple, and other hardwoods. These are probably too tall and stringy to be released, however, if these are flush cut just prior to a harvest, there is a chance that some, especially the sugar maple, can vigorously resprout from their established root system and be viable. However, even if these do resprout, it is questionable whether they will grow and prosper, or merely become fodder for deer and moose. This type of regeneration is mainly found under the tall white pines and under the red pine and Scots pine described above in sections (1) and (2). In section (7) above there is also good sugar maple regeneration in places, though there is no intention to begin regenerating this section.

Interfering native vegetation: Hay-scented fern is absent to light throughout the stand, with no patches seen. Grapevine does not have a significant presence in the stand, except in the red pine portion near the dense bittersweet patch in the northeast area. Here bittersweet vines could be seen twining their way into the canopy by climbing the grapevines. It is difficult to tell whether the windthrown red pines were compromised by grapevines previously. As Molly Hale noted in her 2002 report the gap was already in existence and covered by bittersweet then.

Other native understory vegetation (species and distribution): Ground vegetation was mostly absent from the stand, but evergreen wood fern was present under some of the pine stands, up to 25-50% cover in some spots. Very light laurel was also present in sparse amounts, and uplands along wetland edges had a little more vegetation including some hobblebush, cinnamon fern, hairy woods grass and foamflower.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 2. Most of the stand is free of invasive plants and would be ranked as a 1. Even along W-W Road there are virtually no invasives. A glaring exception however, is a 8.7- acre blowdown zone (visible in a recent pre-foliage aerial photo) in the NE corner of the stand that is covered 75-100% with bittersweet. This area by itself would be ranked a 5 in severity but does not appear to be spreading far into the surrounding forest. However seeds are probably present that will germinate when a canopy gap occurs. As one heads east from the patch of bittersweet, bittersweet gradually tapers to nothing by 750 ft. South of the patch the gradient is sharper with no more bittersweet observed after about 300 ft.

Other exceptions are a very minor amount of multiflora rose and bittersweet near Dry Hill Road. A few scattered barberry bushes and the beginnings of a small patch of bittersweet were growing in the seepy areas south of W-W Road. The groundcover moneywort is growing in several patches along that road.

Soils (type, moisture, drainage and productivity): A combination of productive soils, predominantly Merrimac fine sandy loams, and both Colrain and Shelburne stony or extremely stony loams or fine sandy loams, with Limerick-Saco silt loam along sections

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of the Sanderson Brook floodplain. All three soils are very well-suited for both tree growth and tree harvesting; and erosion potential on the Merrimac is minimal, and is more typical on the other two soils.

1. The Merrimac soils are concentrated in the area between Williamsburg Road and Old Williamsburg Road. This soil consists of deep, somewhat excessively drained soils formed in glacial outwash deposits derived from granite, gneiss and schist. Lacking a drainage-restricting fragipan, rooting depth can be as deep as 60". These soils are underlain by coarse sand and gravel at a depth of about 2 feet. Notably, the pines growing on this soil in this stand are especially tall.

Where topography dips below the water table, vernal pools may have formed.

For tree growth purposes: the Merrimac very good, with site indices of 70 for white pine; 65 or more for red oak; and 58 or more for northern hardwoods. Both pine and hardwoods grow well here (as does hemlock).

For logging purposes: the Merrimac is good — much of this stand is on sandy, well-drained soil that is sited for logging at most times of year. Starting at about mid-way down the steep escarpments, however, seeps pick up where the seasonal water table leaches out of the ground. These areas are erosion-prone and not suited to logging, unless long cables are used to winch trees up to higher slope positions.

2. Bounding the areas of Merrimac, the soil is Colrain stony, or very stony, fine sandy loam (Note: in the Hampshire County Soil Survey, this soil seems to be referred to as "Woodbridge". This well-drained soil formed in glacial deposits derived principally from dark gray schistose material and impure limestone. With moderate to rapid permeability and fairly high moisture-holding capacity, this soil can produce good yields of timber. Site indices or 58 or greater for northern hardwoods, 65 or greater for upland oaks, 70 or greater for white pine, and 70 or greater for red pine. (The site indices for Woodbridge are listed as: 67 for white pine, 72 for northern red oak, and 65 for sugar maple)

For tree growth purposes: Colrain (and Woodbridge) is excellent, with elevated fertility in lower-slope positions, and diminished fertility at tops of slopes.

For logging purposes: Due to their moisture-holding capacity, and the slow drainage through the hard substratum, Colrain (and Woodbridge) soils cannot be operated during wet times of the year; this becomes more critical in swales and along the bottom of slopes. Conditions must be dry or frozen to avoid excessive rutting, compaction, and root damage, or tops and poles must be laid down to form a mat.

3. In the southern stretch of Stand 9, the soil is Shelburne extremely stony loam, a well-drained loam formed in compact glacial deposits derived mainly of dark-gray schistose material and impure limestone, with a hardpan at about 24" This soil has good moisture retention.

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For tree growth purposes: Good. Site indices of 52-57 for northern hardwoods, 55 and up for red oak, 60-69 for white pine, and 60-70+ for red pine.

For logging purposes: Due to their moisture-holding capacity, erosion and gullyng are a risk, and it is important to design roads so as to not concentrate water.

4. Along Sanderson Brook, on a very limited basis in small floodplains, there is Limerick-Saco silt loam, a poorly/very-poorly drained silt loam that formed in deep alluvial deposits, and which can be flooded seasonally.

For tree growth purposes: Not suited to upland oaks. White pine can grow well, with a site index of 50-59, though flooding and beaver activity may interfere.

For logging purposes: not suited. No logging would take place in these immediate stream-buffer areas.

General Habitat: Red and white pine are predominant throughout this stand, sometimes occurring mixed together, sometimes in single-species stands, and sometimes occurring together with large and vigorous Norway spruce, moribund Scots pine, or mixed hardwoods. Some hardwood stands with red oak are interspersed with the pine and mixed stands. The large size and quality of the white pines and spruce is notable, with most white pines 14-24" dbh and up to 36" in some sections. They are straight, clear and single trunked below first 16 ft., but the white pine in some areas north of the road could be infected with black knot. The red pines are generally 14-20", having been thinned at least 15 years ago. As in other stands in the Ryan watershed, the red oak are noteworthy for their size (typically 18-26") and quality.

The midstory is generally dense, and mostly deciduous or mixed, with beech the main component, along with witch hazel, hemlock, black birch, and sugar maple. A dense hemlock midstory occurs in the few areas that are under hemlock or huge white pine canopy. Shrub density is light to sparse and ground vegetation is sparse to none. Tree regeneration over 6" high is essentially absent. The canopy is mostly >70% cover, but the red pine stands tend to be more open, resulting in two distinct understory layers. There, the black birch, black cherry and striped maple are in the taller layers, and beech is underneath, around 15 ft. high.

Coarse woody debris is ample on the north half and adequate on the south half. Live cavity trees and snags over 12" dbh were very sparse. Recent deer or moose browsing in this stand is insignificant

Do wetlands occupy more than 10% of this stand?: No, but a 2.5 acre shrub wetland occurs between V.P. 14 and V.P. 16. It has dense groundcover of cinnamon, sensitive, New York and lady ferns, rue, buttercup, poison ivy, and sedges, and a clumped distribution of shrubs such as spicebush, winterberry, and striped maple. Two smaller wetlands are at the far east end of the stand, one just east of Dry Hill Road and the other (actually in Stand 11) south of W-W Road.

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Sanderson Brook is a second-order stream the flows roughly parallel to W-W Road and into the West Whately Reservoir. It is densely shaded, 8 ft. in width with undercut banks about 2 ft. high. In October 2011 the depth ranged from 3" deep riffles to 3' deep pools. The bottom is sand with cobbles up to softball size. There are some fallen trees crossing the stream, but not much woody debris in it.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes, the lower elevation part of this stand has very unusual topography with numerous deep depressions separated by convoluted steep ridges that may be eskers. There are 9 vernal pools north of Williamsburg Road (14-17, 38). All of these were evaluated as possible to definite vernal pools.

Are NHESP layers indicated for this stand? (if "yes", describe) Yes. Much of the area where the vernal pools are located is designated by NHESP as both Priority Habitat and Estimated Habitat (2008 data), no doubt due to the presence of Jefferson salamanders that breed in the vernal pools and live in the surrounding uplands. This species is listed as Special Concern in Massachusetts.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): The exceptionally large white pine are also unusual and at least some should be preserved for potential future cavity trees. Sanderson Brook should be maintained in a shady condition.

Special risks to habitat: The spread of bittersweet from the dense patch in the red pine section is the biggest threat.

Desired habitat modifications (options will vary, including "none"): Attempt to reduce bittersweet in the dense patch.

Historical/archaeological/contemporary: (1) various cellar holes along Old Williamsburg Road and stone walls associated with agricultural use; (2) various conifer plantations.

Management history: Various thinnings. The eastern end was thinned approximately in 1986 - 1987; red pine sections were thinned in about 1992. Other harvests may have occurred, with no record available.

Desired future condition: (See Introductory section above for an overview) Continuation of this forest type with vigorous overstory trees, with the following exceptions (1) invasive species and grapes will not threaten the stand and (2) most of the poorly vigorous red pine and Scots pine will be replaced by a native tree mix.

Recommended Management for the next 10 years: management is section-specific:

(1) Thin overstory white pines to maintain vigor.

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(2) On the well-drained soil between the Henhawk Trail and Old Williamsburg Road, as well as in the red pine section in the eastern part of the stand, prepare the understory for a shelterwood overstory removal to convert to hardwoods. Steps include controlling vines and flush-cutting established saplings, along with follow-up monitoring. If successful, the overstory can be removed, and the understory released, approximately 5 years after completing the preparation.

(3) Restoration of 8.7-acre red pine pulldown. This would be a multi-step, multi-year process involving monitoring and timely application of herbicides. Possibly some site-prep or cutting would be needed, at least to allow access (through the total mess) for monitoring and herbicide applications.

(4) Optional light thinning of subdominant trees to maintain overstory vigor.

(5) Monitor and control any vines and scattered invasives throughout.

(6) Maintain red oak — no management needed.

(7) Control grapes, as well as any scattered bittersweet, and other invasives. To a limited extent, where accessible without going onto very wet ground, thinning out firewood would help established, dominant trees maintain good vigor into the future.

(8) None other than monitor for invasives and control any that are detected.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	Volume growth rate (Mbf/yr)
10	BB	52.4	11.0	84	3.3	6.8	1.4	60 OR	8.5

Stand Name: Dry Hill South

Watershed / Sub-watershed: West-Whately / Sanderson Brook

Special water quality concerns (for stands within a reservoir watershed):
avoid introduction of sediment into any stream draining into Sanderson Brook.

Silvicultural Status (options are "suitable" or "not suitable"): not suitable

Overstory: Forest Type and Condition: This stand contains a mix of types that are grouped together by lack of access. Though the northern boundary of this stand could not be exactly located during the course of this work, there was no concern that the boundary, when found someday, will cause this forest type to change. In the southwestern section, along Sanderson Brook, there is a mix of large old-field white pine with northern hardwoods, including yellow birch, black birch, paper birch and red oak. The hardwoods are of large-pole and small sawtimber size. In the central, lower-slope section, where the ground is very seepy, sugar maple is abundant, with yellow birch and other hardwoods. These trees range from large pole-size to sawtimber size. This is very fertile soil, and a tributary of Sanderson Brook drains through here. Just east of this section is a steep, dry slope with hemlock, oak and beech. Many of these are sawtimber size, and the hemlock also occurs in thickets as a midstory tree. Where moisture is more abundant, there is sugar maple and yellow birch. These trees are generally old and rough, with both the hemlock and the beech either dead or rapidly dying.

A long piece of land stretching to the north comprises the rest of the stand, which features scattered old-field pine with red maple, black birch, and red oak at the southern end. Heading north, and up, the midslope is a mixed bag, with pole-sized red maple and black and paper birch, sometimes with grape vines.

Higher on the slope, the species mix becomes predominantly red oak, black birch and red maple, with sugar maple that seems left over from long-ago efforts to grow and tap these trees. The quality of the trees decreases noticeably with increasing elevation, presumably due to increasing wind exposure and ice damage (very evident) as well as ever-decreasing soil depth. Toward the top of the slope, the trees are perhaps only 2/3 as tall as they are at the bottom, and many of the trees of sawtimber size are so riddled with defect so as to effectively only be useable as firewood. The red oaks appear to be old, even though they are not large. Ironwood and striped maple are common here.

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There are some very notable, large boundary trees, testifying to the great expanse of time that has passed since this land was cleared for farming. On the eastern boundary there is a 45" white ash near a very large sugar maple. On the western boundary there is a group of half a dozen or so very large red oaks, sugar maples, and beech in very rough condition. The beech is dead and down. Together, this group of trees exemplifies the type of mature-forest features that should be allowed to increase over time.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: essentially lacking, but in some parts of the mid-slope area there are abundant sugar maple seedlings that could be developed if there were to be any silvicultural work here.

Interfering native vegetation: Hay-scented fern is significant in the north part of this stand, where the land is driest. It is densest at the far north end of the stand, moderately patchy in the central part of the north arm of the stand, and fades out completely in the southern part of the stand. However, it is in the southern, wetter sections where grapevine becomes significant. There are numerous grapevines 1-4" diameter throughout this section. The grapevines are worst in the seepy section north of Sanderson Brook.

Other native understory vegetation (species and distribution): In the moister areas, ferns (Christmas, New York, sensitive, cinnamon, evergreen wood) form a patchy dense ground layer. Here there is witch hazel and spice bush. In the dry, southeastern section, and in part of the drier southwestern section, there is mountain laurel and lowbush blueberry.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level is 2 (ranging from 1 to 3). The north half of the stand is essentially free of non-native invasives (though it has lots of hay-scented fern). The main exception is in the northeast corner area, where there are seeps draining down the east face of Dry Hill. Here, dense barberry patches follow the moisture, but barberry is absent outside of these wetter areas. In the southern section, medium sized barberry shrubs and seedlings of bittersweet are present at a fairly light density, and widely dispersed, so it would be challenging to treat these thoroughly.

Soils (type, moisture, drainage and productivity): The predominant soil type is listed as Charlton-Hollis-Rock outcrop complex (same as Stand 4), a variable glacial till soil including both deeper, well-drained pockets, and shallow, poorly drained pockets, as well as shallow, droughty pockets, with about 10% of the surface in ledge outcrops. Moisture improves substantially from the drier hilltop down to the riparian zone of Sanderson Brook, and tree growth reflects this. As such, tree growth is good, but variable. Moisture-holding capacity is moderate, and trees are subject to windthrow and ice pull-down on the steeper east face. Site index for red oak is 65, for white pine also 65, 60 for shagbark hickory, and 55 for red maple.

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For tree growth purposes: on the lower half of the slope, moisture is adequate, good or excellent for tree growth (site index OR 65+). On the upper half, moisture becomes limiting (site index OR 50-65). An average site index of OR 60 will be used.

For logging purposes: Most upper areas of the stand can be readily worked, but the lower half is soft and very challenging due to soil moisture, and tending to become seepy on the lower quarter of the slope. Conditions would have to be exceptionally stable to work this lower quarter. Ideally, to log this stand you would access the upper part of the stand without crossing the lower part, which, due to the boundary line configuration, would mean coming in off an abutting property. The lower slope would remain unlogged. As a result, no silviculture was recommended for this stand at this time.

General Habitat: The north part of the stand is nearly pure hardwoods with very sparse inclusions of white pine in the canopy and hemlock in the midstory. The hardwoods are dominated by red maple, but also include white birch, black birch, beech and red oak, generally less than 13" dbh. In at least one place there is good quality red oak 14-24" dbh. A stand of mature beech, some healthy looking but most not, is located midway in the stand. Some had bear claw marks. Sprinkled in the hardwood canopy are very sparse inclusions of forked white pine 10-30" dbh. Under the hardwood canopy beech is widespread but not excessively dense in the midstory and varies from none to dense in the shrub layer.

The few hemlocks in the stand have thin crowns, indicating that they are probably infected with either elongate hemlock scale or woolly adelgid.

Throughout the stand regeneration is very limited and where present, it is browsed.

Do wetlands occupy more than 10% of this stand? No. There is a small wetland of very dense shrubs near the junction of the Henhawk Trail and Old Williamsburg Road. The vegetation includes winterberry, laurel, spicebush, alder, ferns, and goldenrod. The area just north of the stream is seepy.

Were vernal pools identified/mapped for this stand? (if "yes", how many): No.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.):
None.

Special risks to habitat: Potential for grapevine and bittersweet to create pulldowns in the future. Potential for spread of barberry, especially if canopy gaps occur in the wetter areas.

Desired habitat modifications (options will vary, including "none"): None.

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Historical/archaeological/contemporary: old wire fencing and short runs of stone walls; there is a very old, faint road crossing roughly west to east (see map) and a small cluster of enormous old sugar maple, red oak and beech along the boundary.

Management history: logging was intended in the late 1990's under DPW's previous forester Karl Davies but was never carried out. There is no record as to why this harvest was not implemented.

Desired future condition: Mixed-species, mixed-age stand that is relatively free of invasive vegetation and not choked with grapes with a strong component of red oak (and sugar maple on the lower slope) and other long-lived hardwoods.

Recommended Management for the next 10 years: No silviculture (harvesting) is recommended but any cutting of grape vines on the lower slope will be beneficial.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
11	WH	277.4	13.9	132	5.8	12.7	8.6	65 WP	44.9

Stand Name: Grass Hill Road

Watershed / Sub-watershed: West-Whately Reservoir / Sanderson

Special water quality concerns (for stands within a reservoir watershed): avoid introduction of sediment into Sanderson Brook, especially caused by the sudden and dramatic erosion and wash-out of Grass Hill Road itself (as was seen during hurricane Irene, 8/2011), but also as was being caused by ongoing off-road-vehicle use of this road, in part to access abutting DFW land.

Silvicultural Status (options are "suitable" or "not suitable"): suitable (suitable overall but many sections, especially on lower slopes, are expected to be too wet)

Overstory: Forest Type and Condition: This diverse stand derives from old-field pine and hardwoods that were cut-off in some places and not in others and reflects variable history and soil types. The resulting mix, with a tall overstory throughout, is an uneven mix of red oak, with black birch and other hardwoods (paper birch, red maple and black cherry, with less white ash, yellow birch and shagbark hickory), and white pine, typically in grove-like concentrations. Hemlock is absent or occurs typically as a scraggly midstory. Moisture for timber growth varies greatly with landscape position, ranging from excellent and abundant on lower slopes, to restrictive on upper slopes and ledgy areas, and timber quality varies accordingly. With better moisture, the oaks, and other hardwoods, can be quite impressive. Likewise, the white pine ranges from very large, and, on the terrace of Merrimac soil, extremely large and well-formed, to very scraggly at the top of the hill.

The hemlock at higher landscape positions is in very poor health, with elongate scale and presumably also adelgid, causing crowns to be thin. In some spots, groups of hemlocks have been peeled away from shallow ledge (cf. The same effect in Stand 7). Lower down on the land, the hemlocks do not seem to be affected yet or as much. Based on what we know at this point, there is no reason to expect hemlock to thrive over the medium or long term.

Variations from this main forest type include:

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- (1) a central wetland saddle featuring large pole and small timber-size red maple, yellow birch, and white ash
- (2) a large shrub swamp and hemlock-red-maple swamp along the southern boundary
- (3) a sedgy knob of hickory and hophornbeam along the southern boundary, near the town line
- (4) increasing amounts of sugar maple, many of large timber size, on the northern toe of the land, mainly in the eastern half, where moisture is quite abundant
- (5) an area of red pine on the east side of Grass Hill Road with a tall understory of hardwood saplings, mostly black birch. The red pine exhibits the same symptoms of poor vigor as other red pine sections do across this watershed.
- (6) a small area of red pine along Williamsburg Road. Vigor similar to above.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Essentially lacking, with the exceptions being, mainly, areas of black birch or red maple saplings or poles. Moose congregate at the top of the land and heavily browse any saplings, leaving behind a contorted mess of young trees with little promise.

Interfering native vegetation: Several small to large patches of hay-scented fern were found on the east side of the hill at the far western side of the stand and the northeast side of the hill labeled 315 on the USGS topo map. This fern was also fairly dense in the red pines east of Grass Hill Road because there are several canopy gaps there from blowdown. Grapevine is mostly limited to wetter areas, in particular a wet area near the north boundary where the topo map says 255, the saddle downhill (northwest) from hill 315, downhill from vernal pool 13, and south of the wetland east of Grass Hill Road. Witch hazel is present in some parts of the stand, but is not dense except where the canopy is more open.

Other native understory vegetation (species and distribution): Largely lacking in the uplands but where present includes ferns, blackberry, dewberry, clubmoss, lowbush blueberry, chestnut sprouts, beech and maple-leaf viburnum.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 2. Most of the stand is free of invasives. A few bittersweet plants, mostly less than 1 foot long, were found along the bottom of Grass Hill Road and higher up along the road, where the NDPW property straddles both sides of that road. A few individual barberry shrubs, medium to large size, were found at the bridge along W-W Road, in the wet zones along the north

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boundary of the stand and in the wetland east of Grass Hill Road. These same wet areas also had a very few small multiflora rose shrubs.

Soils (type, moisture, drainage and productivity): Predominantly Westminster extremely rocky loam, a droughty and shallow soil formed in glacial material derived from gray mica schist that contains impure limestone. Soil depth is about 18 inches to dark gray-schist bedrock. The shallow bedrock prevents deep rooting, and trees may not be windfirm (or may be uprooted in heavy ice or wet snow if the ground is not frozen — sometimes whole groups of trees can peel away in a clump and leave bare, exposed bedrock, a situation made more likely by grape or bittersweet vines climbing in trees).

The small area to the east of Grass Hill Road, half of which is in red pine, is Buckland extremely stony fine sandy loam. Formed in glacial deposits of dark gray schistose material and impure limestone, this soil has a hardpan at about 20" and is wet and seepy, staying wet in spring and becoming wet in the fall. The water-holding capacity is better than in the adjacent Westminster, and tree rooting may be deeper. Site indices are about 5' greater than the indices shown below for Westminster. The site index for red pine is 70+.

For tree growth purposes: Site index on this Westminster for northern hardwoods is 46-51; site index for upland oaks is 55-64; site index for white pine is 60-69, and 70+ for red pine.

For logging purposes: On both soils, erosion and gulying in woods roads and logging roads is a serious risk on this soil, and durable water diversions are needed to prevent this (this became very evident with Hurricane Irene — Grass Hill Road had a severe washout, dumping sediment into Sanderson Brook). This soil is slow to dry out in spring or after periods of heavy rain. In general, there are no very dry, low-risk access points to this stand. Logging access will have to contend with water, and be designed accordingly, and supported by a general practice of avoiding the wettest areas (as a note: the old logging trails through areas with sugar maple — areas I would consider too wet to try and log in today's time — are a reminder of colder winters that we once had which allowed areas such as this to be accessed with minimal disturbance).

General Habitat: This mostly closed canopy stand contains distinct zones that vary in tree composition. The west part of the stand is mostly hardwoods with black birch, red oak and red maple most common in the canopy with a moderately dense midstory of beech, sugar and red maples and black birch. The hilltop areas in this west section have some characteristics of hickory-hop hornbeam forest: thin soil over rocky ledge, shagbark hickory included in the canopy and hop hornbeam in the midstory. The ground vegetation on these rocky summits is denser than other areas, with regeneration 1-2 ft. high of oak, red maple, black cherry, and beech along with maple leaf viburnum and laurel. The tree regeneration has been browsed. In the rest of the west portion of the stand, there is a light shrub layer of laurel and striped maple, and a near absence of ground vegetation.

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The lower part of the north-facing slopes on the east section is a similar hardwood mix—minus the hickory and hop hornbeam—but with the addition of hemlock in the midstory and/or canopy. On the ridgetop and its upper slopes white pines become a common canopy component. A relatively dense mixed deciduous midstory is underneath, and there is evidence of a long-past forest fire in some of the white pine zone. This east portion of the stand mostly lacks shrub and ground layers.

East of Grass Hill Road is a hardwood swamp with ash red maple and yellow birch and a red pine plantation (dbh \leq 14") on the higher ground. In both the upland and wetland the shrub layer is dense, with winterberry in the wetland and beech, striped maple and red maple under the red pines. The red maple has been heavily browsed. The upland ground vegetation consists of hayscented fern, blackberry, evergreen woodfern and prickly dewberry.

In the whole stand the red oak and white pine reach up to 26" dbh in some areas. The other canopy tree species are between about 8 and 18 inches.

The amount of coarse woody debris ranges from sparse to adequate.

Do wetlands occupy more than 10% of this stand? No but there are several wetlands, located along part of the border with stand 9, the saddle west of the largest hill and in the low area east of Grass Hill Road. Also, there are seepy slopes in the V-shaped draw that flows north into stand 9.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes. There are 4 south of Williamsburg Road. (7, 8, 10, 10A). These are near the boundary with stand 12. Also, there are two large vernal pools located near the stand's south boundary. VP 12 is definite, with over 2 dozen egg masses of spotted salamanders and is mostly open water with some highbush blueberry. VP is probable but was too shrubby with blueberry and hummocks of cinnamon fern to confirm amphibian breeding. Its depth, size and presence of open water in some parts makes it likely to function as a vernal pool.

Are NHESP layers indicated for this stand? (if "yes", describe) Yes, a portion of a Priority Habitat/Estimated Habitat polygon covers part of stand 11 south of VPs 7, 8, 9, and 10. The importance of these polygons is undoubtedly related to the vernal pool complex and its population of Jefferson salamanders.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): There are small talus fields along some of the steep slopes, but aside from a few possible sites for porcupine dens, they probably don't provide significant habitat.

Special risks to habitat: As in many of the other stands, overbrowsing is hindering tree regeneration, suggesting a need to bring deer populations into a better alignment with the desire to promote a vigorous and diverse understory.

Desired habitat modifications (options will vary, including "none"): None.

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Historical/archaeological/contemporary: (1) cellar holes (on and near the property) and dense stone wall network in the section of deeper, better-drained soil east of Grass Hill Road and which peter out heading west into marginal terrain; (2) Grass Hill Road itself, and a parallel, older road that may have served as an earlier grass Hill Road; (3) red pine plantations; (4) the sugar maples (mentioned above) are probably part of an old sugarbush

Management history: Much of this stand has never been thinned. A section along Williamsburg Road was thinned in 1989. Both red pine sections were thinned at some point, roughly 20 years ago.

Desired future condition: Maintain this general type as is but replace red pine sections with new age class of native trees and add component of viable regeneration in small groups on the western-facing slope.

Recommended Management for the next 10 years: (A) in red pine sections, conduct the same type of preparation for regeneration as in Stands 7 & 9. Monitor, and harvest overstory to release regeneration if regeneration is adequate and vines/invasives are under control; (B) in scattered, accessible areas, especially on the western-facing slope, use group selection to establish pockets of young growth.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
12	RM	41.3	10.4	27	1.3	2.2	0.4	55 RM	1.0

Stand Name: Nash Hill Road Swamp

Watershed / Sub-watershed: drains partly into "Beaver Brook" then into Sanderson Brook and then into West-Whately Reservoir; the remaining section flows southward out of the watershed, into Joe Wright Brook and then into the Mill River (at Williamsburg Station)

Special water quality concerns (for stands within a reservoir watershed): (1) avoid introduction of sediment into Beaver Brook and Sanderson Brook; (2) limit vegetative and seed-caused spread of invasive plants, especially bittersweet; (3) limit ability of grapes to pull down overstory along Nash Hill Road and exacerbate bittersweet problem

Silvicultural Status (options are "suitable" or "not suitable"): not suitable (due to high water table). (A small section along Nash Hill Road has been logged in the past, but due to invasives and grapes, this section is being reserved from harvesting at this time)

Overstory: Forest Type and Condition: A mix of upland and wetland forest surrounding a central, active beaver pond (with lodge and current tree-felling) that is sited in a traditional shrub-swamp and marsh situated on a "saddle" that sheds water slowly in two directions (see above). Along Nash Hill Road there is a cellar hole surrounded by tall, well-formed white pines that have been thinned. These trees are vigorous. Unfortunately, the understory of tall black birch saplings has been overrun by grapes and bittersweet. Just west of the pine grove there is an old sugar bush, with vigorous sugar maples in a range of sizes. Beaver flooding or chewing/felling could compromise these trees, though currently this is not happening. Heading south-westward, the overstory becomes a mix of large hardwoods including red oak and yellow birch interspersed with very wet, seepy ground. The remainder, and bulk, of the forest is a scraggly overstory of red maple, yellow birch, white ash, elm and hemlock on very hummocky ground with mountain laurel and winterberry shrubs. This remainder includes a fringe upland area on the southern side of the wetland with midstory hemlock and thick mountain laurel under tall white pines.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Entirely lacking, though this is not a problem in this situation. The one exception is under the pine grove, where the established saplings have been overrun by vines.

