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Executive Office of Environmental Affairs
Division of Fisheries and Wildlife
Biodiversity Initiative—Forestry Program

Resource Management Plan

Taconic Mountains and Marble Valleys Forest Management Zone

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Executive Summary

The Division of Fisheries and Wildlife (DFW) is responsible for the stewardship and management of >137,000 acres of state wildlife lands. DFW has identified nine Forest Management Zones (FMZs) across Massachusetts that are based on U.S. Forest Service Ecoregion boundaries. Each FMZ includes multiple DFW properties, and the Taconic Mountains and Marble Valleys FMZ consists of more than 6,654 acres in 23 properties, including 1,171 acres that is co-owned with the Department of Conservation and Recreation (the Jug End State Reservation and WMA). A combination of ecological, socioeconomic, and administrative factors led DFW to combine the following associations in two ecoregions which span the two ecological provinces in Massachusetts into the Taconic Mountains and Marble Valleys FMZ: the Taconic Highlands and Western New England Marble Valleys Associations of the Taconic Mountains Ecoregion in the New England–Adirondack Province and the Western New England Marble Valleys Association of the Hudson Highlands Ecoregion in the Eastern Broadleaf Forest (Oceanic) Province.

The hierarchy of forest management planning on DFW lands begins with DFW’s statewide “Forest Management Guidelines for Wildlife Management Areas” (Scanlon and others 2000), followed by ecoregion assessments of forest resource issues and opportunities on public and private lands compiled by the Massachusetts Executive Office of Environmental Affairs (EOEA). Next, individual FMZ plans provide an assessment of current forest conditions and identify a desired future condition that will achieve DFW’s wildlife habitat goals on state wildlife lands. FMZ plans describe forest management and monitoring activities designed to achieve the desired future conditions and monitor the outcome of management activities. FMZ plans identify active and passive management sites on DFW land. Active management sites provide young forest habitat, enhanced structural attributes (e.g., snags, den trees, and coarse woody debris) and a sustainable flow of wood products. Passive management sites include forest reserves that will conserve elements of biological diversity that are missing from harvested sites, provide biologically mature forest habitat, facilitate assessment of sustainable harvesting practices, and provide aesthetic, recreation, and spiritual opportunities. FMZ plans are followed by property level plans (site plans) for individual DFW Wildlife Management Areas (WMAs), then by Ch. 132 Forest Cutting Plans for actively managed stands within an individual WMA.

DFW properties in the Taconic Mountains and Marble Valleys FMZ contain a mixture of mid-aged upland forest, wetlands, and abandoned or active agricultural sites. About 71% (4,742 of 6,654 acres) of DFW lands in this FMZ are forested (including 4,132 acres of upland forest and 610 acres of wetland forest), and about 29% (1,912 of 6,654 acres) are non-forested (including 28 acres of developed land, 747 acres of non-forest upland, and 1,137 acres of non-forest wetland). Of the more than 3,600 acres for which cover type data is available, more than 1,500 acres is central and northern hardwood forest with mixtures of white pine and hemlock, more than 600 acres is wetland forest; more than 1100 acres is non-forest wetlands, and more than 300 acres is abandoned field, grassland, and shrubland habitats. Much of the unmapped area is known to be forested upland, although the types are awaiting the completion of our forest inventory.

DFW forest composition goals recommend 15-20% young forest habitat (seedling, sapling, and small-pole forest typically ≤ 30 years old), and 10-15% biologically mature (typically >150 year old) forest habitat. Of the area mapped as forest, there is no seedling forest, 5% young sapling/pole-sized forest and no known biologically mature forest habitat. Accordingly, 770 acres (about 16.4% of the estimated area of forest) have been designated as forest reserves to provide future biologically mature forest habitat, and at least 2,400 acres will be managed with even-aged silviculture to create adequate young forest habitat. Management activities require environmental permit compliance, soil and water conservation, rare species protection, public recreation opportunities, and conservation of historical and cultural resources, and additional small areas around certain disturbance-sensitive resources will be designated as patch reserves.

Public meetings have been scheduled for December 6 and 7, 2006 at times and places to be announced to present a summary of this draft FMZ plan and to solicit oral comments on the plan. Further, this draft plan will be posted for public review on the DFW website in November, 2006, and written comments on this draft plan will be received by DFW until February 16, 2007.

I. Background

1. DFW statutory responsibilities

The Division of Fisheries and Wildlife (DFW) has statutory responsibility for the conservation—including protection, restoration and management—of Massachusetts' flora and fauna (Darey and Jones 1997), and is responsible for the stewardship and management of over 137,000 acres of state wildlife lands.