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Interfering native vegetation: Hayscented fern and prolific grapevines were growing in the area described in the 2nd paragraph under General Habitat. Laurel was dense in some other areas. No other interfering native vegetation was present.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 2. Most of the stand has no invasive species. Only 2 small barberry bushes and 3 small multiflora rose bushes were spotted along the stream in the northeast section of the stand. However, the area described in the 2nd paragraph of General Habitat below has lots of bittersweet (severity level 4 in that small area) and has the potential for more pulldowns and for being overrun by bittersweet, similar to stand 7 at Mountain Street.

Soils (type, moisture, drainage and productivity): Upland fringes of Merrimac sandy loam (see Stand 9 description) but overwhelmingly this is Maybield silt loam, a deep but poorly drained silt loam that occur in low places. Available water capacity is high, permeability is low. The water table is high throughout the year, causing shallow rooting, and the soil is considered poorly suited to the growth of timber.

For tree growth purposes: Not suited to growing timber in most places even without beavers; with beavers, the fluctuations in the water table and risk of chewing/felling render long-term growth prospects questionable.

For logging purposes: Terrible. This soil could only be logged under very frozen conditions with thick ice and small equipment with winches and long cables.

General Habitat: The forested upland has a mostly closed canopy of white pine, red oak, red maple, ash, yellow birch and a few hemlocks. These trees are in the large pole to small sawtimber size. The midstory is dense with hemlock in the southwest section and with hemlock and mixed hardwoods in the northeast section. Laurel is moderate in some sections but tall and very dense south of the beaver pond. Groundcover and other upland shrubs are essentially absent. The amount of coarse woody debris is low.

One small area that is distinct is sandwiched north of the beaver pond and south of Nash Hill/Williamsburg Road. This section has red and white pine up to 20" diameter with abundant bittersweet and grapevine including some pulldowns. The ground has lots of evergreen woodfern and hayscented fern. There is lots of coarse woody debris from fallen red pines.

Do wetlands occupy more than 10% of this stand? Yes. Most of the stand is a wetland. A beaver pond with open water occupies the middle part of the stand. This pond is perched on a saddle and drains in two opposite directions —northeasterly along Williamsburg Road (in/into Sanderson Brook) and southerly, going east of Nash Hill. The southerly wetland is especially extensive. Both drainages are within this stand and are shrubby swamps, with about a 40% cover of trees. The shrubs are winterberry, spicebush, laurel and some alder. Emergent plants are also abundant, dominated by tall

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sedges, royal fern, goldenrod, and along the edge cinnamon fern and sensitive fern. Some sections of the shrub wetlands could possibly function as vernal pools. There are some sphagnum hummocks in the southerly drainage that might provide marginal habitat for 4-toed salamanders. The wetland certainly provides a valuable habitat for a variety of wetland wildlife, but the only wetland specialists observed in October were wood ducks.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Besides the possibility that obligate species such as wood frog and spotted salamander might breed in some of the shrub wetland, there are 4 discrete vernal pools (vps 7 to 10) along the boundary between this stand and stand 11. Breeding of obligate species was not observed in pools 8 or 9, but was in 7 and 10. Another confirmed vernal pool is located within 200 ft of this stand, on private land north of Williamsburg Road.

Are NHESP layers indicated for this stand? (if "yes", describe) Yes. Most of the stand is within NHESP polygons for Estimated Habitat and Priority Habitat.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): An old cellar hole is located at waypoint 24-04, just south of Williamsburg-Whately Road. The majority of this stand is in, or within, 150 ft of a wetland and these riparian corridors should have little if any cutting. The reasons are to prevent runoff and to allow for nesting of birds such as wood duck, red-shouldered hawk and green heron.

Special risks to habitat: No phragmites was seen in the wetland but it could easily become established.

Desired habitat modifications (options will vary, including "none"): None, other than controlling vines along Nash Hill Road..

Historical/archaeological/contemporary: (1) cellar hole along Nash Hill Road; (2) an earthen farm or logging bridge "abutment" at Beaver Brook (see map showing logging trail to landing) that currently does not have a bridge in place; (3) a small sugarbush (described above).

Management history: The edge along Nash Hill Road has been thinned. The southern shore was marked for a thinning by Karl Davies but the work was never carried out (paint still evident).

Desired future condition: (See Introductory section above for an overview) Maintain this type but without vines or invasive plants. If beavers are to be tolerated, consider a beaver deciever to prevent the water level from going much higher than it is now (and flooding sugar maples and pines).

Recommended Management for the next 10 years: (1) control vines (several acres) along Nash Hill Road (grapes and bittersweet); (2) mark western boundary

Growth Rate Method and Volume (see "Notes applying to all stands" above):

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15% of DCR/Green-cert rate to account for reduction in growth due to flooded areas.

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Owner(s) City of Northampton DPW

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Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	Volume growth rate (Mbf/yr)
13	WH	30.9	12.5	80	5.7	2.4	6.6	70 WP	5.0

Stand Name: Dry Hill East

Watershed / Sub-watershed: Ryan & West-Whately Reservoir / Ryan & West-Whately Shore

Special water quality concerns (for stands within a reservoir watershed):
normal avoidance of erosion and introduction of sediment into streams.

Silvicultural Status (options are "suitable" or "not suitable"): suitable (except as noted in an included wetland area).

Overstory: Forest Type and Condition: This stand encompasses all the DPW land located between Dry Hill Road and the Ryan & West-Whately Reservoirs that is not generally too steep or too wet or too overgrown with vines to manage or is not already included in Stand 14; this stand is defined this way in order to define an area suitable for silviculture (as opposed to adjacent Stand 14, which is not suitable). The presence or absence of interfering vines or other vegetation will determine the exact boundary between these two stands on the ground.

There are really three main forest types included in Stand 13: (1) in the very northern part, on a well-drained terrace, the forest consists of small-medium sawtimber sized red oak of good quality and vigor and black birch (also of good quality and vigor), sometimes with and sometimes without mid-story hemlock; in areas lacking oak, small openings could be made to establish younger trees; (2) the central part of the stand consists of a dense grouping of large, tall, quite old white pine of old-field origin, mixed with scattered, but large red oak. The fringe areas of this section often lack pine altogether – and this is typically on moister ground, or along the western boundary – but have sugar maple of good vigor and small sawtimber size (but sometimes as large as 24") mixed with red oak, white ash and yellow birch sawtimber. The terrain throughout this section is a combination of well-drained terrace and rolling minor knolls; desirable management for this section would include creating small openings within the dense pine (but preserving the most stable or well-formed trees) as well as releasing small patches of sugar maple seedlings; (3) the southern section (which includes some wetland which is described below) stands out for its widespread and often dense beech, ranging in size from 20"+ sawtimber all the way down to thick pole-trees down to thick, head-high saplings. Mixed in with beech are red oak and black birch, and sometimes sugar maple. Where moisture is somewhat elevated, though, there is not much beech, but more red oak, yellow birch, sugar maple and ash. Hemlock and pine are largely absent, as is black

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cherry; appropriate management would be limited to general control of scattered (and sometimes concentrated) grape vines and spot-occurrences of bittersweet (or rose, honeysuckle, etc.)

Starting at Dry Hill Road, just north of the traditional log landing and skid road (which runs atop an esker-type formation) there is a low-lying, poorly-drained, hummocky, swampy area with more hemlock, red maple and yellow birch. This area is not suitable for silviculture (and cannot be improved by silviculture anyway).

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Altogether lacking in the northern section. Generally lacking in the central section, though there are small pockets of black birch saplings sometimes 10' tall (mixed with beech saplings) and sometimes up to 30' tall, and, notable, there are sugar maple saplings, some quite stout, along parts of the western boundary — any cutting in this area should try to work with/release these. In the southern section, the beech dominates the regeneration layer, but there are areas of black birch saplings.

Interfering native vegetation: Insignificant. This stand lacks the grapevines that are common in the southern portion of stand 14. Hayscented fern was found only in a light cover in a small area.

Other native understory vegetation (species and distribution): In a wet area at the far north end of the stand there was a dense cover of Christmas, New York and cinnamon ferns. Otherwise the ground layer was sparse, probably due to a dense midstory in most of the stand.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. The stand itself has essentially no invasive plants. One small barberry bush was seen in the south area. The adjacent stand 14 does have some multiflora rose and bittersweet, but not in high densities. The abutting Dry Hill Road is a potential seed source since vehicles use it regularly, but so far few invasive plants are growing along this road.

Soils (type, moisture, drainage and productivity): Mostly Colrain extremely stony fine sandy loam (with a minor component of Buckland — see Stand 14 soil section for a description of the wetter Buckland), and minor components of Westminster and Shelburne. This well-drained soil formed in glacial deposits derived principally from dark gray schistose material and impure limestone. With moderate to rapid permeability and fairly high moisture-holding capacity, this soil can produce good yields of timber. Site indices of 58 or greater for northern hardwoods, 65 or greater for upland oaks, 70 or greater for white pine, and 70 or greater for red pine.

For tree growth purposes: excellent, with elevated fertility in lower-slope positions, but good fertility throughout this stand.

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For logging purposes: Due to their moisture-holding capacity, these soils cannot be operated during wet times of the year; this becomes more critical in swales and along the bottom of slopes. Conditions must be dry or frozen to avoid excessive rutting, compaction, and root damage, and sometimes tops and poles must be laid down to form a mat.

General Habitat: This is a patchy hemlock-hardwood-white pine stand where the dominant canopy species are hemlock, red oak, white pine, sugar and red maple, beech and black birch. The pines tend to be 20" dbh and up, with the other species ranging from 5 to 20". In the south section, some of the red oaks reach over 22" dbh. A beech stand in the southern part of the stand had signs of recent feeding by bears.

The midstory is dense in many areas, dominated by hemlock in the north and by beech, black birch and other hardwoods (but not oak) in the south. Shrubs and ground vegetation were very sparse. Coarse woody debris was present in adequate amounts (1-10% cover).

Do wetlands occupy more than 10% of this stand? No.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes. Both are on the east edge of Dry Hill Road. VP 23 is a large shrubby wetland in a depression with no inlet or outlet. Breeding by vernal pool amphibians was not confirmed but is likely. The second one is VP 24. This one had wood frog tadpoles (an obligate vernal pool species) but also had an outlet that merges into a non-vernal-pool to the south which drains through a culvert under Dry Hill Road. VP 24 functions as a vernal pool even though it is not isolated, but rather is part of a bigger wetland complex.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): Avoid altering drainage or other aspects of the included wetlands (this will be accomplished by avoidance of silviculture).

Special risks to habitat: None.

Desired habitat modifications (options will vary, including "none"): Create more complex vegetative structure by thinning the canopy and midstory to encourage denser shrub and ground layers.

Historical/archaeological/contemporary: (1) frontage on Dry Hill Road; (2) various stone walls and runs of barbed wire fence; (3) on the adjacent non-DPW property there are barn foundations and a cellar hole from long-past agricultural settlement. These settlements would have been the creators and tenders of the large old sugar maples found in some areas.

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Management history: (Same as Stand 14) The southern part was cut in 1988; parts of the northern section were cut in 1991. These two areas fall into today's Stand 13 & Stand 14 and were managed as a unit. The division of these areas into two separate stands reflects current concerns about minimizing disturbance to wetter ground.

Desired future condition: (See Introductory section above for an overview) Maintain this type but free of vines and with the addition of areas of younger growth.

Recommended Management for the next 10 years: (1) in the northern section, where oak is lacking, small openings could be made to establish this section would include creating small openings within the dense pine (but preserving the most stable or well-formed trees) as well as releasing small patches of sugar maple seedlings; (3) in the southern section, appropriate management would be limited to general control of scattered (and sometimes concentrated) grape vines and spot-occurrences of bittersweet (or rose, honeysuckle, etc.)

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

Reservoir(s) Ryan & West-Whately Town(s) Conway, Whately & Williamsburg

Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	Volume growth rate (Mbf/yr)
14	BB	76.0	12.7	82	3.4	5.7	2.0	70 WP	12.3

Stand Name: Ryan Reservoir West — West-Whately Reservoir West

Watershed / Sub-watershed: Ryan & West-Whately Reservoir / Ryan & West-Whately Shore

Special water quality concerns (for stands within a reservoir watershed):

(1) avoid causing any disturbance on steep, eastern-shore escarpment that could cause increased run-off directly into the reservoir — in particular, this concern applies where seeps appear on the lower half of the escarpment (especially in the northernmost section); (2) avoid encouraging bittersweet (and other invasive plants) and grape vines that can damage trees and ultimately prevent new trees from growing.

Silvicultural Status (options are "suitable" or "not suitable"): not suitable (due to seepy/wet land; steep land heading down to the reservoirs; and substantial vines and risk of vines)

Overstory: Forest Type and Condition: Stand 14 includes all the DPW land located between Dry Hill Road and the Ryan & West-Whately Reservoirs that is not included in Stands 9 or 13. This land is generally too steep (escarpment faces) or too wet, or both, or mildly sloping but too wet, or, in much of the southern section, too overgrown with, especially, grape vines — following heavy logging in the 1980's — and likely to remain overgrown in the future, such that silviculture cannot be recommended. Past efforts to manage parts of this stand silviculturally have resulted in heavy vine growth (primarily grapes).

There is a lot of variability throughout this stand, but the overarching forest type is oak, beech, and black-birch, often of sawtimber size, often with a hemlock midstory. Sugar maple, white ash and yellow birch are scattered throughout where the soil is moister/richer/wetter. White pine is mostly absent, with a few large trees in the very northern and very southern part of the stand being notable exceptions. Red pine was planted, but is not really a monoculture, near the southwest edge of the West Whately Reservoir. These fairly tall trees are in the poor-vigor condition that is typical of most of the red pine across the watersheds, but the trees are spaced widely enough so that stout poles of red oak and bitternut hickory are able to share the overstory, and there is no real risk to water quality if these trees continue to decline and die (though there would be risk to water quality - in the form of both erosion as well as triggering a proliferation of vines - if these trees were accessed, cut and removed in a logging operation). In particular, some reservoir edge trees are overrun with large grape vines and vigorous bittersweet vines.

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On the seepy terrace that is the southern half of the stand, past heavy cutting (in the 1980's) (leaving impressive, large stumps of red oak, sugar maple and yellow birch) did give rise to a new understory of hardwood trees, with abundant witch hazel, however, in many areas these younger trees have been completely overtopped by, and bent over by, wild grapes, such that grapes are, effectively, the overstory in these areas, and there is little reason to think this will change.

On the slope down to West Whately Reservoir, where cutting was less intense, there are a surprising number of basswood trees – these are generally or large pole and small sawtimber size – and are found in a mixture bitternut hickory, poplar and elm, as well as black birch, yellow birch and red oak. This is to my knowledge the largest concentration of basswood trees across the DPW watersheds.

Throughout the stand, where hemlock occurs, it is usually of very rough quality and often shows advanced decline (presumably due to adelgid and scale). Most hemlocks of timber size were counted as pulp due to presumed internal defect. As with the red pine mentioned above, there is no net benefit expected to result from an effort to salvage these trees before they die altogether. The economic loss is minimal, and the impact to the ground would likely be substantial. Allowing any hemlocks to die in this stand will add valuable woody material to the forest floor.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Generally lacking throughout. Almost all the desirable hardwood saplings (mostly black birch) that formed after the cutting in the 1980's have been overrun by grape vines and are not viable.

Interfering native vegetation: Small grapevines (≤ 1 inch dbh) and scattered large grapevines are a serious problem throughout the section west of the West Whately reservoir, in some areas creating large pull-downs of formerly vigorous saplings. Any future cutting or other disturbance such as wind-throw or snow/ice breakage can be expected to cause a further release and expansion of grapes. Hay-scented fern was light to moderate in density in this same area. To the north, west of the Ryan Reservoir, hay-scented fern was essentially absent and the grapevines were far fewer.

Other native understory vegetation (species and distribution): The long northern finger of the stand had very little understory vegetation, but south of here the ground had a patchy dense cover of raspberry and a variety of ferns, especially evergreen woodfern, with lady fern, silvery spleenwort, Christmas fern, sensitive fern and New York fern.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 3 overall. The north long finger of the stand had essentially no invasive species. The south section had a few scattered small to large bushes of multiflora rose and a few small but dense patches of bittersweet. The

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bittersweet patches observed on the survey were estimated to be 700 to 800 square feet in area, with vines from 5 to over 25 ft. long. But also, there were large bittersweet vines along the southwestern edge of the West Whately Reservoir. The multiflora rose could probably be pulled by hand or with a weed wrench. The proximity of this stand to the reservoir could limit the chemical control options for these species.

Soils (type, moisture, drainage and productivity): Similar to Stand 14 in being mainly Colrain extremely stony fine sandy loam (with a minor component of Buckland), but with two important differences: (1) the area of Buckland is larger (several acres in the southern part), and (2) much of this soil is on steep, sometimes seepy, slopes down to the reservoirs and also down to Sanderson Brook, which means that erosion and sedimentation risks are much higher.

The Buckland extremely stony fine sandy loam is formed in glacial deposits of dark gray schistose material and impure limestone, has a hardpan at about 20" and is wet and seepy, staying wet in spring and becoming wet in the fall. The water-holding capacity is better than in the adjacent Westminster, and tree rooting may be deeper.

For tree growth purposes: Because of greater moisture throughout, this soil has very good fertility for tree growth, with site indices being about 5' greater. The drawback to tree growth is both the greater risk of tipping (off slopes and in wet areas) and the greatly enhanced abundance and vigor of destructive vines (bittersweet and grapes).

For logging purposes: Difficult. Given the increased risk of erosion due to the abundant moisture and steep slopes, the risk, and the difficulty of protecting soils and tree roots without the benefit of (ever-rarer) extremely frozen conditions, this soil is not well-suited for logging.

For tree growth purposes: excellent, with elevated fertility in lower-slope positions, but good fertility throughout this stand.

For logging purposes: Due to their moisture-holding capacity, these soils cannot be operated during wet times of the year; this becomes more critical in swales and along the bottom of slopes. Conditions must be dry or frozen to avoid excessive rutting, compaction, and root damage, and sometimes tops and poles must be laid down to form a mat.

General Habitat: The stand is made up of a patchwork of distinctly different vegetation. The southern part of the stand is about 20 acres of regenerating hardwoods (from cutting in the late 1980's) in the sapling to pole size. The species consist of yellow and black birches, sugar and red maples, beech, red oak and aspen, with a few hemlocks sprinkled in. In this area there is generally a light to moderate canopy of pole sized trees over a dense midstory of saplings. The midstory consists of the same species as the canopy with the addition of striped maple, ash and witch hazel. The dense saplings provide good habitat for grouse, which were observed here. Some browse and scat of deer was found, but not a lot.

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The knoll at the far north end of the stand had a canopy of hemlock and black birch with a few oaks. Most of these trees were 12" dbh or less.

The remainder of the stand, including the whole north section and the steep hillside adjacent to the West Whately Reservoir, has a closed, mostly deciduous canopy of hardwoods 8 to 18" dbh with a hemlock-dominated midstory below. There are also some pockets of white pines 26 to 28" dbh and red oaks 20-24".

The beeches in the stand, most around 12-16" dbh, appeared to be healthy, but the hemlock foliage seemed thin, possibly due to the elongate scale insect. Coarse woody debris was sparse in this stand.

Do wetlands occupy more than 10% of this stand? No, but the whole south portion is seepy and there are several streams flowing west to east down the steep slope into the reservoirs.

Were vernal pools identified/mapped for this stand? (if "yes", how many): No.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): If possible, allow dense brush to grow along shorelines for nesting birds, and allow any trees which fall into the water to stay there to create basking sites and aquatic microhabitat.

Special risks to habitat: The grape/bittersweet combo has the potential to create large canopy gaps if no efforts are made to limit these species. This would be especially deleterious since this stand is adjacent to the reservoir. Also, if storms intensify with global warming the streams running down the hill could cause significant erosion going straight into the reservoir. This could be exacerbated even more if the canopy along that steep slope were to open up.

Desired habitat modifications (options will vary, including "none"): Control bittersweet and grapes to prevent pulldowns and related erosion.

Historical/archaeological/contemporary: There is a significant water-powered sawmill complex with impressive stonework on Avery Brook just over the northern boundary of the stand in Stand 5 (Avery Brook West). On an 1871 map this mill is listed as "E.W. Sawmill". The brook was listed as "Sinkpot Brook" and also as "West Brook". (The term "West brook" was used until the early 1990's, and may still be in use.). A local history buff mentioned that this mill was the uppermost of a series (of seven) "privileges" on West Brook. The significant road to the mill (what we call Dry Hill Road from the south, and Waterworks Road from the east) is a reflection on the important economic role played by the mill (and West brook in general) at one time.

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On Sanderson Brook, alongside Williamsburg Road, there is also an old, though much smaller, mill site. There are various stone walls and traces of an old road at the top of the steep escarpment that runs along Williamsburg Road.

Management history: (Same as Stand 13) The southern part was cut in 1988; parts of the northern section were cut in 1991. These two areas fall into today's Stand 13 & Stand 14 and were managed as a unit. The division of these areas into two separate stands reflects current concerns about minimizing disturbance to wetter ground.

Desired future condition: A tall overstory of viable native trees that serve to protect the adjacent reservoir and mitigate possible sedimentation from regular run-off extreme precipitation (i.e. a forest that can serve the basic water-quality protection function of forests). This forest will be free of destructive vines, whether native grape or introduced bittersweet.

Recommended Management for the next 10 years: Control of vines. Though not feasible and perhaps not needed throughout the entire stand, vines should be controlled along the reservoir edge (approximately within 50') to limit the risk of vines pulling down trees.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

STAND DESCRIPTIONS

Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
15	RP	65.2	14.4	163	19.9	3.7	22.1	70 RP	10.6

Stand Name: Ryan North Red & White Pine

Watershed / Sub-watershed: Ryan Reservoir / Avery-Brook-East & Ryan Reservoir Shore

Special water quality concerns (for stands within a reservoir watershed): Poor health and anticipated continued decline of red pine plantations is likely to foster the continued spread of oriental bittersweet vines and native grapes, compromising DPW's ability to maintain a functioning forest canopy.

Silvicultural Status (options are "suitable" or "not suitable"): suitable

Overstory: Forest Type and Condition: Roughly two-thirds of the acreage tall red pine plantations with a sparse mix of native hardwoods (red oak, black birch, black cherry, sugar maple and bitternut hickory); about one third of the acreage is in tall white pine. Both red and white pines are generally 100' tall or taller. A third area, following a central swale with a nearly year-round high water table, is in 30-40' tall black birch, paper birch, poplar and other hardwoods with subdominant white pine; grapes are well-established. This area is a natural regrowth following a small old-field pine-hardwood overstory removal more than 15 years ago. In the upper end of this swale, sugar maple becomes abundant.

Both the red pine and white pine areas are well-stocked with timber, but differ considerably in health. Whereas the white pine is relatively vigorous, the red pine is just the opposite, exhibiting limited vigor. The low vigor of the red pine is readily evidenced by the thin, weak crowns. In some areas, tall red pines that were free to grow are now standing dead. Some of these died as recently as the 2011 growing season (these have dead needles still on them); others died in previous years (sometimes having lost, by now, all their branches and bark).

The poor health of the red pine is apparently not due (substantially) to overcrowding (this stand has been thinned on at least two occasions). Instead, the poor vigor in red pine seems to be attributable to a compounding combination of pathogens and pests, including a severe infestation of Diplodia tip blight/canker, with secondary infestations of bark beetles as well as armillaria root-rot fungus (aka. Shoestring root rot). These factors were determined in a January, 2011, site visit by DCR Forest Health Program Supervisor Ken Gooch, with Michael Mauri. No presence of red pine scale was found, although this is a worry, with red pine scale spreading in Massachusetts and causing rapid die-off of infected red pine stands. Given the poor health/vigor of the red pine, it

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is to be assumed that a red pine scale infestation would quickly cause widespread mortality. Given that even free-to-grow trees are in poor-health, there is no expectation that thinning would improve stand vigor (and, in fact, it could exacerbate the problem by creating additional inroads for armillaria (which infects red pine stands via freshly-cut red pine stumps). Instead, this stand should be regenerated, either exclusively by using natural-seeding to establish a native hardwood mix, or by doing this in combination with planting of a suitable conifer (possibly Norway spruce).

There is significant economic value that would be lost if the red pine is allowed to die in place. Challenges to recovering this value in the course of successfully regenerating the red pine areas would include the presence of aggressive bittersweet and grapes, especially on moister soils, as well as possible restrictions imposed, in some areas, by the presence of vernal pools.

The white pine is good health, though vigor is restricted due to overcrowding (thinnings have occurred in the past, but the overstory crowns have generally closed back together, indicating that it is time for another thinning. Individual white pine trees and overall vigor in white pine areas would benefit from thinning.

The mixed hardwood & white pine sapling area is vigorous but is partially overrun with grapes (to the extent that in some cases all the trees have been completely pulled down).

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Past thinnings did give rise, at the time, in many areas, to a flush of hardwoods, generally from seed, which are now tall saplings (10'-40' tall, 1"-3" in diameter). In some areas, beech is abundant, sometimes with hemlock and black birch. In some areas, black birch, yellow birch, and sugar maple are abundant. Some areas have no saplings. In general, these saplings are too tall and stringy to be released by cutting, and should be flush cut (if there is any logging) so that they can have a chance to resprout and start over. This is especially true of saplings 1" or greater. Given the presence of widespread of black cherry (mainly along certain lengths of stone wall, especially where moisture is better), it is assumed that there is an abundant black cherry seedbank that could be triggered by the creation of adequate (large) openings. Though there are no obvious seedlings/saplings of red oak and bitternut hickory, it is possible, either from seed or from very suppressed/browsed seedlings, that these species could become activated by cutting (letting light in to the understory and, in some cases, compressing nuts into the ground by virtue of driving logging equipment). Birches would certainly be abundant, from wind-blown seed, following any cutting.

Interfering native vegetation: Grape vines are common but not (yet) rampant, grapes are more common in the eastern half of the stand. Grape/ice pulldowns are patchy throughout the extensive pole/sapling stand west and north of Water Works Road. Hay-scented fern is generally absent while witch hazel and striped maple are present in very low amounts.

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Other native understory vegetation (species and distribution): Ground vegetation is typically ferns (evergreen wood, Christmas, lady, New York) along with bristly dewberry, goldenrod, raspberry, poison ivy, and spicebush. The density of these plants varies depending on how much of the canopy has opened up due to dead or fallen trees.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 2. Only a few, generally small, dense patches of invasives were found in this stand. An old landing along Water Works Road (just west of the southern boundary of stand 17) has a dense patch about 1000 square feet in size filled with tall bittersweet. Also along the road were one patch each of multiflora rose and bittersweet. Each of these patches was 100 sf or less. Besides the few patches, only occasional plants were counted of a variety of invasive species ranging from seedlings to large shrubs. The plants were multiflora rose, bittersweet, barberry, honeysuckle, black locust, autumn olive, and glossy buckthorn.

Soils (type, moisture, drainage and productivity): The soil type throughout the stand is Colrain stony, or very stony, fine sandy loam. This well-drained soil formed in glacial deposits derived principally from dark gray schistose material and impure limestone. With moderate to rapid permeability and fairly high moisture-holding capacity, this soil can produce good yields of timber. Site indices or 58 or greater for northern hardwoods, 65 or greater for upland oaks, 70 or greater for white pine, and 70 or greater for red pine.

For tree growth purposes: excellent, with elevated fertility in lower-slope positions, and diminished fertility at tops of slopes.

For logging purposes: Due to their moisture-holding capacity, these soils cannot be operated during wet times of the year; this becomes more critical in swales and along the bottom of slopes; also, the area north of the landing on the long "dogleg" running north along Waterworks Road is saturated by various seeps and is particularly wet. Conditions must be dry or frozen to avoid excessive rutting, compaction, and root damage, or tops and poles must be laid down to form a mat.

General Habitat: This stand is a mosaic of mostly red pine plantations, with some planted white pine (mostly east of Waterworks Road), interspersed with mixed white-pine-hardwood stands and black cherry. The red pine is sharply declining, as evidenced by poor crowns and narrow growth rings from core samples. Within about 10 years there is a good chance that much, or most, of the red pine will be dead or nearly so. In the mixed stands, the hardwoods consist of red oak, black, yellow and white birches, sugar maple, ash and black cherry. Many white pines are >22" dbh, while the other species are generally between 5 and 22".

Most of the stand has a robust midstory consisting of beech and striped maple under a layer of black birch, sugar maple, red maple that reaches to about half the height of the

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pinus. Regeneration at the shrub and ground level is sparse, limited to mostly beech and white pine.

There is one area about 3 acres in size where sapling hardwoods 1 to 6" dbh are the tallest layer. This sapling section had numerous grape/ice pulldowns in a patchy distribution throughout it, and grape vines in most trees. In the sapling section bittersweet was present but not dominant.

Because of the uniform size of the red and white pines, throughout the stand there were hardly any cavity trees or dead trees greater than 12" dbh. Coarse woody debris was variable, from sparse in many areas to abundant in patches where red pines had fallen or been broken due to windstorms.

Do wetlands occupy more than 10% of this stand? No, the soils here are generally dry.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes, Vernal pool 21 is along the western edge of this stand. This is a round pool about 85 ft. in diameter that on 5/19/2011 contained many thousands of wood frog tadpoles and about 50 egg masses of spotted salamanders. It is possible that Jefferson eggs were present too, but the eggs need to be examined more closely and earlier in the season to determine this.

Along the boundary with stand 16 is vernal pool 22 which had abundant fairy shrimp and about 12 spotted salamander egg masses.

Also in stand 16, between 250 and 350 ft. from stand 15, there are three very small possible vernal pools. They were found in the fall after the breeding season, and must be confirmed in a future breeding season.

A 5th pool to check in a future spring is located along the northern boundary of stand 15.

With at least 2 definite vernal pools and maybe as many as 6, it is safe to assume that amphibian movement occurs between these pools and into a significant portion of the upland in the western part of stand 15.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.):
None

Special risks to habitat: Introduction of invasive plants via Water Works Road, both on recreational, maintenance, and logging vehicles. However, evidence of recent vehicle use was not found.

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The likelihood of significant decline and/or dieback red pine over the coming decade, together with the absence of regeneration, could create a situation where invasive plants become more widespread and abundant.

Desired habitat modifications (options will vary, including "none"): Anticipate the loss of the red pine overstory by establishing and releasing a new, site-adapted overstory from native seed by using Silvicultural techniques to remove most of the red pines (but thin the white pines to encourage vigor), while using the opportunity to increase the amount of coarse woody debris.

Historical/archaeological/contemporary: (1) a pair of cellar holes and abundant stone walls (see map), (2) Waterworks Road is part of a main snowmobile thoroughfare; (3) the red pine stand is a man-made plantation

Management history: Apparently thinned in about 1960. Last thinned, apparently, in about 1986/1988.

Desired future condition: Vigorous, multi-aged, mixed-species stand that is effectively free of the unwanted influence of non-native and native interfering vegetation so that watershed protection functions of the forest can be sustained and, secondarily, so that timber can be grown and harvested over time, returning periodic revenue to the City and providing a range of habitat benefits. In this case, the desired future forest will combine areas of large, vigorous white pine with areas of young, vigorous mixed hardwoods growing in place of red pine.

Recommended Management for the next 10 years: Most of this stand is not infested with invasives (severity ranking = 2), and it seems within reach to control existing invasives through active measures, and control grapes as well, while concurrently pursuing silvicultural changes to the forest (if these measures are not pursued, it is likely that invasives and grapes will increase significantly). In the near future, a group and patch selection system would accomplish two goals: (1) remove significant areas of red pine, allowing these to regenerate to native hardwoods, and (2) thin areas of white pine in order to improve the vigor of the pine areas overall.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
16	HH	130.3	12.5	127	6.6	10.8	9.5	65 WP	21.1

Stand Name: Ryan Reservoir North Oak-Hemlock

Watershed / Sub-watershed: Ryan Reservoir / Avery-Brook-East & Ryan Reservoir Shore

Special water quality concerns (for stands within a reservoir watershed):

Avoiding any increase in runoff into Avery Brook, either directly or through its tributaries, as well as avoiding any increased runoff into Ryan Reservoir directly.

Silvicultural Status (options are "suitable" or "not suitable"): suitable

Overstory: Forest Type and Condition: Hemlock, red oak and black birch are abundant throughout, with white pine showing a more limited, clumped distribution. Ash is common, and to a lesser extent sugar maple and yellow birch, where the water table is near the surface — this is a generally sandy, somewhat droughty soil, and these species seem to "follow" the moisture.

The red oak is well-established and well-formed, with large crowns. Size and form of the red oak "follows the moisture" as well, with the largest, tallest oaks found on the steep west-facing slope looking down on the northern half of Avery Brook; the red oak becomes somewhat rough and scraggly on the dry, shallow ridgetops. Between these extremes there is considerable variability. This oak should be the basis for this stand going forward.

The hemlock is, in part due to droughty, ledgy soil, and in part due to its subdominant canopy position, often rough, branchy, and tapering, and may contain a lot of rot or defect. In some areas (especially the central northern swale) there are tall, well-formed timber trees. Along the middle section of Avery Brook there are pockets of quite large, quite tall old hemlocks. Only a few hemlocks were standing dead, and there were only a few areas with noticeably thinning crowns (due presumably to adelgid or scale).

The black birch also "follows the moisture", tending to be at best poorly-formed firewood with stem canker on the dry, upper slopes, and reaching impressive size and form (up to 26" diameter) where the moisture is better.

In general, the white pines are quite tall and of impressive timber size. Together with the red oak, these should be the basis for this stand going forward.

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The ash (timber and firewood) is well formed. It grows well on the wetter sites, and it is a shame that ash is forecast to succumb to the emerald ash borer within the foreseeable future. Even without this now pest moving eastward from the Midwest, ash has been struggling for decades (probably due to a combination of factors).

About 19 acres of this stand, in two larger chunks, are not suited for harvesting. About 9 acres along the edge of Ryan Reservoir is a steep escarpment face: this land is too steep for most harvesting methods — the exception would be a cable system; however, this system is usually not available for removing low-grade hemlock or firewood. About 10 acres along the upper part of Avery Brook is either too steep and seepy, or is actually part of the flat swale which is the Avery brook streambed, is not suited for harvesting due to the extreme wetness (which, with large, modern equipment, is hard to operate on without causing excessive damage). This limitation on the 10 acres is despite the existence of an old road cut, made by a small dozer but, quite possibly, following an earlier cart path, all along Avery Brook and on up into Conway State Forest. If ever the old logging system of a crawler-tractor (small dozer with a winch) returned, the question of logging here could be revisited.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Past cutting has established regeneration in many areas on a scattered, clumped basis. In between these areas, due mainly to hemlock shade, regeneration is altogether lacking. The regeneration occurs, typically, as one of the following types: well-formed black birch as tall saplings or even small pole trees that could become an important component of a future overstory if the grapes that are established in some places do not overwhelm them; black birch and beech; or mainly beech (and witch hazel) — which is not a desirable mix. To a very limited extent there is white pine (10'-15' tall, with black birch) and head-high red oak seedlings. The pine and oak could be released in future work, though attention will need to be paid to grape vines. The moose (prevalent here) may be a hindrance to the success of the oak (there are glades — i.e. gathering points — of heavy moose browse on hardwood saplings, and this is likely to increase). In general, this stand needs a decisive new effort to establish fresh regeneration and, where possible, an effort to release existing, viable regeneration.

Interfering native vegetation: Patches of hay-scented fern grow in some of the gaps in the hemlock forest but otherwise is a minor element in this stand. If sunny gaps open up, this species is expected to increase, but to what degree is unknown. Grapes are a problem in some places where where moisture is better,

Other native understory vegetation (species and distribution): An interesting finding in this stand was a 400 square foot patch of Northern prickly ash, *Zanthoxylum americanus*. This is an uncommon shrub, though it is not rare or watch-listed in Massachusetts. It is growing in the seep at the road intersection where several invasive species are also present.

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Along the shoreline is a 50 to 75 ft. band of saplings of gray birch, red maple, black birch, winterberry and highbush blueberry. In the rest of the stand the shrub layer contains only light amounts of hemlock and beech.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. Except for one small patch, the entire stand is essentially free of invasive plants. The one patch is located at the junction of the main road with a spur road leading to the water's edge. It is at a seepy area along the boundary of this stand with stand 15. This patch contains about 1000 square feet of multiflora rose in a moderate cover of small to large shrubs. It also contains a dense small clump of small barberry bushes and a small patch of bittersweet climbing into a tree. In a ditch on the other side of the road from these plants is a small patch of irises that could be yellow iris, *Iris pseudacorus*. Its identity can be confirmed during flowering season if the flowers are yellow. This is an invasive species that can form clonal colonies often displacing native irises and other wetland emergent plants. In this location it is a low threat because it is not near any other wetlands and there isn't much emergent vegetation in the reservoir.

Soils (type, moisture, drainage and productivity): Same as Stand 15. However, the range in fertility is wider, with greatly elevated along parts of Avery Brook, and reduced fertility at higher landscape positions (where the soil-depth to bedrock is greatly reduced.)

For tree growth purposes: Same as Stand 15 (but see note above).

For logging purposes: Same as Stand 15 (but see note above).

General Habitat: Hemlock is the most common and widespread species in the canopy of this stand. It is strongly predominant in the northern part, either in the canopy, midstory, or both. The steep slope bordering the reservoir is almost all hemlock. Red oak is also present in nearly all parts of the stand, but is much less abundant than the hemlock. Both these species have numerous individuals over 22" dbh as well as smaller sawtimber sized trees. Other common canopy species, generally large pole to small sawtimber size, are black birch, red maple, beech, white pine, ash, yellow birch and sugar maple. The canopy closure is around 70% or more.

The midstory is moderate to dense, always with a hemlock component, and often mixed with beech and other hardwoods. The shrub layer is light to moderate, also with mostly hemlock and beech and white pine in a few small areas. Because of the abundance of hemlock in one or more layers, the ground vegetation is sparse to absent. Overall there is adequate coarse woody debris and more large snags than in other stands. Many of these are dead hemlocks that may have died from the elongate scale insect, water stress or a combination of factors. In the far north part of the stand is a single-species grove of large hemlocks punctuated by gaps where standing or fallen dead hemlocks have given way to a dense growth of hemlock regeneration or of a mix of black birch and beech saplings.

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Recent and old beaver chewings were found along the shore and a bald eagle, which was apparently looking for fish, was flushed from a tree along the shoreline. A ruffed grouse was flushed from a patch of dense hemlock shrub.

Do wetlands occupy more than 10% of this stand? No. The stand is bordered on the west by Avery Brook, which flows directly into the reservoir, and the only other wetlands in this stand are some small intermittent streams and the one seep where the invasive species are located.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes, VP 22 had abundant fairy shrimp and about 12 spotted salamander egg masses. Three very small possible vernal pools (VPs 39 to 41) are located in the floodplain of Avery Brook. They were found in the fall after the biological season, and must be checked in the spring of 2012. Also, VP 21 is located in stand 15, just inside the boundary with this stand.

Are NHESP layers indicated for this stand? (if "yes", describe) No.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): The riparian corridor along Avery Brook.

Special risks to habitat: Thin foliage was observed on some of the hemlocks. Woolly adelgid or hemlock elongate scale, *Fiorinia externa*, were not directly observed, but the thinning could be due to either of these insects, which weaken the trees by sucking their sap. If these pests become well established here, it will radically change the stand composition. Based on existing midstory, the forest would go to mostly black birch with some beech along the reservoir's edge and to a more even mix of these two species in the north section.

Desired habitat modifications (options will vary, including "none"): Diversify the canopy to include more non-hemlock species, add structural diversity and increase regeneration

Historical/archaeological/contemporary: (1) various stone walls; (2) an old bridge abutment made of stones (still extant on the east bank, but not on the west); (3) two former wooden logging bridges across Avery Brook, one of which is now completely washed away (after Hurricane Irene, 8/2011), and the other is essentially a wreck washed partly downstream from its original location. Neither of these locations should be re-used for bridging (the west bank of Avery Brook, and the slopes leading down to it, are not very stable.); (4) snowmobile trail down to Avery Brook; (5) the old mill site on lower Avery Brook is described in Stand 5.

Management history: Definitely thinned in the past, but the date is uncertain. Based on the selective cutting of oaks in some areas, this cut may have followed the gypsy moth infestation of 1979-1981 (and thus may have included salvage of oak).

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Desired future condition: Multi-aged forest with a substantial component of mature red oak, and in places white pine, with two vigorous, younger generations of mixed hardwoods (i.e. black birch and other hardwoods).

Recommended Management for the next 10 years: A selection system on about 98 (of 130 total) acres that would establish new areas of regeneration, release existing areas, and generally reduce the hemlock volume by > 66% while retaining 90% or more of the red oak and white pine. This would be combined with control of grapes in selected areas (so that well-established existing regeneration can grow freely) and monitoring of grapes and potential invasives going forward. Skid/forwarder trails would be stabilized and in some cases re-routed to avoid wetter ground.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

Reservoir(s) Ryan & West-Whately Town(s) Conway, Whately & Williamsburg

Owner(s) City of Northampton DPW

STAND DESCRIPTIONS

Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index
17	BB	65.6	12.6	147	10.0	9.5	2.5	58 BB

Stand Name: Finney Brook

Watershed / Sub-watershed: Ryan Reservoir / Finney Brook

Special water quality concerns (for stands within a reservoir watershed): avoid any changes to the natural flow of water into and in Finney Brook by avoiding erosion and compaction

Silvicultural Status (options are "suitable" or "not suitable"): not suitable (due to significant, wet, sometimes steep, riparian areas)

Overstory: Forest Type and Condition: A fabulous mix of, quite often, old, even very old, trees, grouped together to capture Finney Brook and its immediate bordering land. The stand includes a mature sugarbush. The southernmost area of this stand is a beaver pond and surrounding shrub swamp and shallow marsh (with alder and cattails) — this area is about 4.5 acres. Sticking out of the middle of the beaver pond is an upright, cut stone that seems to fall on the town line. North of the beaver pond area, up to an east-west stone wall, there is a fantastic, old-growth-like area of tall, large hemlocks, with red oaks, ash, and other hardwoods. Numerous large trees have fallen in storms, often by uprooting. The terrain is low, hummocky, stony, and very close to the water table. By their size, height, and bark, it appears that almost all of these trees are quite old. If this is not an old-growth grove per-se (which it probably is not), it is definitely a very old second growth forest. Given their age and the wet ground, it is likely that many of these trees have serious internal defects that would detract from their timber value. Allowing the processes that are already in operation to continue will maintain this old-growth-like condition. The hemlocks do have elongate hemlock scale and, though they do not show major decline yet, they are, in all likelihood, going to be subject to the same fate as most hemlock in this area. If this does happen, there will be a dramatic number of new snags and, ultimately, downed logs. This will all be fine for the watershed.

Both elongate hemlock scale and hemlock woolly adelgid do spread, but (by wind and presumably by birds), but there is no reason to expect that cutting and removing infected trees will prevent a further spread throughout an area. There is a good chance that most of the other hemlocks in the surrounding area already are infected — even if only at a low, difficult-to-detect level. And even if all infected trees could be removed, there would be no way to prevent the ongoing spread of these pests from nearby areas with hemlock.

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To the north of the stone wall, there is hardly any hemlock. Instead, oaks, ash, and other northern hardwoods dominate. These trees are also quite large, and old, and occupy low, or mildly-sloping, wet or seepy ground.

On the uphill side of both the hemlock and oak area, on a long, seepy slope, sugar maple becomes much more prominent, with beech, and pignut hickory. Undoubtedly, some of these trees were used for tapping a long time ago. Despite this, there is probably some significant timber value here. This is a fantastic stand of sugar maple, with trees ranging from 10" to 25", and larger. The soil just beneath the leaf litter is quite black, suggesting elevated fertility, and it is no wonder that sugar maple has prospered here.

West of Old Phinney Road, the stand climbs from a low, wet area along Phinney Brook — this area is dominated by vigorous, large-pole-sized sugar maples — up a series of natural "shelves", each, seemingly, with its own forest type. First there is a large area of tall, large-firewood-sized paper birch and associated black birch, red maple and beech. Then, on the next shelf, the mix is dominated by pignut hickory, with sugar maple and other hardwoods, including red oak. The pignut hickory is generally riddled with canker and often rotten or completely broken off — a situation made worse by grapes and, possibly, the 2008 ice storm.

One shelf higher, the mix is dominated by red oaks with large crowns, with an in-filling of very scraggly hemlock, black birch and other hardwoods, including ironwood. Because this is the top of the land, where the soil is shallow, the oak timber quality may suffer from defect (mineral, or shake-effects of wind). But these trees are vigorous. Along the southern boundary, the stone wall comes to a sudden stop and, heading east, the land drops suddenly, then rises just as suddenly in a magnificent jumble of ledge and broken ledge, with porcupine dens. On top of this ledge there are 3 very old, large, weather-beaten red oaks that may be some of the parent trees of most of the other oaks around.

When I got to the top of the land (1/16/2012), 3 moose ran off. Many of the trees, especially on the upper half of the slope, are rough enough to have nesting cavities for squirrels, woodpeckers and fisher.

Throughout this stand there are many large trees. Some of the largest sizes noted (diameter) are as follows (but there may be other trees still larger).

Sugar maple — 38"
Yellow birch — 18"
White ash — 32"
Red maple — 25"
Bitternut hickory — 23"
Black birch — 29"
Red oak — 30"
Beech — 34"
Cherry — 21"
Basswood — 26"

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Hemlock — 35"
White pine — 45"

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Given the abundance of sugar maple in the overstory and the general run of rich soil, it is not surprising that sugar maple seedlings and small saplings are abundant in some areas. If deer and now moose browse were not to be feared, it would be possible to regenerate sugar maple in various areas (through silviculture, which is not intended for this stand).

Interfering native vegetation: The only plant in this category is grapevine. East of Water Works Road there were a few patches with large grapevines, but these were clumped in discrete groups, and it would be easy to cut most of them. West of that road there were areas with numerous grapevines ranging from 1 to 4 inches diameter. It would also be possible to cut these, but it would take longer since they are spread out over a large area.

Other native understory vegetation (species and distribution): The moist lowlands and the seepy upper slope of this stand have *Carex plataginea*, maidenhair fern, and silvery spleenwort. Together with the sugar maple and bitternut hickory these species indicate a rich mesic community. Christmas fern, lady fern and evergreen woodfern were also common in the moister areas. In the drier areas, ground vegetation was sparse, but included laurel, rattlesnake plantain, club mosses, herb robert, and partridgeberry.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level: 2. The eastern parcel is nearly free of invasives, the exceptions being just a few *Euonymus* seedlings and small isolated multiflora rose shrubs and a 10 x 20 ft. patch of *Phragmites* in a wooded wetland. AND, IMPORTANTLY, there is a lone but vigorous bittersweet vine getting started on a broken hemlock stub just upstream from the marshy wetland. This individual should be controlled as soon as possible, and the surrounding area thoroughly checked. Because of the time of year visited (late October) it could not be verified if the *Phragmites* is the native form or the non-native invasive form. In the western parcel there is a light but widespread presence of barberry, ranging from small to large shrubs.

Soils (type, moisture, drainage and productivity): Soils are broadly divided into two distinct groups: in the western section, the soil type is Colrain stony, or very stony, fine sandy loam (with a minor component of Buckland). This well-drained soil formed in glacial deposits derived principally from dark gray schistose material and impure limestone (see Stand 18 for further description of this soil).

The eastern section includes this soil type as well, but at the bottom of slopes where more water seeps out of the ground and eventually the soil type grades, successively, into two poorly-drained soil types: Cabot very stony fine sandy loam, and Shallow Muck. The Shallow Muck consists of 1'-3' of decomposed organic matter and is wet most, or

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all, of the year. The Cabot is formed in the same parent material as Colrain, but due to its landscape position and due to a hard layer at a depth of 10"-20", is poorly drained, is wet most of the year, and can collect and pond run-off from nearby upslope areas.

Stated site indices are lower than nearby soils, with 49 or less for white pine, and 45 or less for northern hardwoods. My observation is that these low site indices are more true for shallow muck than for Cabot (as evidenced by tall hemlocks and ash). A good way to think of this is that, generally, conditions for tree growth improve as you go upgradient, and that, given the extreme variability in micro-terrain within within this area, there are good growing sites for trees.

To capture the variability in this soil, and its potential, a site index of 58 for northern hardwoods (BB) will be used.

For tree growth purposes: generally less productive than nearby soils (but see discussion above).

For logging purposes: Very challenging. The western section could be partially accessed, from abutting property or from DPW land to the southwest, but the lower you go on the slope, the more prone the soil would be to damage from logging. The whole eastern section would be nearly impossible to operate on without causing significant soil damage (this could change someday if very frozen conditions prevailed and small equipment was available).

General Habitat: The slope and lowland on the east side of this stand along Whately Road are composed of a moist to wet hemlock-white pine-hardwood forest. Hardwood species in this section are mainly ash, yellow birch and black birch. Oak is mostly absent from this lower section. The rest of the stand is hardwoods, chiefly, black birch, white birch, red maple, sugar maple and bitternut hickory, with the latter two species becoming dominant in the far western part of the stand and some big oaks east of Water Works Road. The canopy is closed with most trees in the large pole to small sawtimber size. A light to moderate midstory of hemlock sometimes mixed with beech, black birch and sugar maple is in most of the stand. The shrub layer is very light, with a similar composition. The moist soils showed signs of woodcock feeding. Coarse woody debris is sufficient in most sections

Do wetlands occupy more than 10% of this stand? No, but Finney Brook flows the length of the stand, and at the north end of the reservoir fans out into a 4+ acre mix of wetlands with current, and presumably frequent, beaver activity. Habitat conditions here are expected to continue alternating from flooded to deep or shallow marsh, to wet-meadow to shrub swamp vegetation and possibly to red maple (ash & hemlock too).

Were vernal pools identified/mapped for this stand? (if "yes", how many): No.

Are NHESP layers indicated for this stand? (if "yes", describe) Yes, part of Priority Habitat polygon PH1271 occupies the far north end of this stand. Priority habitat relates to species listed under the Massachusetts Endangered Species Act (MESA) and

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can be related to plants or animals, including invertebrates. Priority Habitat polygons are the filing trigger for project proponents, municipalities, and all others for determining whether or not a proposed project or activity must be reviewed by the NHESP for compliance with MESA and its implementing regulations.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): The rich mesic forest should retain a closed canopy.

Special risks to habitat: In the lowlands grapevines may not be a problem because they are in discrete patches and bittersweet appears to be lacking. In the higher areas, grapevine is widespread so opening of the canopy by nature or by logging has a higher chance of creating grapevine thickets. Also, the lower part of this stand is next to Williamsburg Road which is a possible route of introduction of invasive plants..

Desired habitat modifications (options will vary, including "none"): Remove some of the grapevine but consider leaving some for wildlife food.

Historical/archaeological/contemporary: (1) stone walls; (2) an old concrete box culvert in the beaver pond area (possibly left over from reservoir construction or otherwise from a preceding road.

Management history: no recent management apparent; last logged probably > 100 years ago

Desired future condition: Maintain this type. Prepare to tolerate loss of hemlock and ash to incipient and incoming pests

Recommended Management for the next 10 years: monitor and control invasives (ESPECIALLY BITTERSWEET); investigate the phragmites to determine whether it is the invasive, non-native form

Growth Rate Method and Volume (see "Notes applying to all stands" above): DCR/Green-cert.

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Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index
18	WH	50.9	14.3	113	3.2	10.9	3.1	65 WP

Stand Name: Waterworks Road Northwest

Watershed / Sub-watershed: Ryan Reservoir / Finney Brook

Special water quality concerns (for stands within a reservoir watershed): XXX.

Silvicultural Status (options are "suitable" or "not suitable"): suitable

Overstory: Forest Type and Condition: A group of diverse sub-stands grouped together by proximity and common access along Waterworks Road and Old Phinney Road. About 6 acres, in the southern end (bounded by stone walls) are a white pine plantation with small amounts of red pine on the northern and southern fringes. As in other stands (cf. Stand 15), the white pine is doing well, but the red pine is not as vigorous (though it does not appear in as poor health as in Stand 15). Past thinning (at least one, if not two) has helped the white pine remain vigorous, but the stand is overcrowded again and would benefit from thinning. At the same time, it would be wise to cut out the red pine. Heights are good (2.5 - 3+ logs per tree) and quality appears good. Sizes range from 14" - 20" (rarely 24"). The red pine is smaller (12"-16"). This is a nice sub-stand of pine timber, but grapes are a serious problem, causing some overstory trees to lose their tops (perhaps in conjunction with ice). As a result, there are numerous tall snags, and many long trees on the ground.

Directly north of the plantation, there are 13+ acres of old-field hardwoods with scattered white pines. The pines are typically tall, sometimes large, and very rough, rarely with timber qualities. The hardwoods are a variable mix of red oak and black birch, with less paper birch, red maple, pignut hickory, and black cherry. The black birch trends to suffer from black birch necrotic canker (probably reflecting the sandy component of the soil). While many of the red oaks have stout trunks (up to 25") and large crowns, and appear vigorous, the other hardwoods are much smaller (mainly firewood size) and the quality/form is generally poor. One way to approach management here would be to use a patch-selection system, where openings up to 2 acres in size are interspersed with retention areas that may be thinned. The retention areas would be designed to keep most of the oak and tall pine; the openings would be focused in black-birch concentrations.

Downslope from this old-field area is about 10 acres of black-birch (mostly) and other hardwoods, of pole and small timber size (up to 16"). The birch is overrun with defect and rot, presumably from canker, or possibly there was a minor fire. This would also be

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a good area to open up patches, as described above, retaining concentrations of better-formed trees.

Down-slope from the north-south stone wall the forest mix is different, essentially an old northern hardwood stand, with very large red oaks (25"-30") with great form, crowns, and vigor, mixed with sugar maple and beech (of timber size, but smaller) with an in-filling of tall beech poles and saplings. The moisture is probably better in this area, and the black birch seems to have less defect. Over time, left to its own devices, this hillside seems headed toward beech. Management here would be incidental thinning to keep selected large trees vigorous by removing nearby firewood trees, generally.

The remaining section lies between Waterworks Road and Whately Road, and is essentially a stony shelf of land along Waterworks Road that then drops steeply, sometimes over ledge, down to the very top of Finney Brook. This forest is somewhat scraggly in appearance, owing to the midstory of hemlock and beech under a tall, pole-sized overstory of beech and other hardwoods. Along the stream there is ash and scattered elm. Management here would be incidental thinning to begin promoting vigorous, well-formed trees of any species.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Under the pine plantation there is a tall understory of black birch and other hardwood saplings that grew in after the last thinning. These are sometimes overtopped by grapes. These hardwoods would be viable regeneration if, in combination with a harvest, they were flush cut and the grapes were controlled. In the old-field pine-hardwood area, beech (abundant) is the main regeneration. Beech — not desirable — is the only common — often abundant — regeneration throughout the rest of the stand. Hemlock regeneration occurs mainly to the east of Waterworks Road.

Interfering native vegetation: Many grapevines are in the midstory in the pine plantation. They extend only a short way into the deciduous area to the north. Beech is a consistent component of the midstory, often in the absence of other midstory species and often dense. Other species that can be problematic, including hay-scented fern, are absent.

Other native understory vegetation (species and distribution): Because of a mostly closed canopy and/or midstory, and because of heavy browsing, the ground layer is very sparse, containing lowbush blueberry and clubmoss.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. Occasional individual barberry bushes were present in the pine stand, otherwise the stand was free of non-native invasives.

Soils (type, moisture, drainage and productivity): The soil type throughout the western half of the stand (uphill from the north-south wall) is Colrain stony, or very stony, fine

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sandy loam (with a minor component of Buckland). This well-drained soil formed in glacial deposits derived principally from dark gray schistose material and impure limestone. With moderate to rapid permeability and fairly high moisture-holding capacity, this soil can produce good yields of timber. Site indices of 58 or greater for northern hardwoods, 65 or greater for upland oaks, 60-69 or greater for white pine, and 70 or greater for red pine.

Below the wall, on both sides of Waterworks Road, soil is Westminster extremely rocky loam. This "droughty", "shallow" soil formed in layers of glacial material derived from gray-mica schist containing impure limestone, with dark-gray schist bedrock at a depth of about 18". The water table is high 7 - 9 months of the year, and this soil is subject to erosion. Overall, trees in this soil cannot develop deep root systems (due to high water tables and shallow depths to bedrock) and are often not windfirm. These soils are considered to produce "poor yields" of timber.

However, there is great variability within this broad categorization, and trees can and do grow well in some areas. Black birch seems to do quite well, but red oak can as well. Perhaps it is the shallow depths to the water table that seem to favor the growth of grapes and invasive plants (esp. bittersweet). According to the Soil Survey, "the growth of miscellaneous hardwoods and shrubs has to be controlled to prevent the overtopping of young conifers". If written today (50 years later), grapes and bittersweet should be included in this list.

Site index for northern hardwoods: 46-51, site index for upland oaks: 55-64, site index for white pine: 60-69. My own measurements (on this soil, but in other locations) indicate a site index of 70-75 for black birch and poplar.

For tree growth purposes: Cabot & Buckland: good or excellent. Westminster: despite problems (see above), growing timber is still a viable option for this soil.

For logging purposes: Due to their moisture-holding capacity, these soils cannot be operated during wet times of the year. Conditions must be dry or frozen to avoid excessive rutting, compaction, and root damage. Extreme care must be used to minimize rutting and erosion on Westminster soils; very frozen or very dry conditions must prevail. Skid roads must be properly drained off (water bars, etc.) and should be closed to unofficial vehicle use.

General Habitat: Most of this dry stand is hardwoods between 5 and 12" dbh. Red oak, beech, black birch, red maple with a little black cherry and white birch make up the hardwoods. Of the beech, some is blighted and some appears to be healthy. The red oaks and some white pine inclusions are up to 22" dbh. In the south end of the stand is a white pine plantation (with red pine on the north and south fringe) with the trees mostly between 14 and 21" dbh. In this plantation there is a heavy midstory of black birch and sugar maple that is above a sub-midstory of beech. In the rest of the stand there is a heavy to moderate midstory with the same species and structure. Sometimes only the beech layer is present. The shrub and ground layers are light, but when present beech is the prime species. Regeneration of red maple, red oak, and black cherry is

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occurring but most seedlings are less than a foot high due to browsing by deer or moose. The black cherry does not seem to be browsed as much.

Recent signs of bears feeding on beechnuts were observed, and there were lots of turkey diggings for beechnuts and acorns. There is adequate coarse woody debris in this stand.

Do wetlands occupy more than 10% of this stand? No.

Were vernal pools identified/mapped for this stand? (if "yes", how many): No.

Are NHESP layers indicated for this stand? (if "yes", describe) Yes, Priority Habitat polygon PH1271 occupies the northeast corner of this stand. Priority habitat relates to species listed under the Massachusetts Endangered Species Act (MESA) and can be related to plants or animals, including invertebrates. Priority Habitat polygons are the filing trigger for project proponents, municipalities, and all others for determining whether or not a proposed project or activity must be reviewed by the NHESP for compliance with MESA and its implementing regulations. At this writing, an information request has been sent to NHESP so that we may learn which species are indicated for this polygon.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): A 40" red oak (unusual in its girth) is found in the central area of this stand.

Special risks to habitat: Browsing is limiting regeneration to beech and black birch.

Desired habitat modifications (options will vary, including "none"): an experimental/research idea would be to fence off a small area in the north of this stand to assess the extent that browsing is limiting growth of other species. This location is especially good for this treatment because it lacks invasive species or even interfering native vegetation.

Historical/archaeological/contemporary: (1) cellar hole perched on a shelf of land that once had a nice view; (2) stone walls; (3) Waterworks Road and Old Phinney Road.

Management history: Pine area and section right along Waterworks Road thinned at least once; the uphill old-field area does not seem to have been managed in modern times

Desired future condition: Healthy, maturing or mature white pine, red oak, and other hardwoods in a multi-aged mix including patches of younger, free-to-grow trees.

Recommended Management for the next 10 years: a combination of thinning and group/patch selection (see more specific discussion above in "Overstory: Forest Type and Condition" section.

Growth Rate Method and Volume (see "Notes applying to all stands" above): DCR/Green-cert.

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Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
19	HH	45.7	15.0	185	7.8	15.3	15.5	70 WP	7.4

Stand Name (location): Conway Road Terrace (terrace and escarpment on east shore of Ryan Reservoir)

Watershed / Sub-watershed: Ryan & West-Whately Reservoir / Ryan & West-Whately Shore

Special water quality concerns (for stands within a reservoir watershed): avoid causing any disturbance on steep, eastern-shore escarpment that could cause increased run-off directly into the reservoir — in particular, this concern applies where seeps appear on the lower half of the escarpment (especially in the northernmost section)

Silvicultural Status (options are "suitable" or "not suitable"): suitable

Overstory: Forest Type and Condition: A diverse, dense, and interesting mix of native trees occurring in a range of sizes, from thick areas of saplings, to very large, old trees (sometimes decrepit or dead, such as a 40" hemlock stub 25' tall near the east-west stone wall.). Most abundant are timber-sized (and pulp-sized) hemlock and timber-sized hardwoods (primarily red oak, with less black birch and beech), but there is also a spatially-restricted concentration of very large white pine. Other hardwoods, not abundant, include white ash, black cherry, red maple and sugar maple. The hemlock seems to come in four sizes and growth-forms: very large and old, rough trees (scattered sparsely), very tall, mature timber (up to 25" in diameter), stout but suppressed trees with, at best, potential to be pulpwood, and very dense thickets (with hardwood saplings). The hemlock is generally limited to the flat, central terrain.

Many of the red oaks are quite vigorous and large (20"-25" diameter), with stout, large-branched crowns, though there are areas of younger, taller, pole-sized red oaks (mixed with other hardwoods). Though some of the other hardwoods are of timber size, many are firewood size and quality. The oaks are found throughout the stand, but tend to reach their maximum size and abundance, and probably their best timber quality, near the top of the escarpment and down the side of it. This is presumably due, in part, to elevated moisture availability in these sites.

The larger hardwoods (other than oak) may reach 15"-18" diameter. In scrubby, roadside areas, there are dense thickets of tall mixed-birch saplings, with poplar. On the southern end of the stand there are very tall, pole-sized trees (beech, black birch and red oak).

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As impressive as some of the hemlock and red oak is, some of the white pines are even more so, with (in a few cases) diameters of 45" and heights of 100'-120'. These trees appear to be vigorous.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: lacking throughout the stand (due to shade)

Interfering native vegetation: Notably, very little was found. Hay-scented fern was absent, and grapevine, striped maple, beech, laurel, and witch hazel were essentially absent.

Other native understory vegetation (species and distribution): Because of mostly closed canopy and/or midstory, and because of browsing, the ground layer is very sparse, containing lowbush blueberry and clubmoss.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 2. With the following exceptions, both next to the road, no invasive plants were seen in this stand. Near Conway Road there is a 25' x 25' patch of vinca and a 50' x 50' patch of goutweed. Both patches are 75-100% invasives cover. Also, 1 small autumn olive bush was found at the more northern of 2 parking pullouts.

Soils (type, moisture, drainage and productivity): The bulk of the soil (the entire terrace) is Merrimac fine sandy loam. This soil is very well-suited for both tree growth and tree harvesting, and erosion potential is minimal.

The Merrimac series consists of deep, somewhat excessively drained soils formed in glacial outwash deposits derived from granite, gneiss and schist. Lacking a drainage-restricting fragipan, rooting depth can be as deep as 60". These soils are underlain by coarse sand and gravel at a depth of about 2 feet. Notably, the pines growing on this soil in this stand are especially tall.

For tree growth purposes: very good, with site indices of 70 for white pine; 65 or more for red oak; and 58 or more for northern hardwoods. Both pine and hardwoods grow well here (as does hemlock).

For logging purposes: good — much of this stand is on sandy, well-drained soil that is suitable for logging at most times of year. Starting at about mid-way down the steep escarpments, however, seeps pick up where the seasonal water table leaches out of the ground. These areas are erosion-prone and not suited to logging, unless long cables are used to winch trees up to higher slope positions.

General Habitat: The canopy of this densely shaded stand contains hemlock, white pine, black birch, red oak, red maple and a little white birch. The trees are generally less than 18" dbh but some of the red oak reaches up to 22" and some of the white pine

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reaches up to 26". Most of the stand has a dense midstory of hemlock. Ground and shrub layer are basically absent, but coarse woody debris and small cavity trees are abundant. There is a beech stand along the south-facing slope of the small inlet at the south end of the stand. The beeches here are in the small sawtimber size and appear to be healthy.

Browse was not noticed in this stand, but that could be because low vegetation was so scarce. It's possible that deer and moose are infrequent in this stand since it is separated from surrounding land by both the Ryan Reservoir and Williamsburg Road.

Do wetlands occupy more than 10% of this stand? No.

Were vernal pools identified/mapped for this stand? (if "yes", how many): The terrain has many irregularities, similar to stand Ryan/West-Whately Stand 9, but no vernal pools were found.

Are NHESP layers indicated for this stand? (if "yes", describe) Yes, most of this stand is included in the Priority Habitat polygon PH990. Priority habitat relates to species listed under the Massachusetts Endangered Species Act (MESA) and can be related to plants or animals, including invertebrates. Priority Habitat polygons are the filing trigger for project proponents, municipalities, and all others for determining whether or not a proposed project or activity must be reviewed by the NHESP for compliance with MESA and its implementing regulations.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): None.

Special risks to habitat: The steep slopes facing the reservoir would be prone to erosion if excessive trees are removed or blown down.

Desired habitat modifications (options will vary, including "none"): This could be a good place to try to regenerate oak or pine due to its dry soils, lack of invasives and potentially low activity by browsers.

Historical/archaeological/contemporary: (1) various lengths of stone wall (see map); (2) quite old tires and other trash (south of east-west stone wall); (3) old cart paths including some cut into hillsides

Management history: no apparent history of forest management

Desired future condition: Vigorous, multi-aged, diversely-structured mixed-species stand providing optimal watershed protection functions and, secondarily, allowing timber to be grown and harvested over time so that periodic revenue can be returned to the City, while providing good wildlife habitat.

Recommended Management for the next 10 years: All in all, given the forest type and condition, the excellent access, and the good terrain (on about half of the lot), this

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is an excellent stand to manage in a way that would further diversify forest structure. On the spectrum from immature to mature, this stand is weighted heavily toward mature. This creates an opportunity to establish an immature component. A shelterwood-type cut, which, stand-wide, lets light into the understory to establish seedlings, but which also creates small openings that can regenerate more rapidly (and diversify structure) would fit well here — but only on the terrace and very upper part of the escarpment. The mid- and lower slopes should be kept out of harvesting (to avoid causing erosion).

A follow-up cut, probably beyond the 10-year window of this plan, would work to further diversify structure while releasing established seedlings in groups or patches.

Any harvesting is contingent on compatibility with NHESP habitat indicated for this stand. Typically, harvesting is not precluded by NHESP/MESA rules, but sometimes restrictions are implemented (in conjunction with obtaining a CH 132 Forest Cutting Permit). An information request to determine which species/habitats are indicated is in process.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
DCR/Green-cert.

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Stand	Type	Acres (GIS)	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
20	WH	108.3	12.9	108	6.0	8.5	13.6	65 WP	17.5

Stand Name (location): Poplar Hill (between Whately Road and Poplar Hill Roads)

Watershed / Sub-watershed: Ryan Reservoir / Finney Brook

Special water quality concerns (for stands within a reservoir watershed):
avoid causing erosion into Finney Brook, a direct tributary to Ryan Reservoir.

Silvicultural Status (options are "suitable" or "not suitable"): suitable

Overstory: Forest Type and Condition: Highly variable mix of shifting combinations of white pine timber and pulp (mostly of old-field origin), hemlock timber and pulp, and a hardwood mix dominated by black birch, with paper birch (and, in wetter places, yellow birch), red maple, sugar maple, and red oak, and, in some dry areas, beech (where beech is abundant, it tends to have severe beech bark disease), and in some wet areas, ash. Tree sizes range mainly from large poles to sawtimber, with a few small patches of tall black-birch saplings 3"-6" in diameter. There is also pitch pine, in surprising quantity, 12"-17" in diameter, scattered through the southern end of the stand. It is surprising to see this amount of this normally fire-dependent species that is more typically found on gravelly outwash soils.

Some areas contain no pine, and some areas contain no hemlock. Overall, by volume, white pine timber occurs at a roughly 3:1 ratio to hemlock. Total pitch pine volume is insignificant.

Overall, most trees are between 8" and 15" diameter, with scattered trees up to 28", and a few relic trees up to 35".

In some cases, the pines are quite tall (100' or more). The timber quality of the pine is highly variable, ranging from rough, multi-stemmed, large-branched "old-field" trees to tall, well-formed trees with nice timber features. The quality of the hemlock is mixed, and many of the timber-sized trees may have internal defects. Though not prevalent, the quality of the red oak is good; the stems are not particularly tall (crowns branch out after about 1.5- to 2 log-heights), but stem quality is good.

The black birch varies in quality from some scraggly old-field trees to much straighter stems that grew amidst hemlocks or dense mixes of hardwoods. Overall, black birch will probably become even more prominent in this stand over the foreseeable long-term. Whereas hemlock will probably become much less so (due either to harvesting, or loss due to pests, or both). Pine and oak will probably not be as abundant as they are now,

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since neither is likely to be recruited into regeneration mixes in great numbers, though this can be attempted.

Sugar maple occurs on a limited basis, in pockets of elevated fertility.

In the central, southern part of the stand, the headwaters of the minor, seasonal stream fans out into a broad, stony, mossy swale with numerous tipped trees, and then fans out further into a broad swamp. Most of the ash is found in this area, along with an abundance of red maple, along with pine and hemlock. This area should not be logged.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory: Generally lacking. Desirable regeneration that could be released is rare, and usually takes the form of small pockets of tall black birch saplings or small poles that were created by openings from previous logging. Otherwise, regeneration is either entirely lacking (due to hemlock shade), or is mainly suppressed hemlock, with or without beech, or is mainly beech and striped maple (under white pine concentrations), or is a "sea" of head-high white pine saplings that are very suppressed and may never be able to be released.

Interfering native vegetation: Essentially absent. No witch hazel or hay-scented fern were seen. Striped maple was only lightly present (but especially under old-field white pine overstories). The only potentially troublesome species were beech and grapes. Beech was a common but not dominant species in the canopy and midstory (except under old-field white pine overstories, where it is thick). A few grapevines were seen at one spot, and a complete grape pulldown occurred in the NE corner; also, the cellar hole is surrounded by grapes) and bear scat containing grape seeds was also found. Grapes are abundant on nearby properties on the east side of Poplar Hill Road (though the soil type may be richer there), and would presumably increase with any cutting.

Other native understory vegetation (species and distribution):

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 1. Except for 2 small autumn olive shrubs at the parking pullout, the only other invasives found in this stand were in the wetland at the south end. Here, about a dozen barberry bushes ranging from small to large in size, were growing. None were seen outside the wetland, but the heavily logged property to the south had more barberry which could be a seed source.

Soils (type, moisture, drainage and productivity): The soil type throughout the stand is Colrain stony, or very stony, fine sandy loam. This well-drained soil formed in glacial deposits derived principally from dark gray schistose material and impure limestone. With moderate to rapid permeability and fairly high moisture-holding capacity, and good rooting depths, this soil can produce good yields of timber. Site indices of 58 or greater for northern hardwoods, 65 or greater for upland oaks, 70 or greater for white pine, and 70 or greater for red pine. If stones are removed, this soil is actually suitable for hay,

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tillage and orchards. In reality, the pattern of shelves, knolls, swales, and exposed ledge provides for a wide array of micro-soil types, with a range of properties, including sandier soils more suited to pine, and richer, moister soils suited to both hardwoods and pine.

For tree growth purposes: excellent.

For logging purposes: Due to their moisture-holding capacity, these soils cannot be operated during wet times of the year. With good road design and judicious timing of logging, limitations to operability are slight.

General Habitat: Most of this stand has a hardwood canopy with a dense midstory of hemlock, or of hemlock mixed with beech or striped maple. The most common canopy hardwood is black birch, followed by beech and red oak. In patches of the southern part of the stand, this species mix changes to white pine and black birch in the canopy with a dense deciduous midstory of beech, black birch, and red maple. Because of the closed canopy, the dense midstory, and browsing, the shrub and ground layers are sparse. The size of the hardwood canopy trees is generally 8 to 12" dbh, with the pines and oaks up to 18 or 20" dbh.

Do wetlands occupy more than 10% of this stand? No. There is one small forested wetland at the south end of the stand. Vegetation includes foamflower, evergreen woodfern and cinnamon fern. It also contains several barberry bushes.

Were vernal pools identified/mapped for this stand? (if "yes", how many): Yes. VP 42 is about 100 x 20 ft in size. This potential vernal pool was found in the fall, so it needs to be checked again in the spring.

Are NHESP layers indicated for this stand? (if "yes", describe) Yes, Priority Habitat polygon 1271 occupies part of this stand west of Williamsburg Road. Priority habitat relates to species listed under the Massachusetts Endangered Species Act (MESA) and can be related to plants or animals, including invertebrates. Priority Habitat polygons are the filing trigger for project proponents, municipalities, and all others for determining whether or not a proposed project or activity must be reviewed by the NHESP for compliance with MESA and its implementing regulations.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): None.

Special risks to habitat: None.

Desired habitat modifications (options will vary, including "none"): Reduce browsing by allowing hunting. This, combined with a selective harvest, may help restore needed regeneration.

Historical/archaeological/contemporary: (1) cellar hole on Poplar Hill Road; (2) various runs of stone walls and wire fence; (3) old road cuts for logging useable (if modernized) as modern-day log landings, (4) a snowmobile trail

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Management history: Thinned about 20 years ago or so based on stumps and old, narrow skid trails (no record found).

Desired future condition: (See Introductory section above for an overview) Same as Stand 19 (Vigorous, multi-aged, diversely-structured mixed-species stand providing optimal watershed protection functions and, secondarily, allowing timber to be grown and harvested over time so that periodic revenue can be returned to the City, while providing good wildlife habitat.)

Recommended Management for the next 10 years: (1) Under the general heading of "improvement cut", modernize/re-establish access (one or two landings) and conduct a harvest that will focus on cutting firewood, softwood pulp, and hemlock timber, using approaches from group and patch selection, shelterwood, and thinning while concurrently controlling grapes (2) blaze and paint north and south boundaries; (3) monitor post-harvest for interfering vegetation (esp. grapes and possibly bittersweet and beech) and control if necessary; (4) establish rules (if any) for use of snowmobile trail

Growth Rate Method and Volume (see "Notes applying to all stands" above): DCR/Green-Cert rate.

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Stand	Type	Acres	Size (MSD")	Basal Area (ft ² /ac)	Mbf per acre	Cords per acre (wood)	Cords per acre (pulp)	Site Index	DCR Stand growth (Mbf/yr)
21	GR	18.7	N/A	N/A	N/A	N/A	N/A	N/A	0.0

Stand Name: Ryan & West-Whately Dams

Watershed / Sub-watershed: Ryan & West-Whately Reservoir / Ryan & West-Whately Shore

Special water quality concerns (for stands within a reservoir watershed):
Avoid any direct sediment or chemical inputs into Ryan and West-Whately Reservoirs.

Silvicultural Status (options are "suitable" or "not suitable"): not suitable

Overstory: Forest Type and Condition: This stand includes a number of distinct cover types, with much of the land area (about 7.0 acres) taken up by maintained grass below and on the West-Whately Reservoir dam, and all along the eastern shore of the West-Whately Reservoir, and below and on the Ryan reservoir dam.

Within the grassy area there are a number of scattered trees as well as a central grove (about 0.7 acres) of red pine of medium height. Although at first glance this red pine looks better than other red pine across the watersheds, it is not in very good health, with tops that are somewhat thin and stunted. The understory of this small grove is full of sugar maple, red oak and black cherry seedlings and small saplings, many which are sprouts (re-sprouting) from landscape maintenance. These sprouts are vigorous and will likely thrive if the red pine overstory is cut, as long as grape vines (which are present) are controlled. The ability of the hardwoods to resprout may come in handy if the red pine overstory declines further. A decline or die-off of the red pine would not be a water-quality concern (the hardwoods in the understory are already occupying the site), but it might be an eyesore to the public. However, by the time this happens, the public may be much more accustomed to seeing dead trees, given the widespread decline of hemlock.

On the south side of Williamsburg Road (below the West-Whately Reservoir dam) there is a small triangle of mature hardwoods (about 0.6 acres), bounded to the west by West Brook, a stony swift stream, with mostly red oak (quite large) and sugar maple, but also white ash and basswood. This is a rich site. The overstory is vigorous, and there is an abundance of stout sugar maple saplings in the understory, with elm closer to West Brook. Grapes are present, but only minor at this point. There is a small patch of yew (Canada yew) in the understory, which has not been observed anywhere else. There

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seems to be evidence of unauthorized camping here. No management is needed here, but it would be a good idea to cut back any grape vines.

On the east side of Ryan Reservoir there is a 9.0-acre terrace, partly fenced in, that apparently was heavily disturbed during the creation of the dam — it may even be partially constructed. The vegetation is best characterized as “an absolute thicket” of autumn olive (a non-native invasive), with bittersweet, barberry, and multiflora rose, under a thin overstory of gray birch, poplar, and sometimes paper birch. These trees are 30'-60' tall, ranging from 3"-8" diameter. Sometimes, the overstory has been pulled down by grapes or damaged by ice, injecting even more vigor into the shrubby understory. Given that gray birch and poplar are weak, short-lived trees, there is little hope of long-term shade helping to push back the invasives. This terrace poses a significant challenge. The only possible management would be a decisive clearing and control of non-natives, with re-vegetation options ranging from planting Norway spruce to maintaining early successional habitat to converting to grass.

On the west side of the West-Whately Reservoir, on about 0.9 acres of steep, seepy, rich soil, there is a mix of hemlock, yellow birch, sugar maple, and other hardwoods, with scattered white pine. Logging about 20 years ago removed many of the larger trees (pulling them back up the slope), leaving a mix of larger hemlocks and medium sized hardwoods and hemlocks. Most of the hemlocks are close to complete mortality due, apparently, to the hemlock scale. Some have died, and some have snapped off. Left to its own devices, this process will create an interesting, complex forest structure (there is no reason to try to salvage the hemlock, and logging on this site is very risky). Both bittersweet and grapes are present here, though, and could thrive on this soil. Recommended management would be to control the invasives so that normal forest processes can operate.

A remaining area, about ½ acre, at the north end of the West-Whately Reservoir, is a tangle of vegetation with a strong component of autumn olive, some of which was recently cut back (but cutting won't kill it). Trying to decide what to recommend here really ties back to a basic, perhaps unanswerable, philosophical question of how, if at all, will non-native invasives be tolerated. If the level of tolerance is zero, then these invasives should be controlled. Otherwise, no action is recommended at this time.

Understory:

Desirable Tree Regeneration (species and distribution) for future overstory:
Present in two parts of the stand (see above)

Interfering native vegetation: A small amount of grapevine in places; but certainly grapes could thrive here.

Other native understory vegetation (species and distribution): The small red pine plantation is very interesting because this is possibly the only site on the Ryan & West-Whately land where browsing hasn't significantly affected the understory. The road, reservoirs, and mowed grass have probably kept deer and moose away, and as a

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result this serves as an example of the type of regeneration that might appear under similar conditions if deer were excluded. In addition to hay-scented fern, there is a dense growth of goldenrod, oak, blackberry, red osier dogwood, autumn olive, red maple and some grapevine.

Non-native invasive vegetation (species, distribution/severity) (see "Notes applying to all stands" above): Severity level 4. This designation is an imperfect fit for this stand because much of the stand is grass, therefore not intended for silviculture. But severity level = 5 north of the fence that extends east of the dam, autumn olive is omnipresent, autumn olive has a nearly 100% cover of large shrubs. South of the dam invasive plants are kept in check by mowing of the grass, but the border of mowed shrubs along the outlet stream consists mostly of invasives, namely autumn olive, bittersweet, multiflora rose and honeysuckle. If mowing were to stop, these plants would definitely run rampant. A small patch of Phragmites is located along the shoreline of the lower reservoir. It is interesting to note that the small red pine plantation in the southern tip of this stand is, surprisingly, low on invasives. See section above.

Soils (type, moisture, drainage and productivity): To the west of the West-Whately Reservoir, and to the east of Ryan Reservoir, the soils are listed as Westminster extremely rocky loam, a soil that is common across the watershed (See Stand 1). West of the West-Whately Reservoir, this is a rich but seepy and fragile soil, poorly suited for logging (unless very dry or frozen conditions prevail) and difficult to maintain and stabilize roads on, but very fertile for tree growth (and grapes).

East of Ryan Reservoir, the soil appears heavily altered (by the construction of the reservoir) and may bear little resemblance to the original soil (the soil survey pre-dates the reservoir). It is hard to say what the properties are, though the soil does seem adequate for tree growth, with minimal erosion risk other than on the steep bank.

The remaining soil is listed as Colrain, another soil that is common across the watershed (see Stand 2). This soil is well-suited for tree growth and is suitable for logging, with minimal risk of soil damage or erosion as long as conditions are stable (dry or frozen). Most of this soil type in this stand is in mowed grass.

General Habitat: There are two sections of this stand. North of a chain link fence that extends east of the dam, the land is forested or shrubby. The trees are 1 to 10 inches in diameter, consisting of black, white, and gray birches, pin cherry, white pine, hemlock, and aspen. Underneath is a light midstory of white pine and hemlock. Autumn olive is present throughout and gets extremely dense in the south of this section.

South of the dam is mostly a mowed grassy area through which flows a rip-rapped outlet channel from the reservoir. The grassy area could potentially be used for nesting by turtles emerging from the lower reservoir, but the turf is fairly dense and might be difficult for turtles to excavate. The habitat value of the grassy value is low because it is kept mowed short and excludes vegetation that provides cover.

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Sprinkled through the grassy area are a handful of open-grown red pines about 20-30 ft. high. These are no doubt attractive nesting sites for a variety of birds. Also present is the small red pine plantation which could be used for roosting by owls and raptors.

Do wetlands occupy more than 10% of this stand? No.

Were vernal pools identified/mapped for this stand? (if "yes", how many): No.

Are NHESP layers indicated for this stand? (if "yes", describe) Yes, Priority Only the very northernmost tip of this stand is part of Priority Habitat polygon PH990.

Other Special Habitat (elements to preserve) (e.g. tall ledge outcrops, etc.): An outstanding talus slope is located at the very northern tip of this stand at point 87-09. The boulders are up to 8 ft. across, with drill holes hinting that they were remnants from the construction of Williamsburg Road. This collection of boulders has numerous large crevices that would serve as excellent sites for turkey vulture nests. A much smaller collection of huge boulders is located at point 87-07 and could serve the same function.

Special risks to habitat: Lack of regeneration due to autumn olive.

Desired habitat modifications (options will vary, including "none"): Control autumn olive in north section.

Historical/archaeological/contemporary: the Ryan & West-Whately Dams are significant public works infrastructure.

Management history: None, other than logging west of the West-Whately reservoir (see above).

Desired future condition: Ideally, this stand would be free of non-native invasives and any undesirable effects of grapes.

Recommended Management for the next 10 years: If desired, restore the 9.0 acre terrace and control other invasives in areas mentioned above.

Growth Rate Method and Volume (see "Notes applying to all stands" above):
No appreciable growth assumed.

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Explanation of Silvicultural Methods

“Silviculture” is the body of ideas and practices used by foresters to shape the forest. Ideally, the forester will mark the silviculture (by painting trees to be cut). A crucial aspect of success is to find a logger who is willing and able to carry out the marked cutting as the forester intends.

To the landowner: recommended silvicultural methods for your particular forest stands are referred to in Stand-level management practices on subsequent pages and are drawn from the following list, which is based on (proposed) Chapter 132 (Forest Cutting Practices Act) regulations. Silvicultural methods are broadly divided into two groups, intermediate cuts and regeneration cuts. Intermediate cuts focus on improving growth existing overstory trees. Regeneration cuts focus on establishing and promoting new stands of trees. Please note that in considering or implementing any of the methods described below there are numerous factors that must be contemplated and addressed, such as competing vegetation, browse, optimal logging systems, woodlot access (roads, landings, etc.), time of year and ground conditions, and measures to protect state-listed species, watercourses and wetlands, etc.

Intermediate Cuts

Thinnings & Improvement Cuts: these reduce the density of trees to enhance the vigor of residual trees. An improvement cut is usually an initial treatment that removes trees of low quality or undesirable species. Thinnings are subsequent adjustments to continue focusing growth on selected trees. Intermediate cuts that are overly “heavy” (i.e. cuts that let in a lot of light) are classified as regeneration cuts: *proposed* (pending as of this writing) basal area thresholds are as follows: BA = 100 for conifer stands, BA = 60 for hardwood stands, BA = 80 for conifer-hardwood stands.

Regeneration Cuts

Regeneration cuts use existing stands of trees to create future stands of trees. The future stands of trees can be of a single age (known as “even-aged”), two ages (two-aged) or of three or more ages (uneven-aged). In regeneration cuts, particular attention is paid to seed sources and/or existing seedlings/saplings for the future stand, light conditions in the understory, and interfering factors (e.g. native or non-native competitor plants in the understory, browsing by deer or moose, etc.). A regeneration cut can be sudden and decisive (clearcutting, seed-tree, coppice, single-cut shelterwood), or a regeneration cut can be staggered (multiple cut shelterwood), or ongoing (uneven-aged, i.e. “selection system” or “irregular shelterwood”).

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Even-aged Regeneration Methods

Clearcut: All established trees are removed to allow new trees to grow from seed in full sun. Clearcutting is especially appropriate for early-successional species (e.g. paper birch, poplar and black cherry plus gray birch and pin cherry) and may grow with mixes of hemlock, red maple and other birches. Seeding is assumed to occur from edge trees or from seed stored in the soil (cherry). Clearcuts may be up to 5 acres, or, if artificial seeding or planting is used, up to 10 acres. Larger clearcuts require special permission. Clearcuts separated by more than 100 feet are considered separate. Clearcutting is sometimes confused with the final cut ("overstory removal cut") in a shelterwood system (see below), but the difference is that clearcutting is done to grow new trees from seed, whereas the overstory removal cut in a shelterwood system is done to release existing seedlings or saplings. Clearcutting is also sometimes confused with patch selection (see below); in fact, the distinction between two practices falls into a gray area.

Seed-Tree Cut: Similar to a clearcut except that seed trees are retained to provide seed (and either cut later or leave) and except that any species may be grown. There is no acreage limitation. At least 4 seed trees (20-inch diameter or greater (BA = 10)) or 12 seed trees (14-20 inches diameter) (BA 20) must be retained per acre.

Shelterwood/ Shelterwood System: usually a multi-step approach to establish desirable trees in the understory in medium-light conditions before the overstory is eventually removed to release the seedlings. The final step in the shelterwood system is the overstory removal, which is done to release the established young trees. Used especially for oak, sugar maple (giving these species years to establish well-developed root systems) white pine and hemlock (giving these species years to establish competitive height). Black birch typically becomes abundant as well. Regeneration that is adequate for release must typically be 2 feet tall, well-distributed and abundant. Interfering vegetation must be identified and (ideally) controlled.

Coppice: a complete "cutting off" of small or medium-sized hardwoods, especially oaks, hickory, red maple) to cause these to re-sprout and form a new stand from the same root systems. This is an old system that sometimes occurs inadvertently, and is useful for reliably producing firewood or whips.

Two-aged Regeneration Methods

Clearcut, Seed-tree, Shelterwood with "reserves": Same as methods described above but with retention of trees (12 inches diameter or larger) (possibly for timber, seed source, habitat or aesthetic reasons, but not for the purpose of managing understory light conditions).

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Uneven-aged Regeneration Methods (Selection/Irregular Shelterwood)

In an uneven-aged stand there will always be trees in a range of size and age classes that are *free to grow*. Often current conditions will be an approximation of this, but over time a true multi-aged stand can be created and maintained. A selection cut is a mix of thinning and creating or enlarging openings. Openings are defined either as groups or patches; new openings generally do not cover more than 50% of the stand area.

Group Selection: openings may range from single-tree-size up to 1/4 acre (e.g. equivalent to a circle about 120 feet in diameter in size, which is about 1.5 times the mature height of many trees (80'-100')). No special provisions are needed to prepare the understory for this more conservative opening size, though, to achieve the ideal outcome, it may be necessary to control competing vegetation (native vegetation such as beech or striped maple, or non-native invasive vegetation such as bittersweet, buckthorn, etc.).

Patch Selection: openings may range up to 2 acres (e.g. equivalent to a circle about 333 feet in diameter). Interfering vegetation (if present) should be identified and ideally controlled so that seedlings can be established/released. Please note: in Massachusetts, patch cuts will appear identical (to the public) as clearcutting.

Continuous-Cover Irregular Shelterwood: (see "The Irregular Shelterwood System", *Journal of Forestry*, December, 2009) is used to "create and maintain an unbalanced, multi-aged stand for a long and indefinite period of time by successive regeneration or maintaining complex forests. In this system, elements of thinning, shelterwood, and group selection are combined and applied in ways that reflect the current conditions and ultimate potential of specific woodlot areas, and strongly reflect the judgement and vision of the forester. A forest managed in this way will not have an "industrial" feel and should be rewarding for people with a wide range of interests ranging from on-going timber production to contemplative enjoyment of nature. This system is not used when the landowner wants to maximize short-term income or dramatically alter the landscape (for this see "Even-Age Regeneration Methods" above).

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to be done within next 10 years

Overview of Silviculture by Stand

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
1	BB	None	0	0	0	0	0	N/A
2	BB	None	0	0	0	0	0	N/A
3	WH	selection	133	36	134	476	263	2012
4	WH	selection	46	28	34	142	50	N/A
5	BB	None	0	0	0	0	0	N/A
6	HH	None	0	0	0	0	0	N/A
7	[RP]	Shelterwood	4	80	50	4	4	2017
7	OH	Selection	5	120	20	75	21	2017
8	HH	Shelterwood	30	50	50	30	90	2012
8	[BB]	Thinning	120	30	20	300	0	2017
9	[RP]	Shelterwood	8	80	100	8	8	2017
9	[WP]	Thinning	18	30	50	5	20	2012
10	BB	None	0	0	0	0	0	N/A
11	WH	selection	83	33	120	263	179	2012
12	RM	None	0	0	0	0	0	N/A
13	WH	selection	12	20	18	7	20	2012
14	BB	None	0	0	0	0	0	N/A
15	RP	selection	59	41	291	54	324	2012
16	HH	selection	98	32	162	264	232	2012
17	BB	None	0	0	0	0	0	N/A
18	WH	selection	41	40	46	156	43	2012
19	HH	shelterwood	27	65	75	147	149	2012
20	WH	shelterwood	97	32	177	248	397	2012
21	GR	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0	WA	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Totals 782 1,347 2,180 1,802

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
1	BB	None	0	0	0	0	0	N/A

Stand Name: Conway State Forest East

Watershed / Sub-watershed: Ryan Reservoir / Avery Brook West

Practice purpose (how it helps create desired future condition)

Taking no action at this time will maintain current conditions and avoid expenditure of effort and money (e.g. on roadwork and understory management) and avoid using a long stretch of recreational trail for marginal benefit.

Trees to be removed & retained (types, conditions, sizes): N/A

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A

Special soil considerations (erosion, seasonal timing, cultural, etc.): N/A

Special access considerations (erosion, access, timing, cultural, etc.): N/A

Special equipment/logging-system considerations: N/A

Special boundary considerations: None.

Special invasive species considerations: Follow standard monitoring (early-detection & rapid-response) for invasive inspections for stands ranked 1 or 2.

Special habitat improvements (anything particular to accomplish): In anticipation of worsening effects of beech blight, increase diversity of hard mast sources by encouraging the few oaks in this stand to grow bigger. Accomplish this by doing crop tree release around oaks in the pole or small sawtimber size. However, the results could be compromised by cervid browsing of oak seedlings.

Special habitat protection considerations (anything particular to protect): Monitor to enable early detection of, and rapid response to, non-native invasive plants. Since this stand is now virtually barren of invasive species, now is the time to make sure this situation continues. Periodic inspections of the stand should be carried out and if any invasives are found they should be hand pulled before they go to seed.

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Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

Special cultural resource considerations: None.

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to be done within next 10 years

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
2	BB	None	0	0	0	0	0	N/A

Stand Name: Conway State Forest West

Watershed / Sub-watershed: East Branch of the Mill River (out of watershed) / no subwatershed

Practice purpose (how it helps create desired future condition)
None.

Trees to be removed & retained (types, conditions, sizes): N/A

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A

Special soil considerations (erosion, seasonal timing, cultural, etc.): N/A

Special access considerations (erosion, access, timing, cultural, etc.): N/A

Special equipment/logging-system considerations: N/A

Special boundary considerations: None.

Special invasive species considerations: Follow standard monitoring (early-detection & rapid-response) for invasive inspections for stands ranked 1 or 2.

Special habitat improvements (anything particular to accomplish):
None.

Special habitat protection considerations (anything particular to protect):
Same as Stand 1.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

Special cultural resource considerations: None.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
3	WH	selection	133	36	134	476	263	2012

Stand Name: Dry Hill North

Watershed / Sub-watershed: Ryan Reservoir / Avery Brook West

Practice purpose (how it helps create desired future condition)

Helps promote growth and development of black cherry and other hardwoods as well as large white pine, while establishing new areas of seedlings and preserving major natural disturbance features.

Trees to be removed & retained (types, conditions, sizes): Trees to remove will generally be hemlock of any size or quality and white pine of poorer form, as well as firewood-grade hardwoods and pallet-grade hardwood timber, plus ash timber of any grade, but only in selected areas and by individual marking of trees. This will allow an irregularly patterned cutting to thin around desirable trees (especially black cherry) and create openings in opportune locations.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): Regeneration is not a main objective of this cut, but in small openings to be made, ensure that all vegetation is cut or crushed so that the cherry seed bank has a chance to be released in full sun.

Special soil considerations (erosion, seasonal timing, cultural, etc.): Soil must be dry or frozen.

Special access considerations (erosion, access, timing, cultural, etc.): Do not use the existing ATV trail off the Henhawk Trail as an access point (it goes through wet ground). Chose a high and dry location closer to the southwest corner.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: Southern boundary should be marked. Northern boundary with DCR is well-marked.

Special invasive species considerations: Follow standard monitoring (early-detection & rapid-response) for invasive inspections for stands ranked 1 or 2. Because it is confined to the water, the Phragmites is not likely to be influenced by logging.

Special habitat improvements (anything particular to accomplish) To make tree regeneration possible now and in the near future, if at all feasible, reduce hay-

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scented fern cover to re-establish tree regeneration. This must be done in conjunction with reducing deer/moose browsing. Ideally, only after the fern cover is reduced should any additional logging of the deciduous areas take place.

To improve the functioning of the aquatic ecosystem, control of the Phragmites should be considered.

Special habitat protection considerations (anything particular to protect):

(1) Same as Stand 1. (2) Also, if any cutting is done in this stand, it is best done in winter to prevent disturbance of nesting wetland birds.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

Special cultural resource considerations: None.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
4	WH	selection	46	28	34	142	50	2012

Stand Name: High Ridge East

Watershed / Sub-watershed: West-Whately / Sanderson Brook

Practice purpose (how it helps create desired future condition)

Helps promote growth and development of long-lived hardwoods as well as large white pine, while establishing new areas of seedlings.

Trees to be removed & retained (types, conditions, sizes): Trees to be retained will generally be larger-crowned hardwoods and most white pine of timber size, as well as groves of midstory hemlock, whereas trees to remove will generally be hardwoods of firewood or pallet grade. No trees will be cut along High Ridge itself.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): Regeneration is not a main objective of this cut, but in small openings to be made, ensure that all vegetation is cut or crushed so that the cherry seed bank has a chance to be released in full sun.

Special soil considerations (erosion, seasonal timing, cultural, etc.): Soil must be dry or frozen.

Special access considerations (erosion, access, timing, cultural, etc.): the existing ATV trail (on an old farm road) off the Henhawk Trail is wet for a long stretch, and would be challenging to use even if ATV riding was not expected to follow. With the expectation that ATV users will be trying to ride on the logging trail, chose as high and dry a route as possible through the stand.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: Mark northern boundary with Krawczyk.

Special habitat improvements (anything particular to accomplish): Same as Stand 1. This should be fairly easy since any invasives were found in the zone near the stream.

Special habitat protection considerations (anything particular to protect): Patches of hemlock midstory should be retained, as should most of the white pine.

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Special invasive species considerations: Control scattered bittersweet along southern boundary.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): An unimposing but well-established traditional trail follows, generally, the High Ridge ridgeline (the trail was not mapped for this project). This trail crosses back and forth between Stand 6 and Stand 4. Within Stand 6, just where the trail crosses off DPW onto land now or formerly of Krawczyk, there is a bronze plaque set in a large stone by a local hiking club (approx. date 1920).

Special cultural resource considerations: Protect cellar hole from any damage; protect stone walls from any unnecessary damage.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
5	BB	-	-	-	-	-	-	-

Stand Name: Avery Brook West

Watershed / Sub-watershed: Ryan Reservoir / Avery Brook West

Practice purpose (how it helps create desired future condition)

Other than cutting grape vines (see below) and boundary work (see below), refraining from any harvesting in this stand will help maintain current conditions and avoid introducing risks of erosion on steep, seepy slopes and introduction of invasive species and still more grapes.

Grape vines can be cut as much as possible. There may be a Dry Hill abutter who is willing to do this work.

Trees to be removed & retained (types, conditions, sizes): N/A

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A

Special invasive species considerations: N/A

Special soil considerations (erosion, seasonal timing, cultural, etc.): N/A

Special access considerations (erosion, access, timing, cultural, etc.): N/A

Special equipment/logging-system considerations: N/A

Special boundary considerations: Boundary with southern abutter is difficult to find in places. Ideally, this boundary should be clarified.

Special invasive species considerations: Severity level is 2. The standard procedure for invasive inspections for stands ranked 1 or 2 should be followed. In addition it would be prudent to search now for and hand pull any barberry or bittersweet that is found. The bittersweet seedlings are small enough that they could be hand-pulled but might be hard to spot. A weed wrench may be needed for the larger barberry bushes.

Special habitat improvements (anything particular to accomplish): None.

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Special cultural resource considerations: Protect Williamsburg Reservoir site and keep it looking attractive/decent throughout and after logging.

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Harvest A

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
9	RP	Shelterwood*	8*	80	100	8	8	2017

*ca 7 acres along the Henhawk Trail and Old Williamsburg Road (this area includes some Scots pine) and about 1 acre near the eastern end of Old Williamsburg Road. This is an optional harvest in red pine section if viable understory is established to be released. Target year of 2017 is the earliest expected year if preconditions (preparation for regeneration) work began today. For a later start on preconditions, the actual timing of logging would be delayed accordingly by about 5 years. Areas that already have viable saplings that are free to grow (i.e. where the overstory has already been removed) should be left alone.

Harvest B

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
9	WP	thin	18**	30	50	5	20	2012

**harvest in the eastern section of the stand

Stand Name: Old Williamsburg Road

Practice purpose (how it helps create desired future condition)

In red pine areas, this is the same as in Stand 7 (see above). In the white pine section, this harvest will promote overall stand vigor and longevity.

Trees to be removed & retained (types, conditions, sizes): See Stand 7 for description of red pine harvest. In white pine section, trees to be removed will generally be white pines; these will be trees with less vigor or trees that are more poorly formed than nearby trees.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): See Stand 7 for description of red pine harvest. In white pine areas, any tall saplings that are damaged should be flush cut to promote resprouting.

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Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 2.

Special soil considerations (erosion, seasonal timing, cultural, etc.): Ground should be dry or frozen. The areas designated for logging do not include steep slopes or areas with unusually problematic drainage.

Special access considerations (erosion, access, timing, cultural, etc.): Keep Henhawk Trail, Old Williamsburg Road, Dry Hill Road, and Williamsburg Road in as-good or better condition than before logging. By operating from the west (landing next to Henhawk Trail) and the east (landing either on Dry Hill Road or in that vicinity), the need to cross streams on Old Williamsburg Road can be avoided.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: Mark boundary with Bean.

Special invasive species considerations: The bittersweet patch should be treated if possible. Otherwise, this patch including a buffer of 300 to 500 feet around it should be left undisturbed. Follow standard regime for inspection for stands ranked 3.

Special habitat improvements (anything particular to accomplish): At waypoint 141-02 is a small patch of bigtooth aspen, with 8 aspen trees 10-14: dbh within about ¼ acre. Because aspens are an important food for wildlife this component should be increased if possible. One possibility is to do a small clearcut in this area to foster aspen regeneration.

Special habitat protection considerations (anything particular to protect): Protection of the habitat of Jefferson salamanders should be the highest priority for this stand. According to the Massachusetts Forestry Conservation Management Plan for MESA-listed Mole Salamanders the following forest management is required: a 50 ft. no-cut zone around each vernal pool; retention of a 75% canopy cover within the 50 to 450 ft. zone; within the 450 ft. zone any areas that are cut should not be concentrated disproportionately close to the pool; new landings and skid roads must be located at least 100 ft. from any vernal pool; use of machinery in the protected zones should be limited to March 1 to May 14. The above canopy and distance specifications are minimums. Ideally only minimal if any cutting would occur within 450 ft. and also the protected zone would extend 600 feet from each pool, because Jefferson salamanders in the Northeast have been found to travel this far from vernal pools. The following guidelines are also recommended: no skid roads, patch cuts or landings should be

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located between the pools since salamanders travel between them; coarse woody debris should be left in place and at least 2 snags or dying or old trees per acre should be left to provide future woody debris; harvesting should only occur when the ground is frozen in order to reduce soil compaction and prevent rut formation.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): Keep Henhawk Trail in an attractive condition. Note, the use of the trail may need to be suspended during any logging. Meet with Bean and Sabin and other abutters, if they are interested, as needed to agree on use of and practices on Dry Hill Road.

Special cultural resource considerations: None.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
10	BB	None	0	0	0	0	0	N/A

Stand Name: Dry Hill South

Watershed / Sub-watershed: West-Whately / Sanderson Brook

Practice purpose (how it helps create desired future condition)
None.

Trees to be removed & retained (types, conditions, sizes): N/A

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A

Special invasive species considerations: N/A

Special soil considerations (erosion, seasonal timing, cultural, etc.): N/A

Special access considerations (erosion, access, timing, cultural, etc.): N/A

Special equipment/logging-system considerations: N/A

Special boundary considerations: None.

Special invasive species considerations: Consider controlling Japanese barberry and scattered bittersweet and cutting grapevines on the lower slope. Track down and kill a large bittersweet vine at the southwestern corner of the long piece of land stretching to the north. Control barberry in the northeastern corner area (assuming boundaries have been located).

Special habitat improvements (anything particular to accomplish): To increase mast production encourage red oak regeneration by controlling hay-scented fern.

Special habitat protection considerations (anything particular to protect): Preserve vegetative diversity of lowlands by pulling barberry shrubs.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

Special cultural resource considerations: None.

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Harvest A

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
11	RP	Shelterwood*	8*	80	100	8	8	2017

*ca 2 acres along Williamsburg Road and 6 acres on Grass Hill Road. This is an optional harvest in red pine section if viable understory is established to be released. Target year of 2017 is the earliest expected year if preconditions (preparation for regeneration) work began today. For a later start on preconditions, the actual timing of logging would be delayed accordingly by about 5 years.

Harvest B

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
11	WH	Selection	83**	33	120	263	179	2012

**Harvest to focus on western part of stand

Stand Name: Grass Hill Road

Practice purpose (how it helps create desired future condition)
Same as Stand 7.

Trees to be removed & retained (types, conditions, sizes): In Harvest A, the entire overstory will be removed; in harvest B, poorly-formed trees of any species will be singly removed or removed in small groups (up to ½ acre) so that nearby trees have increased growing space and/or conditions for regeneration are established.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): In openings cut all woody vegetation except any habitat or seed trees specifically intended for retention.

Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

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Current level = 2.

Special soil considerations (erosion, seasonal timing, cultural, etc.): Overland flow of water (especially on Grass Hill Road) and seepiness/soil-saturation will be challenges to any logging operation here. This work should be limited to very dry or very frozen times. Preparation of Grass Hill Road before logging, as well as follow up, may require the use of excavating equipment and imported material (e.g. stone). The bulk of the acreage would be accessed off Williamsburg Road. The main skid trail should be well-stabilized with logging tops, poles, etc that will be left in place. Since this is not an intended hiking trail, leaving the tops in place to stabilize the skid trail will not be an inconvenience.

Special access considerations (erosion, access, timing, cultural, etc.): See section just above. Also note: at this time it is not recommended to create new logging access into the main body of the stand off Grass Hill Road. Reasons include the difficulty of the terrain (and resulting need for water/erosion management) as well as the chance that this could become an ATV trail.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: Mark southern and eastern boundaries. Both have old, faint blazes and paint.

Special invasive species considerations: Severity level is 2. Follow standard procedure for invasive inspections for stands ranked 1 or 2, and make efforts to remove the few invasive species now present before they get worse.

Special habitat improvements (anything particular to accomplish): Reduce hay-scented fern and grapevine. Increase regeneration by reducing overbrowsing.

Special habitat protection considerations (anything particular to protect): Follow Best Management Practices for Vernal Pools. Retain character of hickory-hop hornbeam areas by not cutting these two species.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): A few questions to research: who, if anyone, is authorized to use Grass Hill Road? Are water diversions currently in place (installed after Hurricane Irene 8/2011) adequate? Can the necessary level of legal access be maintained while also preventing future storm run-off events such as the Hurricane Irene 8/2011 major washout (in other words, will legally permitted use of the road, if indeed there is any, perpetuate a risk of erosion in major storms, and is there any way this can be mitigated?).

Special cultural resource considerations: None.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
12	RM	None	0	0	0	0	0	N/A

Stand Name: Nash Hill Road Swamp

Watershed / Sub-watershed: drains partly into "Beaver Brook" then into Sanderson Brook and then into West-Whately Reservoir; the remaining section flows southward out of the watershed, into Joe Wright Brook and then into the Mill River (at Williamsburg Station)

Practice purpose (how it helps create desired future condition)

This non-silvicultural practice is controlling vines (native grapes and bittersweet) and any other invasive shrubs, which are limited in extent to the upland margin along Williamsburg Road.

Trees to be removed & retained (types, conditions, sizes): N/A

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A

Special invasive species considerations: N/A

Special soil considerations (erosion, seasonal timing, cultural, etc.): N/A

Special access considerations (erosion, access, timing, cultural, etc.): N/A

Special equipment/logging-system considerations: N/A

Special boundary considerations: None.

Special invasive species considerations: This level 2 stand should definitely have the grapes and bittersweet, and other invasives removed from the section described above. Bent over or damaged saplings should be flush cut as well to allow resprouting or to allow other seedlings to become established.

Special habitat improvements (anything particular to accomplish): None.

Special habitat protection considerations (anything particular to protect):
The treatment area should retain a closed canopy to maintain shade.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

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Special habitat protection considerations (anything particular to protect):

The formation of gaps in this stand is inadvisable because the wet soils and sloping terrain could lead to erosion, especially with increasingly extreme weather events. Refrain from thinning any trees until hay-scented ferns are sparser and potential invasives have been searched for and removed. At least some of the dense patches of grapevines, especially those near bittersweet seed sources should be cut to prevent pulldowns that can further inhibit tree regeneration.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

Special cultural resource considerations: None.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
6	HH	None	0	0	0	0	0	N/A

Stand Name: High Ridge West

Watershed / Sub-watershed: East Branch of the Mill River (out of the watershed) / no subwatershed

Practice purpose (how it helps create desired future condition):
None.

Trees to be removed & retained (types, conditions, sizes): N/A

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A

Special invasive species considerations: N/A

Special soil considerations (erosion, seasonal timing, cultural, etc.): N/A

Special access considerations (erosion, access, timing, cultural, etc.): N/A

Special equipment/logging-system considerations: N/A

Special boundary considerations: None.

Special invasive species considerations: This stand is now virtually free of non-native invasives. Care should be taken to be sure invasive species are not introduced into this stand via vehicles. Follow standard regime for invasive inspections for stands ranked 1 or 2.

Increased light due to hemlocks thinning or dying from scale or adelgid could also alter ground vegetation and regeneration. If this occurs, the area to be searched for invasives will have to be expanded accordingly.

Special habitat improvements (anything particular to accomplish): None.
Retain as mature forest.

Special habitat protection considerations (anything particular to protect):
None.

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Special trail/recreational considerations (anything particular to accomplish or avoid/protect): An unimposing but well-established traditional trail follows, generally, the High Ridge ridgeline (the trail was not mapped for this project). This trail crosses back and forth between Stand 6 and Stand 4. Within Stand 6, just where the trail crosses off DPW onto land now or formerly of Krawczyk, there is a bronze plaque set in a large stone by a local hiking club (approx. date 1920).

Special cultural resource considerations: None.

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Harvest A

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
7	RP	Shelterwood*	4	80	50	4	4	2017

*Note: this is an optional harvest in red pine section if viable understory is established to be released. Target year of 2017 is the earliest expected year if preconditions (preparation for regeneration) work began today. For a later start on preconditions, the actual timing of logging would be delayed accordingly by about 5 years.

Harvest B

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
7	OH	Selection**	5	120	20	75	21	2017

**Note: this harvest is described in (4) below

Stand Name: Henhawk Trail Southwest

Practice purpose (how it helps create desired future condition)

These steps constitute a sort of recovery from past conditions and serve to re-establish a viable understory in some places and serve to pre-salvage red pine in one section and convert to native hardwoods.

Trees to be removed & retained (types, conditions, sizes): (1) prepare red pine section for regeneration (treat grapes, flush cut hardwoods), monitor, and possibly go forward with overstory removal of all red pine IF a viable understory is established or appears likely to become established following cutting; (2) in southern spruce section, control grapes and bittersweet and, ideally, flush cut hardwood saplings to allow re-sprouting; monitor and follow-up control of grapes and bittersweet to ensure establishment of new, viable understory from sprouts and seedlings; (3) in northern spruce section, control of grapes and bittersweet in concentrated area along Henhawk Trail and also do search and control throughout the section, but leave viable hardwood saplings in place; monitor and follow-up control of grapes and bittersweet; (4) in scattered sections accessible from the main skid trail (see map), create small openings to attempt to establish areas of young growth that are free to grow (in part to test the response of moose and deer). The siting of openings would be on drier ground, in order to reduce the risk of grapes, and further would be sited where beech is not prevalent, in

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order to minimize any beech resprouting. Any existing, undesirable vegetation would be cut in conjunction with the harvest (just before, as part of, or, if need be after).

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): Control of grapes and bittersweet and flush-cutting of stringy and/or bent saplings as described above.

Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 2 (with exception noted in the northern spruce section).

Special soil considerations (erosion, seasonal timing, cultural, etc.): Conditions must be dry or frozen. In any case, the access into the woods across from the Stand 9 landing should be bolstered with large cobbles or crushed stone of and when any skidders/forwarders are slated for use.

Special access considerations (erosion, access, timing, cultural, etc.): A landing in Stand 9 and a landing inside the southern spruce stand could be used so that the parking area would not be affected.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: The boundaries both to the north, with the Town of Williamsburg Parcel, as well as to the south, toward Nash Hill Road, should be blazed and painted. Part of the latter section of the boundary is not well-marked on the ground by historical features (e.g. no corner pins and only limited old fencing was found in some of the steep sections): this will require additional research.

Special invasive species considerations: The areas of bittersweet encroachment including a buffer of at least 50 ft. should be marked and avoided during any logging operation. Even so, access to this stand involves entry from the Henhawk parking area, where bittersweet is dense. This poses the challenge of how to operate in the stand without introducing bittersweet seeds that may get stuck in the treads of vehicles. A serious effort should be made to cut grape vines along the Henhawk trail and elsewhere and control bittersweet before any nearby silviculture takes place (and before the Norway spruce stand suffers a storm knock down and nearby red pine continues to decline or is harvested)

Barberry is infrequent enough that any wet areas should be inspected as soon as possible and barberry bushes pulled.

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In general, the standard regime for invasive inspections for stands ranked 1 or 2 should be followed with the following modification: If logging occurs in this stand it should be inspected both the first and second years following cutting.

Special habitat improvements (anything particular to accomplish): Create more large snags, possibly by girdling, and retain defective large trees that have the potential to form cavities. Encourage regeneration after invasives are in check.

Special habitat protection considerations (anything particular to protect): Follow CMPs described in Stand 9 in zones within 600 ft. of vernal pools.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): Keep Henhawk Trail attractive and open for hiking (though the trail may need to be closed off temporarily during logging operations both for public safety and also to minimize disruption of the work itself).

Special cultural resource considerations: Protect Henhawk Trail; even though some alterations are needed to manage water and even though there may be logging alongside the trail, try whenever possible to maintain the general "pleasant road into the woods" character.

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Harvest A: west of East Branch of Mill River

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
8	HH	Shelterwood	30	50	50	30	90	2012

*Note: this shelterwood harvest will attempt to create or enhance conditions for the establishment of a vigorous understory of viable, desirable seedlings for partial release in future cutting.

Harvest B: east of East Branch of Mill River

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
8	[BB]	Comm. Thin	120	30	20	300	0	2017

*Note: This thinning (the term used on CH 132 permits id "Commercial thin") would improve growing space for well-formed trees of various hardwood species including red oak, black cherry and black birch. Any developments in the understory would be incidental. Grape vines should be controlled along main skid trails at the same time. There would be no cutting in wetter areas.

Stand Name: Judd Lane

Practice purpose (how it helps create desired future condition)

See above.

Trees to be removed & retained (types, conditions, sizes): Harvest A: trees remove are mainly hemlock of pulp quality, some hemlock timber, some white pine pulp and timber, and a limited amount of firewood. Retain a consistent overstory of well-formed trees with wide-enough spacing to let adequate light into the forest floor to establish/promote seedlings. Cutting will be lighter around central wetland to protect nesting habitat (see below).

Harvest B: trees to remove are mainly poorly-formed hardwood firewood trees where these compete with well-formed trees.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): Harvest A: none. Harvest B: Control of grapes along the skid trails.

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Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 2. However, the invasives ranking in Harvest A and Harvest B areas is 1. Any occurrence of invasives is incidental. If/where noted, these should be controlled in conjunction with the harvest.

Special soil considerations (erosion, seasonal timing, cultural, etc.):
Conditions must be dry or frozen.

Special access considerations (erosion, access, timing, cultural, etc.):
Harvest A: none. Harvest B: the washed-out crossing of the river will need to be reconstructed, probably as a temporary bridge on log abutments.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable. Harvest A could be done by any method, including whole-tree chipping. Harvest B would most likely be a cut-to-length operation.

Special boundary considerations: Most boundaries seem to have old blazes. The boundary with Rizos was repainted in 2012. Any boundary within 200' of cutting should be re-painted prior to the harvest (though, ideally, the entire boundary would be repainted).

Special boundary considerations: Mark (i.e. remark by painting old blazes) all boundaries.

Special invasive species considerations: This stand is ranked 2, but most of it is free of invasives in the upland areas that haven't been logged recently, so selective cutting could occur as long as the standard procedure for invasive inspections for stands ranked 1 or 2 is followed.

Special habitat improvements (anything particular to accomplish): Selective cutting to promote regeneration.

Special habitat protection considerations (anything particular to protect): A 100 to 200 foot wide zone of no-cut or very limited cutting should be retained around the main wetland for nesting of birds such as red-shouldered hawks, green herons and wood ducks that nest in forests near wetlands.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): Try to limit ATV access and usage of the trails in this stand (the main trail, the lower trail, and the upper trail all show current ATV use).

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Special cultural resource considerations: None.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
13	WH	selection	12	20	18	7	20	2012

Stand Name: Dry Hill East

Watershed / Sub-watershed: Ryan & West-Whately Reservoir / Ryan & West-Whately Shore

Practice purpose (how it helps create desired future condition)

Use normal silvicultural processes to build on existing forest conditions to further develop a multi-aged, mixed-species forest that can provide watershed protection as well as a range of other benefits including periodic timber income.

Trees to be removed & retained (types, conditions, sizes): (1) in the northern section, where oak is lacking, make small openings by cutting mainly hemlock and black birch (any size or quality); and where oak is present, cut competing species; in the central section, cut pine, red oak, black birch and other species, but try to avoid cutting (sugar maple) to create small openings within the dense pine (but preserving the most stable or well-formed trees) as well as to release small patches of sugar maple seedlings; (3) in the southern section, appropriate management would be limited to general control of scattered (and sometimes concentrated) grape vines and spot-occurrences of bittersweet (or rose, honeysuckle, etc.)

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): In patch openings, all existing hardwoods and any hemlock should be flush-cut, even trees too small to have economic value, so that the patch can regenerate uniformly. There will be some cost to doing this extra step (possibly to be factored into timber bidding). Also, in the central section (western side of it) try to avoid damage to sugar maple saplings by directing skidder movements around this area.

Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 1.

Special soil considerations (erosion, seasonal timing, cultural, etc.): Ground must be adequately dry or frozen so that rutting/compaction are avoided

MANAGEMENT PRACTICES
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Special access considerations (erosion, access, timing, cultural, etc.): Access (off Dry Hill Road) is traditional and straightforward, and can be designed to minimize impacts to roadside scenery.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: The boundaries with the abutting parcels on Dry Hill Road should be clearly marked. Some parcels have been surveyed, but some may not have been. In the past there was a bit of disagreement with abutter Roger Bean (now deceased) about a boundary line (this was told to Mike Mauri by Roger Bean around the year 2002). The Bean land is still in the Bean family. It would be advisable to discuss the boundary with them (especially if no surveying has been done) and come to an agreement.

Special invasive species considerations: This stand is ranked 1 and so the standard procedure for invasive inspections for stands ranked 1 or 2 should be followed. In addition, if silviculture is carried out here, tree marking should be accompanied by removal of individual invasive plants or marking them for removal before the harvest.

Special habitat improvements (anything particular to accomplish): Create more complex vegetative structure by thinning the canopy and midstory to encourage denser shrub and ground layers.

Special habitat protection considerations (anything particular to protect): None.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): Dry Hill Road is posted no trespassing, but is used for various forms of recreation (e.g. snowmobiling). It would be good to clarify who has rights of access to this road. The road should be maintained in good condition.

Special cultural resource considerations: Minimize any damage to stone walls.

MANAGEMENT PRACTICES
to be done within next 10 years

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
14	BB	None	0	0	0	0	0	N/A

Stand Name: Ryan Reservoir West — West-Whately Reservoir West

Watershed / Sub-watershed: Ryan & West-Whately Reservoir / Ryan & West-Whately Shore

Practice purpose (how it helps create desired future condition)

This non-silvicultural practice is controlling vines (native grapes and bittersweet) and any other invasive shrubs, which are concentrated in the southern portion of this stand. This will limit the risk of pull-downs near the reservoir, so that tall forest can be maintained.

Trees to be removed & retained (types, conditions, sizes): No trees to be removed. However, (1) within a pre-determined distance of approximately 50' (though this distance can be viewed flexibly so that major vines falling beyond 50' can be included), walk with chainsaws and cut all grape vines close to ground level. Bittersweet vines can either be cut and hand-pulled (which may not kill individual plants entirely) or can be treated with an herbicide (probably an outside bark oil formulation or a cut-stem application). (2) A more thorough and aggressive practice would be to comb through the stand (southern section) and control bittersweet and other invasives. This probably goes beyond the scope of what is realistic, but is mentioned here for the record.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A

Special invasive species considerations: See "Trees to be removed" above.

Special soil considerations (erosion, seasonal timing, cultural, etc.): N/A

Special access considerations (erosion, access, timing, cultural, etc.): N/A

Special equipment/logging-system considerations: N/A

Special boundary considerations: None.

Special invasive species considerations: See "Trees to be removed" above. Overall severity level is 2 for invasives, due to the bittersweet and multiflora rose in the south section. Ideally, this stand should have the grapes and bittersweet, as well as multiflora rose and any other invasives controlled throughout the southern section. Bent over or damaged saplings in those same areas should be flush cut as well to allow resprouting or

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to allow other seedlings to become established. However, this is probably unrealistic at this time.

Special habitat improvements (anything particular to accomplish): Same as above.

Special habitat protection considerations (anything particular to protect): Allow any tree-fall to remain in order to increase coarse woody debris over time to help prevent erosion

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

Special cultural resource considerations: (1) Continue passive protection of old sawmill site; do not alter the site; (2) consider researching the history of this site and nearby settlements.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
15	RP	selection	59	41	291	54	324	2012

Stand Name (location): Ryan North Red Pine Plantation (along southern half of Waterworks Road)

Practice purpose (how it helps create desired future condition)

The purpose is to concurrently reduce the current and potential impact of interfering vegetation (native and non-native) and to continue normal silvicultural processes, to effect a successful transition from red pine (in those areas) to a multi-aged, mixed-species forest that can provide watershed protection as well as a range of other benefits including periodic timber income. Due to the poor health of the red pine, there is an elevated urgency to carrying out this management. In the white pine areas, the objective will be to promote individual tree vigor in the white pines that will be retained.

Trees to be removed & retained (types, conditions, sizes): In red pine areas, all trees will be removed in groups (up to a half-acre in size), with surrounding areas essentially left uncut (because, apparently, each new thinning of red pine further introduces armillaria root rot. In white pine areas, this will be a thinning to remove poorer-quality white pine and retain well-spaced white pine with good vigor. No trees will be cut in the sapling/pole section, except on a limited basis to "mop up" grape pull downs.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A.

Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 2.

Special soil considerations (erosion, seasonal timing, cultural, etc.): Ground must be adequately dry or frozen so that rutting/compaction are avoided.

Special access considerations (erosion, access, timing, cultural, etc.): Access is straightforward.

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Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: Blaze & paint northern boundary with "OUT" parcel.

Special invasive species considerations: This stand is ranked 2 for invasives. Before any silviculture is done, the invasive hotspots should be treated. Whatever efforts can also be made to remove or kill individual plants of multiflora rose, bittersweet, barberry, honeysuckle, black locust, autumn olive, and glossy buckthorn will make it easier to keep these species in check after cutting occurs. In addition, the standard procedure for invasive inspections for stands ranked 1 or 2 should be followed.

Special habitat improvements (anything particular to accomplish): Encourage advance regeneration

Special habitat protection considerations (anything particular to protect): If cutting occurs in this stand, there is a risk that populations of vernal pool species could be harmed due to drier conditions in the cut areas. If cutting occurs here, BMP requirements and guidelines for vernal pools should be followed. If Jefferson salamanders are confirmed, then the "Massachusetts Forestry Conservation Management Practices for MESA-listed Mole Salamanders" should be followed. The key practices are limiting the distance and time of year that vehicles operate near the pool, creating a no-cut buffer strip 50' wide around each pool and an "amphibian life zone" 450' of more where 70% of the canopy retains at least 75% cover (Note: a circle of 450 ft radius is about 14.6 acres). Additional requirements and guidelines from the above document should also be followed.

The habitat requirements of spotted salamanders are very similar to those of Jefferson salamanders, so if it is determined that Jefferson salamanders do not occupy these pools, the requirements can be loosened. Although neither species tolerates heavy cutting well, losses to the spotted salamander population are not as crucial because this species is not currently at risk, and depleted populations can be replenished by individuals emigrating from other nearby areas.

The creation and retention of coarse woody debris, and leaving mature trees for future CWD can ameliorate somewhat the sunnier, drier conditions in of a shelterwood cut by providing moist microhabitat refuges for amphibians and the prey they depend on.

Another possible accommodation to protect vernal pool amphibians from the effects of nearby cutting is to provide shaded "retention corridors" linking the pool to the forest beyond the cutting zone

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): Keep established snowmobile trails free of logging debris.

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Special cultural resource considerations: None.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
16	HH	selection	98	32	162	264	232	2012

Stand Name: Ryan Reservoir North Oak-Hemlock

Practice purpose (how it helps create desired future condition)

Introduces within this maturing/mature mix of hemlock and oak a new age class of native trees, in groups and patches, arranged in a way that preserves the abundance of oak while reducing the abundance of hemlock (in the face of the prospect of losing much or all of the hemlock to pests). Also, where tall saplings and poles are well-established and viable, remove constricting side-shade on a limited, protective basis.

Trees to be removed & retained (types, conditions, sizes): In concentrations of hemlock and hardwoods, remove most or all trees in openings up to ¼ to ½ acre. Retain most of the oaks, most of the pines, and pockets of well-established saplings and poles. Retain dense canopy cover (by not cutting at all) in the vicinity of vernal pools.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A.

Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 1.

Special soil considerations (erosion, seasonal timing, cultural, etc.): Ground must be adequately dry or frozen so that rutting/compaction are avoided.

Special access considerations (erosion, access, timing, cultural, etc.): Probably use existing access from the east, as well as the westernmost trail. Redesign the central north-south trail so that it avoids the wettest ground.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

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Special boundary considerations: Northern boundary with DCR is blazed & painted. Blaze & paint northern boundary to this east of DCR parcel (it may be DCR as well, but it is not marked). Blaze & paint eastern boundary and northern boundary with "OUT" parcel.

Special invasive species considerations: The invasive species ranking for this stand is 1. The standard procedure for invasive inspections for stands ranked 1 or 2 should be followed. In addition, the small patch of invasives in the seep area should be treated, and this should be done before any silviculture takes place in this stand or in stand 15. This is important not only to prevent their spread to other areas, but also to preserve the small patch of northern prickly ash which is in the same place.

Special habitat improvements (anything particular to accomplish): Diversify the canopy to include more non-hemlock species, add structural diversity and increase regeneration.

Special habitat protection considerations (anything particular to protect): Same as for stand 15.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): Keep established snowmobile trails free of logging debris.

Special cultural resource considerations: None.

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Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
17	BB	None	0	0	0	0	0	N/A

Stand Name: Finney Brook

Watershed / Sub-watershed: Ryan Reservoir / Finney Brook

Practice purpose (how it helps create desired future condition)

This non-silvicultural practice is controlling invasive plants, which are limited in extent.

Trees to be removed & retained (types, conditions, sizes): N/A

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): N/A

Special invasive species considerations: N/A

Special soil considerations (erosion, seasonal timing, cultural, etc.): N/A

Special access considerations (erosion, access, timing, cultural, etc.): N/A

Special equipment/logging-system considerations: N/A

Special boundary considerations: None.

Special invasive species considerations: This level 2 stand should definitely have the invasives described above removed, which should be easy (for the single bittersweet), but more challenging for the phragmites, both at the southern end of Phinney Brook. Longer-term, with the expected decline and die-out of hemlock and possibly ash, the 13 or so acres south of the east-west stone wall will become much less resistant to the seeding in of invasives: monitoring should be especially frequent and intensive here.

In the western section, barberry should be removed, especially from the rich mesic areas. Since this stand is rated as a 2 in severity, the standard procedure for invasive inspections for stands ranked 1 or 2 should be followed. Because the wet conditions of this stand are favorable for species such as barberry, bittersweet, honeysuckle, and multiflora rose, inspections here are especially important after any canopy gaps occur.

After that, the standard procedure for invasive inspections for stands ranked 1 or 2 should be followed.

Special habitat improvements (anything particular to accomplish): None.

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Special habitat protection considerations (anything particular to protect):
The rich mesic forest should retain a closed canopy. The stream should be allowed to retain any woody debris that falls into it naturally.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

Special cultural resource considerations: None.

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to be done within next 10 years

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
18	WH	selection	41	40	57	195	54	2012

Stand Name: Waterworks Road Northwest

Watershed / Sub-watershed: Ryan Reservoir / Finney Brook

Practice purpose (how it helps create desired future condition)

Use normal silvicultural processes to build on existing forest conditions to further develop a multi-aged, mixed-species forest that can provide watershed protection as well as a range of other benefits including periodic timber income.

Trees to be removed & retained (types, conditions, sizes): Removal will concentrate on poorly-formed white pine plus most red pine (in the pine plantation) and poorly-formed hardwoods — mostly black birch firewood — in other areas. Trees to retain will be well-formed white pines (in the plantation) and concentrations of large-crowned oaks (west/uphill of the north-south wall, leading up to Old Phinney Road), and an impressive mix of red oak, beech and sugar maple along Waterworks Road (most notably on the western side).

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): In patch openings, all existing hardwoods should be flush-cut, even trees too small to have economic value, so that the patch can regenerate uniformly. There will be some cost to doing this extra step (possibly to be factored into timber bidding).

Similarly, all grapes in the pine plantation must be controlled, either prior to, or soon following logging.

Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 1.

Special soil considerations (erosion, seasonal timing, cultural, etc.): Ground must be adequately dry or frozen so that rutting/compaction are avoided. These conditions will be met at most times of year on this soil.

Special access considerations (erosion, access, timing, cultural, etc.): Access is straightforward, and can be designed to minimize impacts to roadside scenery. Possibly,

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a new landing would be developed on a narrow shelf of land on the east side of Waterworks Road. This area should be adequate for tri-axle trucking, but not 18-wheeler trailers.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: The boundary is not in questions, but re-paint old blazes on northern boundary with Laskey.

Special invasive species considerations: Severity level 1. Follow the standard procedure for invasive inspections for stands ranked 1 or 2. If chemically controlling grapes in the pine plantation, control scattered barberry also.

Special habitat improvements (anything particular to accomplish): None.

Special habitat protection considerations (anything particular to protect): None.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): Though this land is posted, people do use Waterworks Road as a walking trail. DPW uses the road to maintain the water supply. Try to keep this road open and neat in appearance.

Special cultural resource considerations: Minimize any damage to stone walls and avoid damage to the cellar hole.

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to be done within next 10 years

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
19	HH	shelterwood	27	65	82	82	137	2012

Stand Name (location): Conway Road Terrace (terrace and escarpment on east shore of Ryan Reservoir)

Watershed / Sub-watershed: Ryan & West-Whately Reservoir / Ryan & West-Whately Shore

Practice purpose (how it helps create desired future condition)

Use normal silvicultural processes to build on existing forest conditions to further develop a multi-aged, mixed-species forest that can provide watershed protection as well as a range of other benefits including periodic timber income.

Note: harvesting is limited to the top of the terrace and along the upper slope; the mid and lower slope will not be cut. Thus, only about 60% of the stand acreage is included.

Trees to be removed & retained (types, conditions, sizes): Removal will concentrate on poorly-formed hemlocks and pines (pulp) and poorly-formed hardwoods (firewood) but will include about 50% of good-quality hemlock timber and up to 10% of white pine and oak-hardwood timber. Trees to retain will be large-crowned and vigorous hemlock, pine, oak and mixed hardwoods as well as notable habitat-potential trees (e.g. very large, rough trees or potential tall snags, etc.). As a shelterwood, this cut will increase general light levels to the forest floor to allow for establishment of seedlings.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): If there is an opportunity to scarify the soil/leaf litter, this will improve the opportunity for white pine to seed in. Similarly, driving through the stand during an oak seed year will press acorns into the ground, allowing better establishment.

Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 2. The main concern is the lone autumn olive,; however, there are others across the street, serving as seed sources. These are probably in the town road layout. Perhaps the town would allow these to be treated as well. The vinca and goutweed can be controlled, or can be kept somewhat in check by avoiding any disturbance in this area. These, with their limited ability to spread, are not considered at this time to be a

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serious hindrance to maintaining a watershed forest (compared to the threat of autumn olive).

Special soil considerations (erosion, seasonal timing, cultural, etc.): Ground must be adequately dry or frozen so that rutting/compaction are avoided. These conditions will be met at most times of year on this soil.

Special access considerations (erosion, access, timing, cultural, etc.): Access is straightforward, and can be designed to minimize impacts to roadside scenery.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: None.

Special invasive species considerations: This level 2 stand should definitely have the invasives described above removed, which should be easy since they are so isolated. After that, the standard procedure for invasive inspections for stands ranked 1 or 2 should be followed.

Special habitat improvements (anything particular to accomplish): Regenerate pine, oak and other hardwoods.

Special habitat protection considerations (anything particular to protect): Comply with any NHESP-imposed restrictions (these are determined by NHESP at the time a CH 132 Forest Cutting Plan is submitted to DCR).

Also, leave an uncut strip along the road to help prevent the entrance of potential invasive species.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): None.

Special cultural resource considerations: Minimize damage to stone walls. Also, in a swale south of the east-west stone wall there are perhaps 20 or so old tires, a metal drum, etc. These should be removed.

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to be done within next 10 years

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
20	WH	shelterwood	97	32	196	275	441	2012

Stand Name (location): Poplar Hill (between Whately Road and Poplar Hill Roads)

Watershed / Sub-watershed: Ryan Reservoir / Finney Brook

Practice purpose (how it helps create desired future condition)

Use normal silvicultural processes to build on existing forest conditions to further develop a multi-aged, mixed-species forest that can provide watershed protection as well as a range of other benefits including periodic timber income.

Note: harvesting would be excluded from the central wet swale (in the southern part of the stand) and would be very limited, if not precluded, on the very steep frontage on Whately Road).

Trees to be removed & retained (types, conditions, sizes): Removal will concentrate on poorly-formed hemlocks (for timber and pulp) and pines (mainly for pulp) and poorly-formed hardwoods (firewood) but will include about 50% of good-quality hemlock timber and up to 10% of white pine and oak-hardwood timber. Trees to retain will be large-crowned and vigorous hemlock, pine, oak and mixed hardwoods as well as notable habitat-potential trees (e.g. very large, rough trees or potential tall snags, etc.). As an "irregular shelterwood", this cut will, in a highly variable manner, increase light levels to the forest floor to allow for establishment of seedlings.

Special regeneration considerations (seed source, seed bed preparation, interfering vegetation, browse, etc.): If there is an opportunity to scarify the soil/leaf litter, this will improve the opportunity for white pine to seed in. Similarly, driving through the stand during an oak seed year will press acorns into the ground, allowing better establishment.

Special invasive species considerations: Please re-confirm severity ranking for this stand (cf. Stand Descriptions section). Stand must be ranked 1 or 2. If ranked 1, no treatment required. If ranked 2, treatment must fall within the same 12-month period as any harvesting. Stands ranked 3 or 4 are not eligible for harvesting.

Current level = 1. The main concern is the unseen threat of bittersweet (the barberry is not expected to spread), which is found, generally, in the area, though not in this stand. This means that there is a chance that bittersweet seed has distributed throughout the area by birds, and, therefore, even though no bittersweet plants were observed, there may be a viable seed bank that could be triggered by disturbance.

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Special soil considerations (erosion, seasonal timing, cultural, etc.): Ground must be adequately dry or frozen so that rutting/compaction are avoided. These conditions will be met at most times of year on some sections of this soil, but other sections will be less forgiving.

Special access considerations (erosion, access, timing, cultural, etc.): Access may require some sitework (cutting into the side of a hill to make a shelf) and the addition of crushed stone and gravel to create a stable, re-useable landing off Whately Road. This will need to be blocked off afterwards to prevent unwanted vehicle access. Also, the landing and surrounding disturbed areas should be monitored for the onset of invasive plants.

Access is also possible from the top of the hill, off Poplar Hill Road. A disadvantage to this access is that it will be harder to monitor once the logging is completed.

Special equipment/logging-system considerations: Any system that can adequately protect the ground/soil and residual stand is acceptable.

Special boundary considerations: Boundaries with northern and southern abutters should be blazed and painted.

Special invasive species considerations: This stand is at the lowest severity level, 1. The standard procedure for invasive inspections for stands ranked 1 or 2 should be followed. Since the abutting stand to the south was recently cut, inspections should occur in the south part of this stand within 3 years. Also, the few barberry shrubs in the wetland should be removed or treated.

In areas with grapes, either control these concurrent with harvesting or avoid cutting in these areas to avoid stimulating grapes.

Special habitat improvements (anything particular to accomplish): Reduce browsing by allowing hunting. This, combined with a selective harvest, may help restore needed regeneration.

Special habitat protection considerations (anything particular to protect): If VP 42 is confirmed as a vernal pool, the appropriate Best Management Practices to protect it should be followed.

Special trail/recreational considerations (anything particular to accomplish or avoid/protect): Avoid unnecessary disruption of snowmobile trail.

Special cultural resource considerations: Minimize any damage to stone walls and avoid damage to the cellar hole.

MANAGEMENT PRACTICES
to be done within next 10 years

Stand	Forest Type	Silviculture (harvesting)	Acres to Cut	BA to Cut	Mbf to Cut	Cords Wood to Cut	Cords Pulp to Cut	Year
21	GR	None	0	0	0	0	0	N/A

Stand Name: Ryan & West-Whately Dams

Watershed / Sub-watershed: Ryan & West-Whately Reservoir / Ryan & West-Whately Shore

See Stand Descriptions for discussion of possible restoration of the 9.0-acre terrace.

Special invasive species considerations: Severity level 4 is mostly due to autumn olive in the north section (R=5). The density of this infestation makes it a prime seed source that can spread this plant to many other areas. Chemical treatments exist that can kill autumn olive, but the proximity to the reservoir precludes the use of these. Fire could be considered here because the area is separated from other forest by the reservoir to the west, the road to the east, the mowed grass area to the south, and a boulder field to the north. With fire, though, there is a good chance that autumn olive will either resprout, grow from seed, or both. One option to consider would be brush mowing at least once per growing season to prevent autumn olive from putting out seed.

Special habitat improvements (anything particular to accomplish): The grassy area below the dam would be a good site for a kestrel box. Kestrels are a sharply declining species, due in part to the shortage of appropriate nesting sites. Numerous nearby fields would provide suitable hunting sites, while powerlines and isolated trees can serve as perches.

Instructions on building and placing nest boxes are available at many websites, including this one: www.wildlifehc.org/new/wp-content/uploads/.../American-Kestrel.pdf Monitoring the nest box is essential. The monitoring and construction of the box could certainly be done by volunteers of such groups as the Hampshire Bird Club or the Boy Scouts.

Special habitat protection considerations (anything particular to protect): The large talus slope should remain unvisited because turkey vultures don't tolerate disturbance well.

List of Locus, Stand Locator, and Stand Maps
(14 maps) for
the Ryan & West-Whately Reservoir Watersheds

Locus Map

Stand Locator Map

Stands 1 & 2

Stands 3 & 5

Stands 4 & 10

Stands 6 & 8

Stand 7

Stand 9

Stands 11 & 12

Stands 13 & 14

Stands 15 & 16

Stand 17

Stand 18

Stand 19

Stand 20

Stand 21

LOCUS MAP

LAND OF: City of Northampton
Department of Public Works

Ryan & West-Whately Reservoirs

ACRES: 2,440 +/- (ca. 94.5 is water)

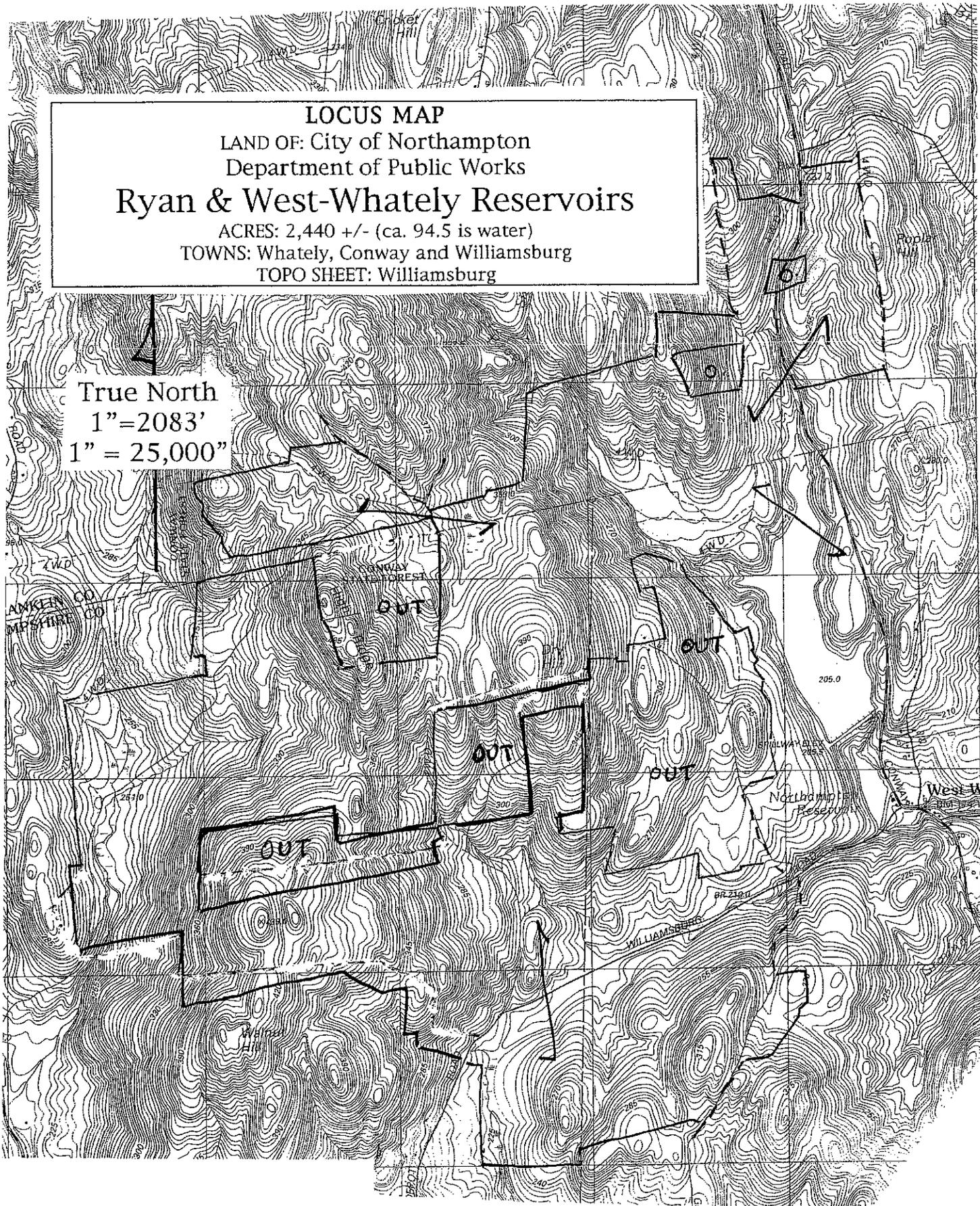
TOWNS: Whately, Conway and Williamsburg

TOPO SHEET: Williamsburg

True North

1"=2083'

1" = 25,000"



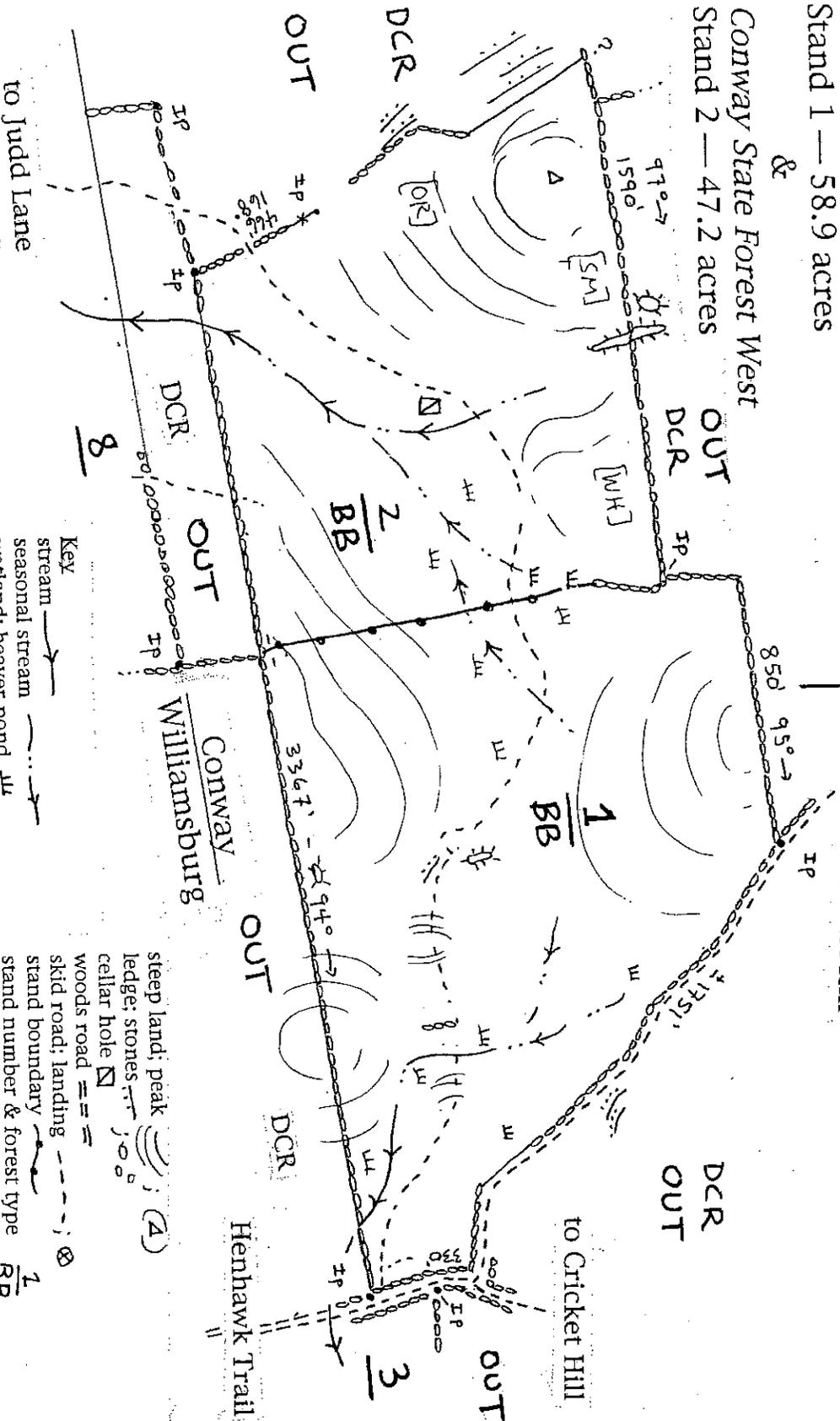
Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Conway, MA

Conway State Forest East
 Stand 1 — 58.9 acres

Conway State Forest West
 Stand 2 — 47.2 acres

True North
 1" = 500'

Map by Michael Mauri, L.F.
 20 West St. S. DfId., MA 01373
 (413) 665-6829 based on tax maps
 old DPW maps (where applicable)
 GIS-based map and fieldwork; 4/2012
 All metes and bounds by GPS/GIS
 Boundaries shown with "?" not confirmed
 on the ground.



Key
 stream →
 seasonal stream →
 wetland; beaver pond →
 vernal pool →
 stone wall →
 barbed wire →

steep land; peak (Δ)
 ledge; stones (□) (○)
 cellar hole (□)
 woods road ===
 skid road; landing (—) (—)
 stand boundary (—) (—)
 stand number & forest type (1/BB)
 included forest type [GEE]
 boundary uncertain ?
 iron pin; stone bound IP • ; SB □

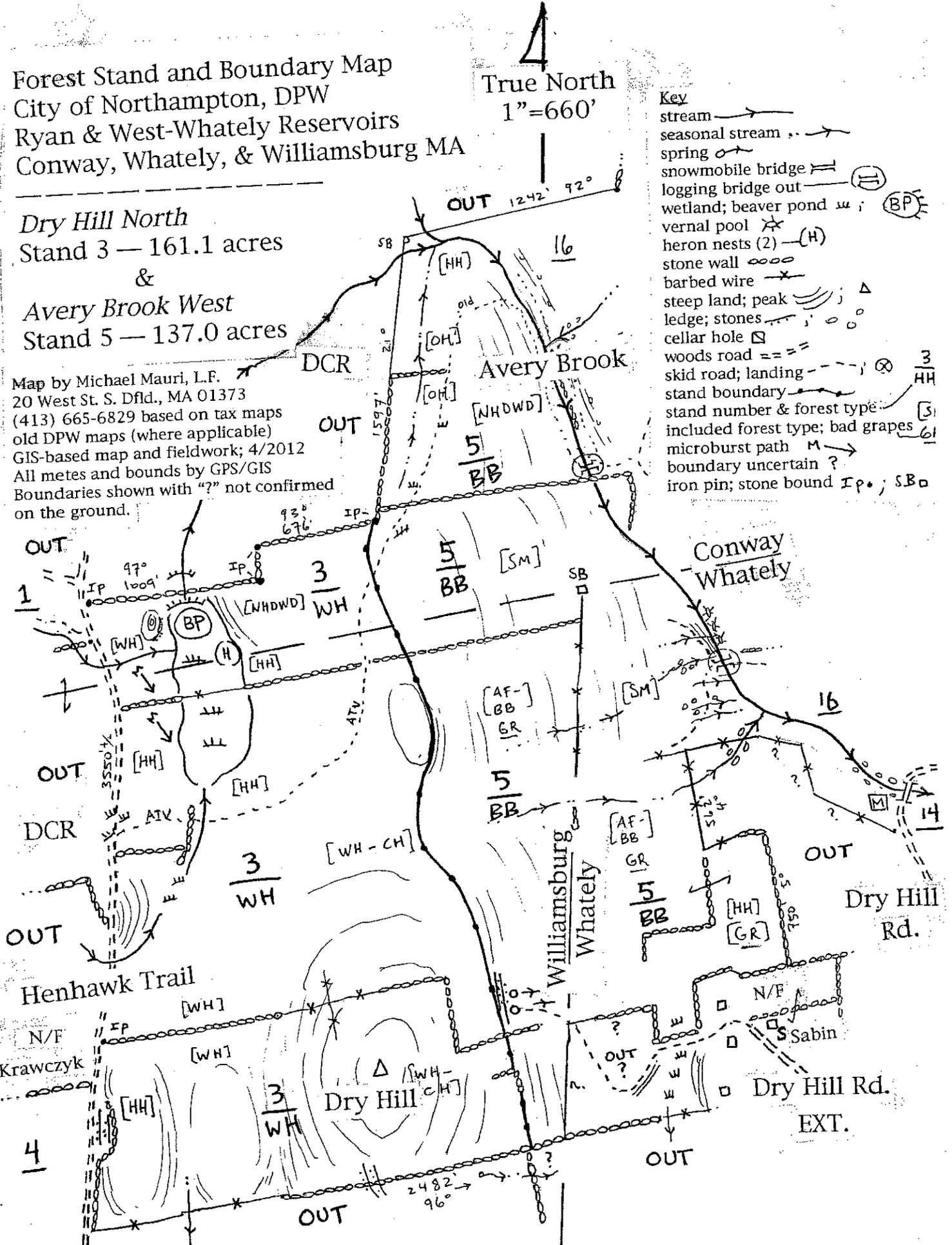
Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Conway, Whately, & Williamsburg MA

True North
 1"=660'

- Key
- stream →
 - seasonal stream .. →
 - spring ○
 - snowmobile bridge =
 - logging bridge out ⊞
 - wetland; beaver pond w ; (BP)
 - vernal pool *
 - heron nests (2) (H)
 - stone wall ○○○○
 - barbed wire -x-
 - steep land; peak ≡ ; Δ
 - ledge; stones ~ ; ○
 - cellar hole □
 - woods road ==
 - skid road; landing ⊗
 - stand boundary - - -
 - stand number & forest type []
 - included forest type; bad grapes []
 - microburst path M →
 - boundary uncertain ?
 - iron pin; stone bound IP ; SB

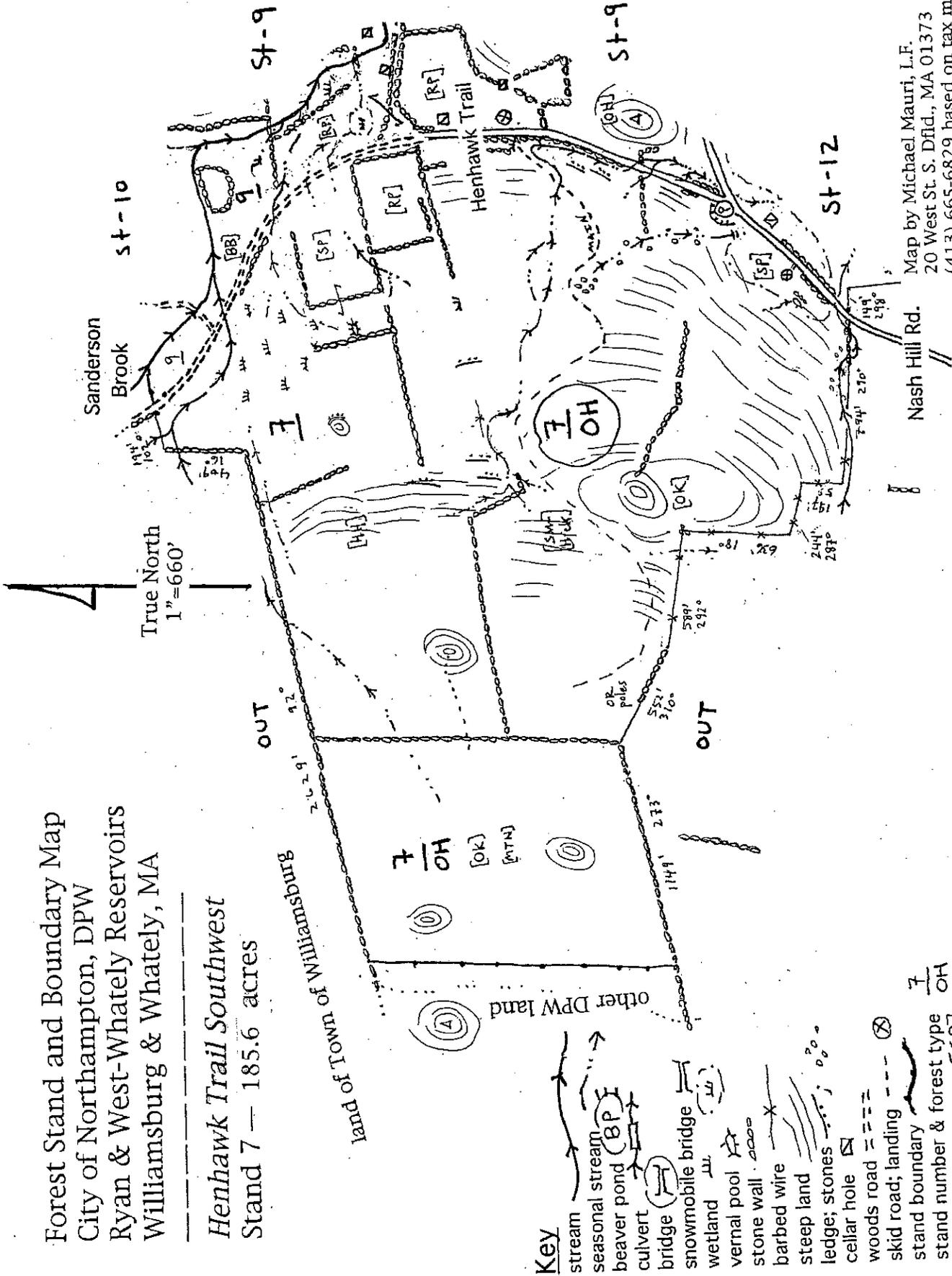
Dry Hill North
 Stand 3 — 161.1 acres
 &
 Avery Brook West
 Stand 5 — 137.0 acres

Map by Michael Mauri, L.F.
 20 West St. S. Dfld., MA 01373
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 GIS-based map and fieldwork; 4/2012
 All metes and bounds by GPS/GIS
 Boundaries shown with "?" not confirmed
 on the ground.



Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Williamsburg & Whately, MA

Henhawk Trail Southwest
 Stand 7 — 185.6 acres



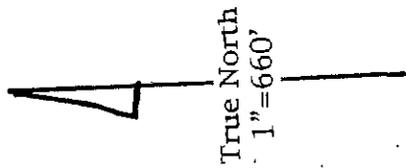
Key

- stream
- seasonal stream
- beaver pond (BPI)
- culvert
- bridge
- snowmobile bridge
- wetland
- vernal pool
- stone wall
- barbed wire
- steep land
- ledge; stones
- cellar hole
- woods road
- skid road; landing
- stand boundary
- stand number & forest type
- included forest type [SP]
- parking (P)
- iron pin (IP)

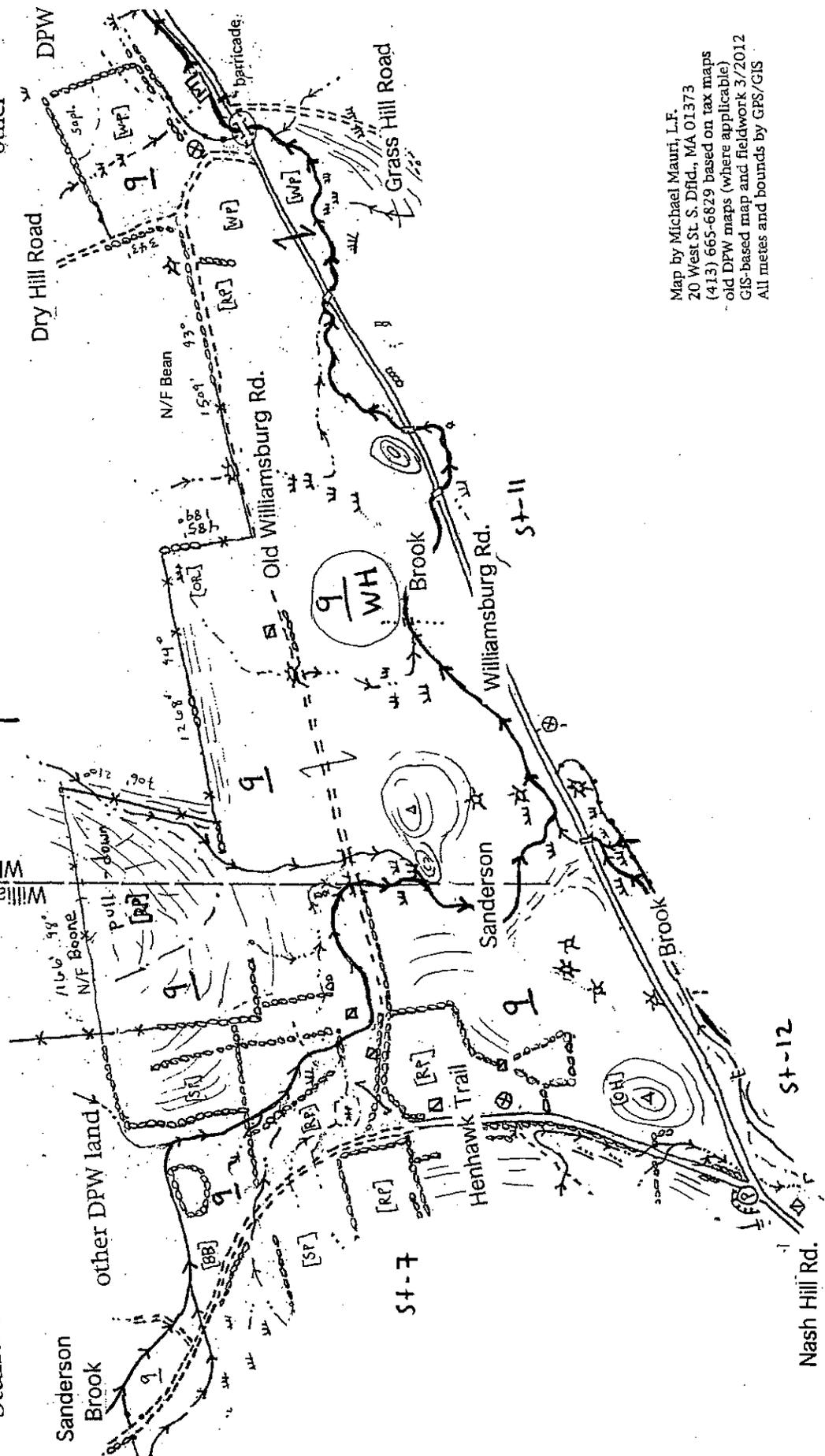
Map by Michael Mauri, L.F.
 20 West St. S. Dfild., MA 01373
 (413) 665-6829 based on tax maps
 old DPW maps (where applicable)
 GIS-based map and fieldwork 3/2012
 All metes and bounds by GPS/GIS

Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Williamsburg & Whately, MA

Old Williamsburg Road
 Stand 9 — 208.1 acres



- Key**
- steep land
 - ledge; stones
 - cellar hole
 - woods road
 - skid road; landing
 - stand boundary
 - stand number & forest type
 - included forest type [SP]
 - parking
 - stream
 - seasonal stream
 - beaver pond (BP)
 - culvert
 - bridge
 - snowmobile bridge
 - wetland
 - vernal pool
 - stone wall
 - barbed wire
 - DPW
 - other

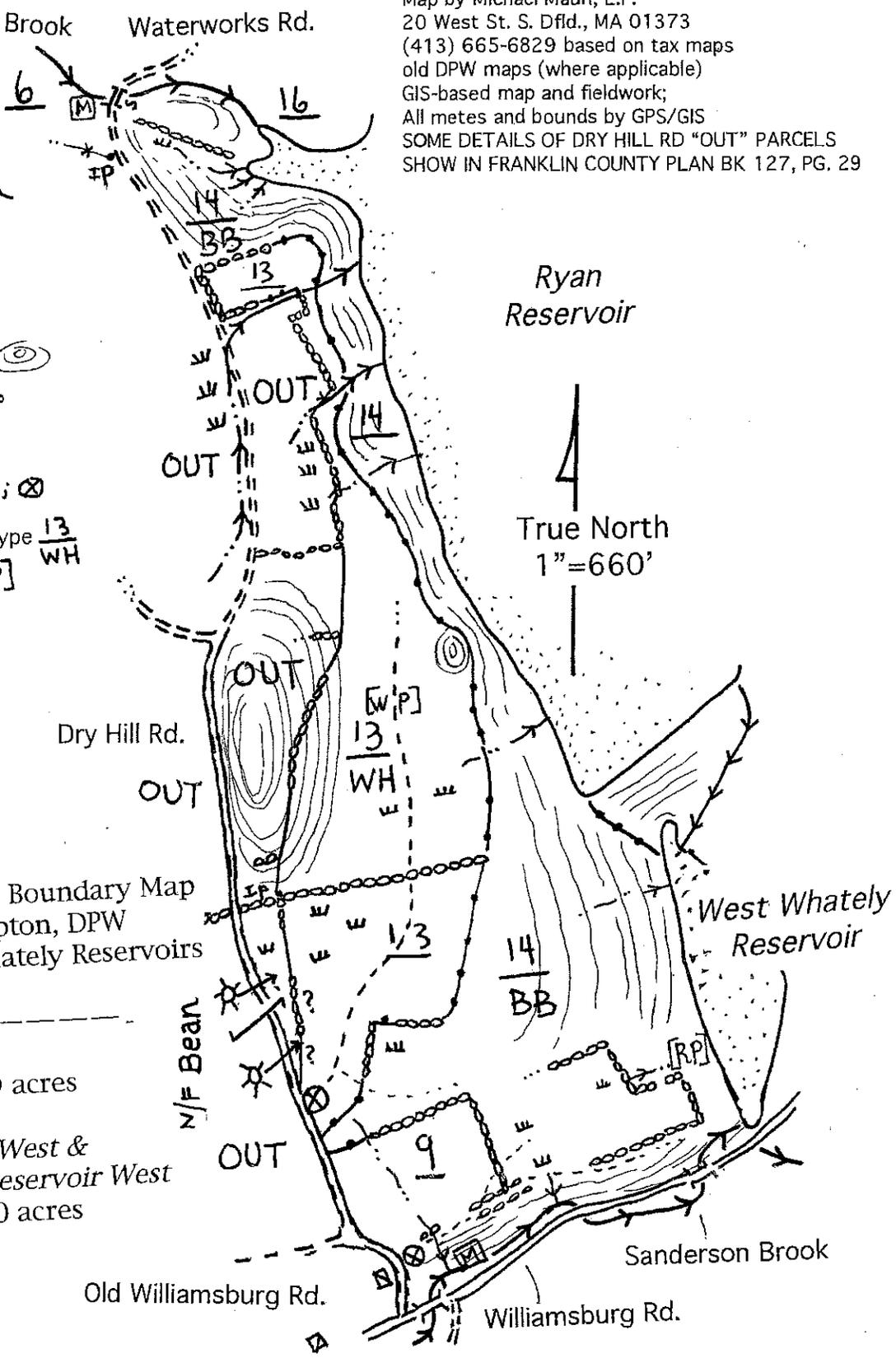


Map by Michael Mauri, L.F.
 20 West St. S. Dfild., MA 01373
 (413) 665-6829 based on tax maps
 old DPW maps (where applicable)
 GIS-based map and fieldwork 3/2012
 All metes and bounds by GPS/GIS

Map by Michael Mauri, L.F.
 20 West St. S. Dfd., MA 01373
 (413) 665-6829 based on tax maps
 old DPW maps (where applicable)
 GIS-based map and fieldwork;
 All metes and bounds by GPS/GIS
 SOME DETAILS OF DRY HILL RD "OUT" PARCELS
 SHOW IN FRANKLIN COUNTY PLAN BK 127, PG. 29

Key

- stream
- seasonal stream
- snowmobile bridge
- wetland
- vernal pool
- stone wall
- barbed wire
- steep land; knoll
- ledge; stones
- cellar hole
- mill site
- woods road
- skid road; landing
- stand boundary
- stand number & forest type $\frac{13}{WH}$
- included forest type [WP]
- iron pin



Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Whately, MA

Dry Hill East
 Stand 13 — 30.9 acres
 &

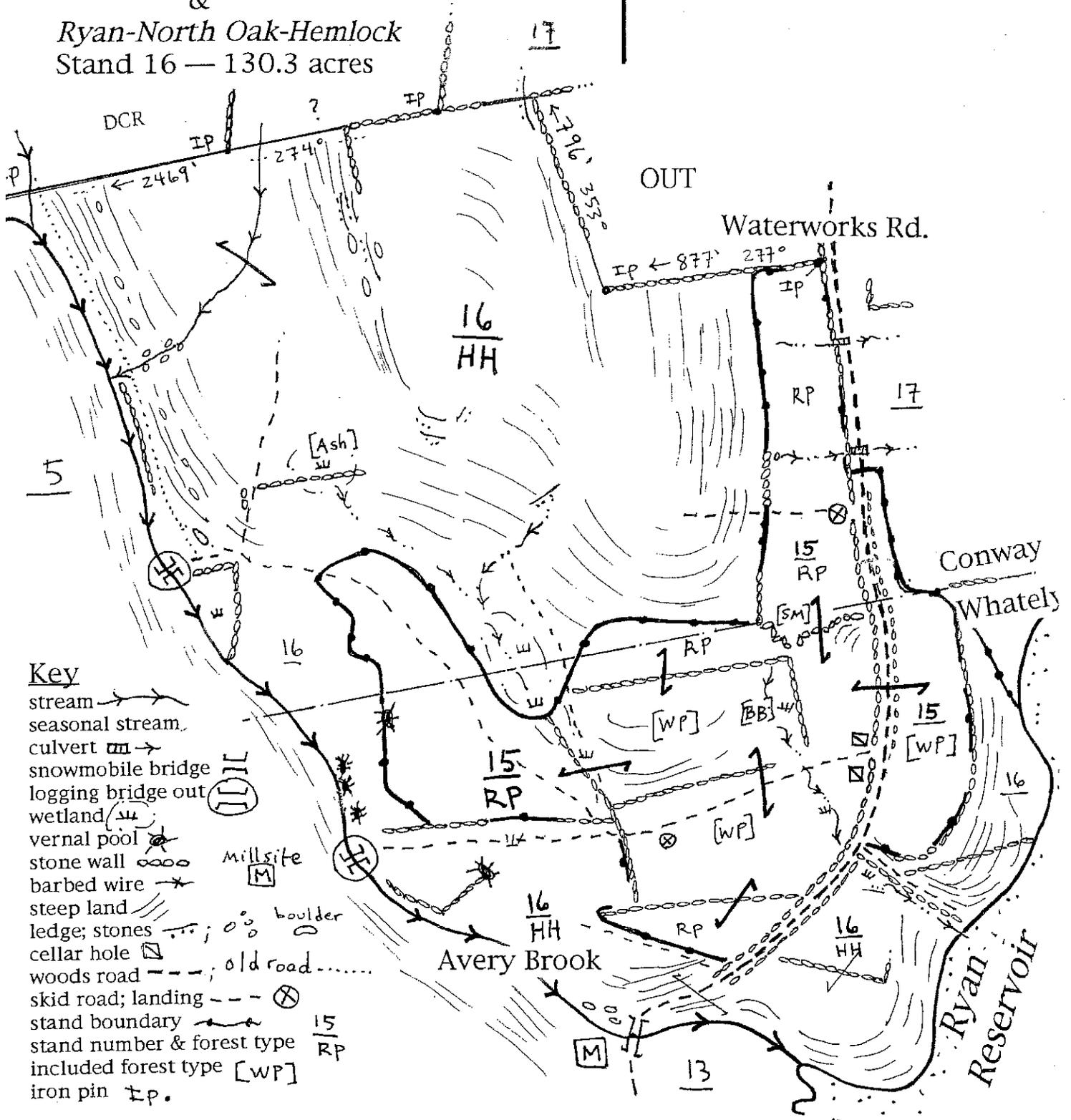
Ryan Reservoir West &
 West-Whately Reservoir West
 Stand 14 — 76.0 acres

Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Conway & Whately, MA

Map by Michael Mauri, L.F.
 20 West St. S. Dfld., MA 01373
 (413) 665-6829 based on tax maps
 old DPW maps (where applicable)
 GIS-based map and fieldwork;
 All metes and bounds by GPS/GIS

Ryan North Red Pine Plantation
 Stand 15 — 65.2 acres
 &
 Ryan-North Oak-Hemlock
 Stand 16 — 130.3 acres

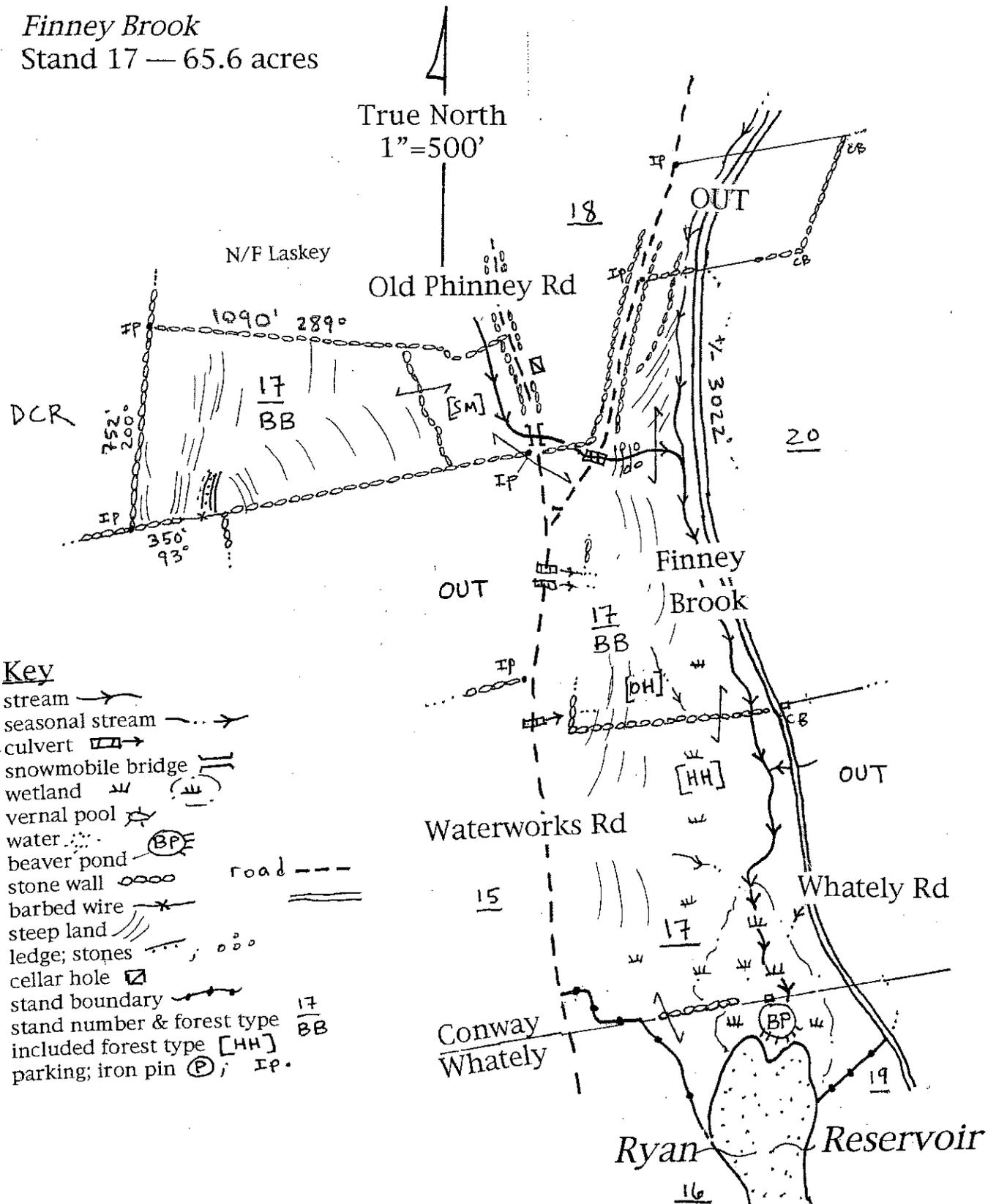
True North
 1"=500'



Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Conway & Whately, MA

Map by Michael Mauri, L.F.
 20 West St. S. DfId., MA 01373
 (413) 665-6829 based on tax maps
 old DPW maps (where applicable)
 GIS-based map and fieldwork;
 All metes and bounds by GPS/GIS

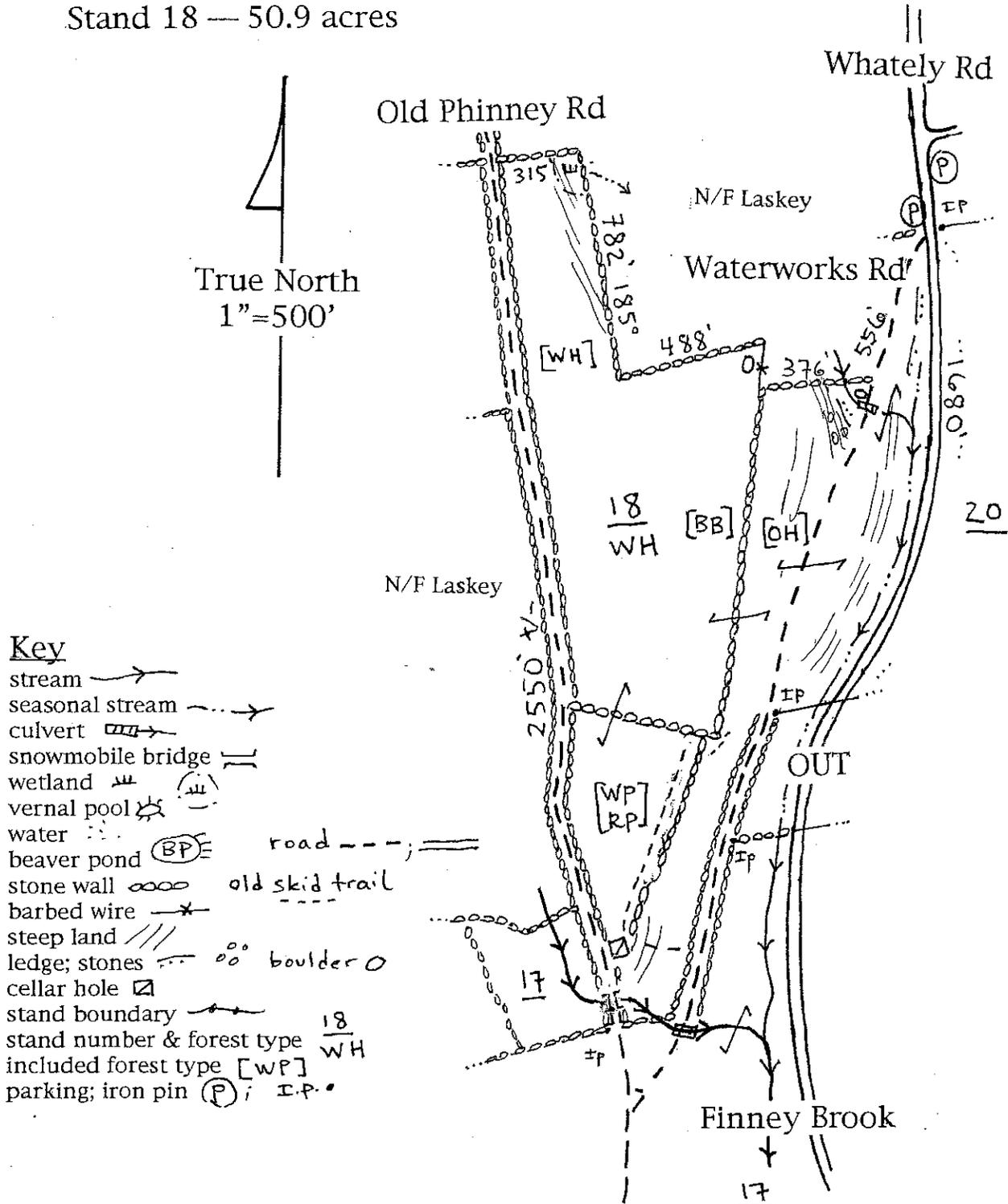
Finney Brook
 Stand 17 — 65.6 acres



Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Conay, MA

Map by Michael Mauri, L.F.
 20 West St. S. Dfld., MA 01373
 (413) 665-6829 based on tax maps
 old DPW maps (where applicable)
 GIS-based map and fieldwork;
 All metes and bounds by GPS/GIS

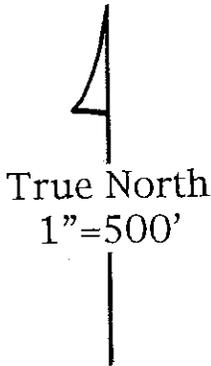
Waterworks Road Northwest
 Stand 18 — 50.9 acres



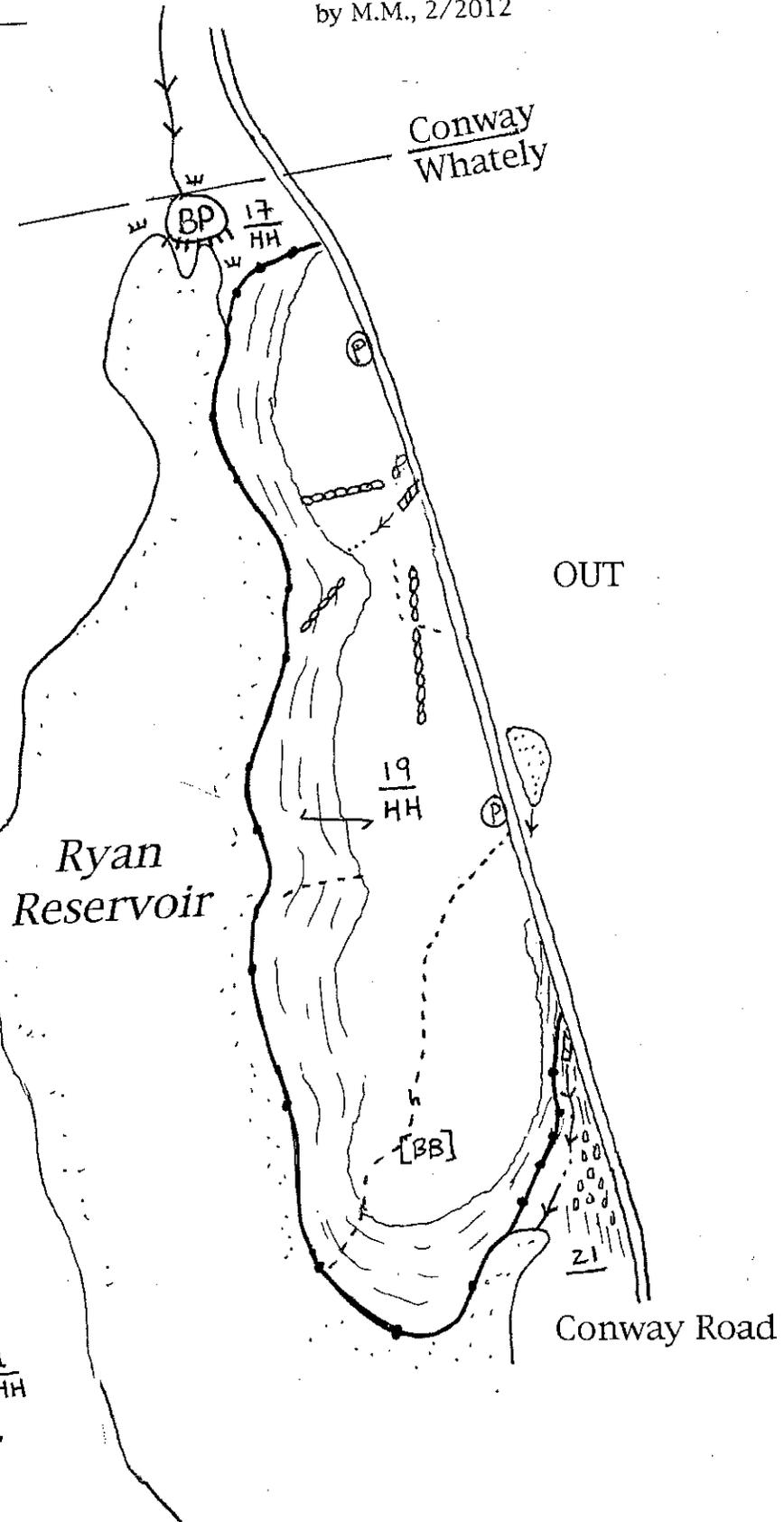
Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Whately, MA

Map by Michael Mauri, L.F.
 20 West Street, S. Deerfield, MA 01373
 (413) 665-6829, based on tax maps,
 old cutting maps (where applicable)
 GIS-based maps and fieldwork
 by M.M., 2/2012

Conway Road Terrace
 Stand 19 — 45.7 acres



other DPW land



Key

- stream →
- seasonal stream →
- culvert [hatched box]
- wetland [wavy lines]
- vernal pool [small circle]
- water [dotted area]
- beaver pond (BP)
- stone wall (∞)
- barbed wire (x)
- steep land [diagonal lines]
- ledge; stones [dots]
- cellar hole [square with diagonal lines]
- stand boundary [dashed line]
- stand number & forest type $\frac{1}{HH}$
- included forest type [BB]
- parking; iron pin (P); i.p.

Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Conway, MA

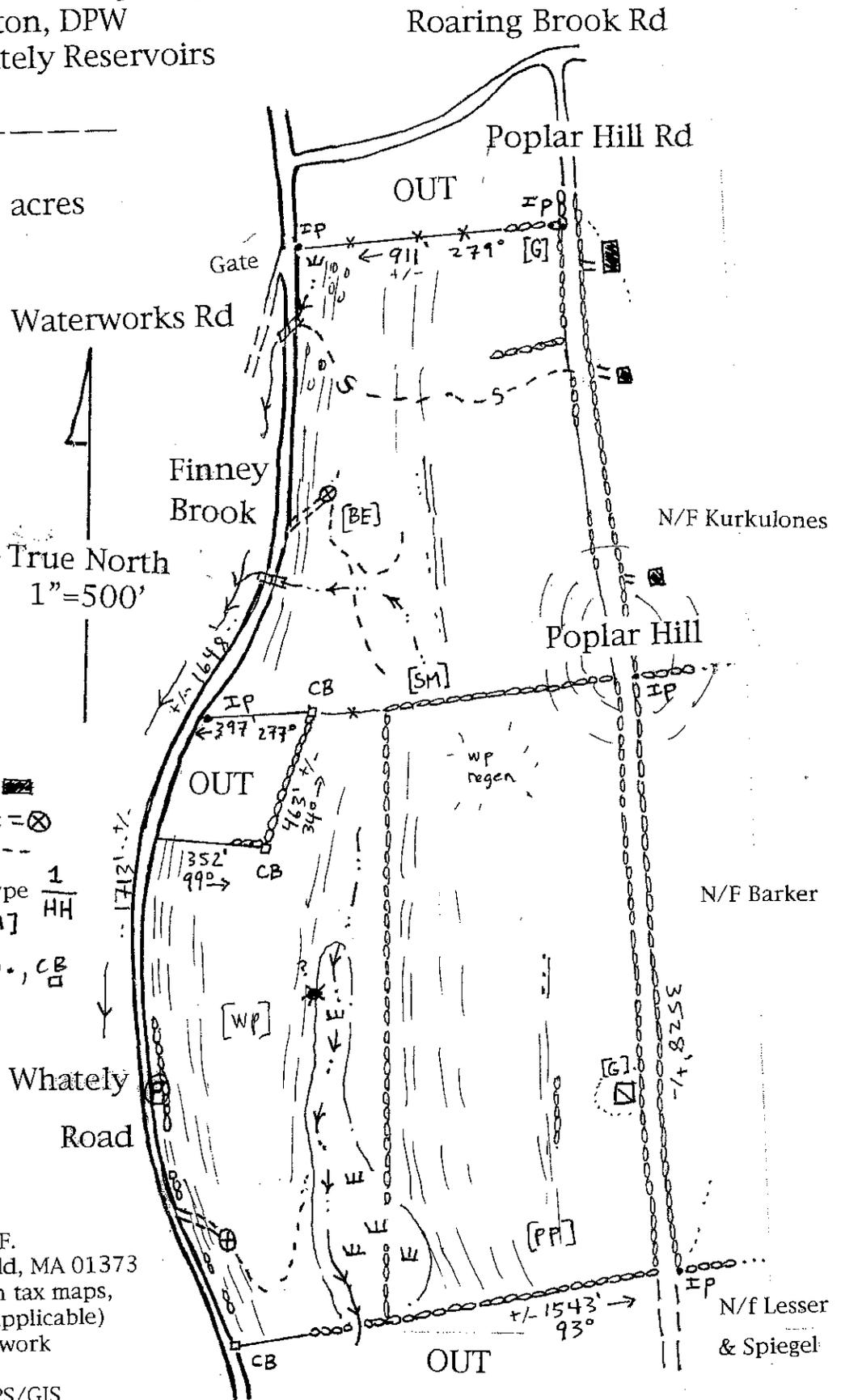
Poplar Hill
 Stand 20 — 108.3 acres

Key

- stream
- seasonal stream
- culvert
- wetland
- vernal pool
- water
- beaver pond (BP)
- stone wall
- barbed wire
- steep land
- ledge; stones
- cellar hole
- house; machine shop
- old road cut to landing
- snowmobile trail
- stand boundary
- stand number & forest type $\frac{1}{HH}$
- included forest type [SM]
- parking (P)
- iron pin; conc. bound IP, CB

- grapes [G]
- sugar maple [SM]
- pitch pine [PP]
- white pine [WP]
- beech [BE]

Map by Michael Mauri, L.F.
 20 West Street, S. Deerfield, MA 01373
 (413) 665-6829, based on tax maps,
 old cutting maps (where applicable)
 GIS-based maps and fieldwork
 by M.M., 2/2012
 all metes & bounds by GPS/GIS



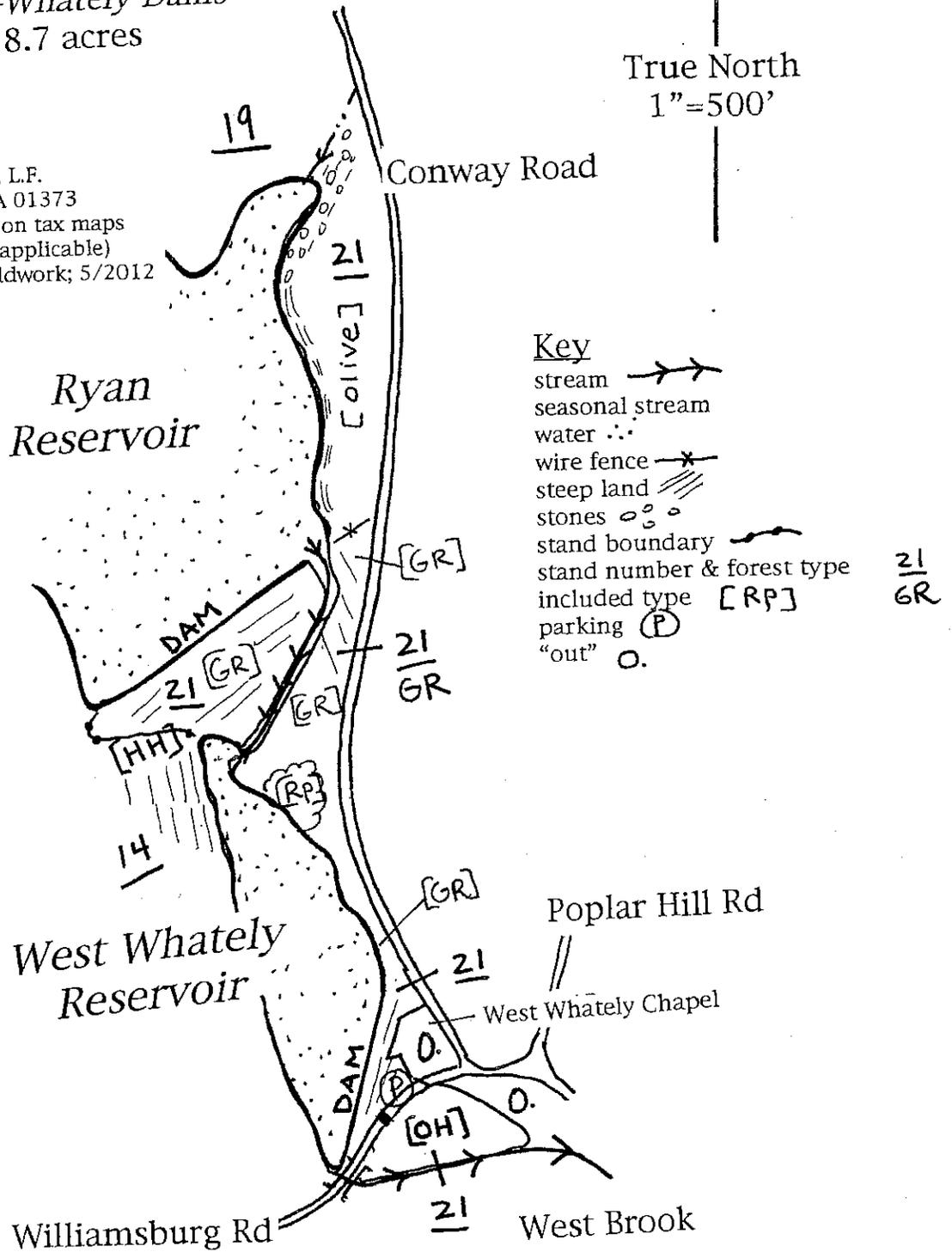
N/f Lesser
 & Spiegel

Forest Stand and Boundary Map
 City of Northampton, DPW
 Ryan & West-Whately Reservoirs
 Whately, MA

Ryan & West-Whately Dams
 Stand 21 — 18.7 acres

Map by Michael Mauri, L.F.
 20 West St. S. Dfld., MA 01373
 (413) 665-6829 based on tax maps
 old DPW maps (where applicable)
 GIS-based map and fieldwork; 5/2012

True North
 1"=500'



Signature Page Please check each box that applies.

CH. 61/61A Management Plan I attest that I am familiar with and will be bound by all applicable Federal, State, and Local environmental laws and /or rules and regulations of the Department of Conservation and Recreation. I further understand that in the event that I convey all or any portion of this land during the period of classification, I am under obligation to notify the grantee(s) of all obligations of this plan which become his/hers to perform and will notify the Department of Conservation and Recreation of said change of ownership.

Forest Stewardship Plan. When undertaking management activities, I pledge to abide by the management provisions of this Stewardship Management Plan during the ten year period following approval. I understand that in the event that I convey all or a portion of the land described in this plan during the period of the plan, I will notify the Department of Conservation and Recreation of this change in ownership.

Green Certification. I pledge to abide by the FSC Northeast Regional Standards and MA private lands group certification for a period of five years. To be eligible for Green Certification you must also check the box below.

Tax considerations. I attest that I am the registered owner of this property and have paid any and all applicable taxes, including outstanding balances, on this property.

Signed under the pains of perjury:

Owner(s) *Edward S. Hunt* Date 6/25/12

Owner(s) _____ Date _____

I attest that I have prepared this plan in good faith to reflect the landowner's interest.

Plan Preparer *[Signature]* Date 6-22-12

I attest that the plan satisfactorily meets the requirements of CH61/61A and/or the Forest Stewardship Program.

Approved, Service Forester *Sean Abbey* Date 7/30/2012

Approved, Regional Supervisor _____ Date _____

In the event of a change of ownership of all or part of the property, the new owner must file an amended Ch. 61/61A plan within 90 days from the transfer of title to insure continuation of Ch. 61/61A classification.

Owner(s) City of Northampton Town(s) Conway, Whately & Williamsburg

Ryan

STAND DESCRIPTIONS

Outreach Plan in Conjunction with Forest Stewardship
Planning: Northampton DPW
Ryan & West-Whately Reservoir Watershed
and Mountain Street Reservoir Watershed
6/6/2012

Purpose: Help develop public awareness of the role of forest management in sustaining the forested watersheds that supply water to most residents of the City of Northampton

Practice 1: create multiple-use/repeat-use educational brochure

Target audience: City residents and water users, abutters, general public; commissions of affected towns

Message: objectives and methods of forest management in a watershed setting

Advertising: include as bill stuffer to water customers; possible press release and posting on City website or other web-based platform; distribute at hikes (see below); possibly mail to abutters; possibly mail to Conservation Commissions and other commissions of Whately, Conway, Hatfield and Williamsburg and to libraries in affected towns.

Evaluation: (1) brochure is created and printed; (2) brochure has been mailed out to every water customer Conservation Commissions and other commissions of Whately, Conway, Hatfield and Williamsburg and to libraries in affected towns

STAND DESCRIPTIONS

Practice 2: offer educational hikes to show forest features (good and bad) and also before and after implementation of management practices

Target audience: City residents and water users, abutters, general public; commissions of affected towns; landowners

Message: concrete examples of forest management in a watershed setting (e.g. timber harvesting, invasive species control, etc.)

Advertising: include as bill stuffer to water customers; possible press release and posting on City website or other web-based platform; distribute at hikes (see below); possibly mail to abutters; possibly mail to Conservation Commissions and other commissions of Whately, Conway, Hatfield and Williamsburg

Evaluation: 10 hikes over a 10-year period