Specifically, as an agency of the Executive Office of Environmental Affairs (EOEA), the Division of Fisheries and Wildlife (DFW) is empowered by Massachusetts General Law (MGL), Chapter 21A, section 2, sub-section 3 to “provide for the propagation, protection, control and management of fish, other aquatic life, wildlife, and endangered species”, and under sub-section 15 to “manage all lands and properties acquired by or assigned to [DFW] to preserve their natural beauty, wilderness, or open character or hydrological, geological, historical, scientific, wildlife management, recreational or other significance or value”. MGL Chapter 131, Section 1H, establishes within DFW “...a bureau of wildlife research and management...[to] provide for all beneficial forms of wildlife ...[through] wildlife research and management...”. Further, Chapter 131:1A places all activities carried out by DFW “...under the supervision and control of the Fisheries and Wildlife Board, which shall consist of seven members to be appointed by the Governor for terms of five years”. Also, the Massachusetts Endangered Species Act (MESA), MGL 131A, states that “All agencies, departments, boards, commissions and authorities shall utilize their authorities in furtherance of the purposes of this chapter and shall review, evaluate and determine the impact on endangered, threatened and special concern species of all works, projects or activities conducted by them and shall use all practicable means and measures to avoid or minimize damage to such species.”

2. Biodiversity initiative

In support of this mandate and with the approval of the Fisheries and Wildlife Board, the Division began a biodiversity initiative in July 1996 which seeks to combine management of upland habitats by the wildlife section with restoration of unique ecological communities by the Natural Heritage section. The goal of this coordinated effort is to enhance and maintain the biological diversity of Massachusetts. From DFW's perspective, the term ‘biodiversity’ refers to the entire assemblage of plants and animals, their supporting habitats and natural communities, and the natural processes that sustain them. This effort involves the DFW Forestry Program (which manages forested portions of state wildlife lands), the Upland Habitat Management Program (which coordinates with DFW District offices to manage abandoned agricultural lands), and the Ecological Restoration Program (which manages degraded and/or altered habitats to support rare species). The Forestry and Upland Programs are components of the DFW Wildlife Section, and the Ecological Restoration Program is a component of the DFW Natural Heritage and Endangered Species (NHESP) section.

3. Forest certification and ecoregion planning approach

This plan covers management activities conducted by the DFW Forestry Program on about 6,654 acres of state wildlife lands in DFW's Taconic Mountains and Marble Valleys Forest Management Zone. DFW lands were certified under the international Forest Stewardship Council (FSC) criteria for sustainable forestry in May of 2004 (Seymour et al. 2004, also see http://www.fscus.org/newsletters/FSCNews_jun_2004.pdf). The FSC certification encourages ecoregion assessment and planning for public forestlands in Massachusetts, and requires that DFW complete forest management plans for all of its properties. Accordingly, DFW has worked cooperatively with other EOEA agencies (including the Department of Conservation and

Recreation (DCR) Division of Forest and Parks–Bureau of Forestry, and Division of Watershed Protection–Watershed Management Section), and with the USDA Forest Service to develop ecoregion boundaries for Massachusetts (Figure 1). EOE, DCR and DFW are preparing ecoregion assessments to be used by all state land management agencies as an initial step in the planning process (see <http://www.mass.gov/envir/forest/>).

4. Forest Management Zones, Districts, and Wildlife Management Zones

Continuing with this process, DFW has identified nine ecoregion-based Forest Management Zones (FMZs) that consider multiple DFW properties in a landscape context (Fig. 2). In some cases, an FMZ represents a single ecoregion. In other cases, an FMZ groups adjacent ecoregions that have similar management issues. Although FMZ boundaries recognize ecoregion boundaries, the process of delineating FMZs incorporated historical, cultural, and socio-economic issues, as well as ecological concerns. To avoid arbitrary changes to FMZ boundaries with the acquisition of new properties, some FMZ boundaries may bisect WMA boundaries. Management within these WMAs needs to take into account the different characteristics of the two FMZs.

While each FMZ overlaps portions of one or two of the five DFW administrative Wildlife Districts, (which are based on town boundaries (Fig. 3)), geodatabase processing allows easy tracking of forest management activities by FMZ and by administrative Wildlife District. Each FMZ also overlaps one or more of the 15 DFW Wildlife Management Zones (Fig. 4). Wildlife Management Zones were established using a combination of ecological and socioeconomic factors, and are used primarily to manage regulated hunting seasons for white-tailed deer, wild turkey, black bear, and bobwhite quail. Accordingly, these boundaries follow easily followed physical features, such as major highways and rivers which provide obvious boundaries that hunters and environmental law enforcement can recognize. Again, geodatabase processing allows easy tracking of forest management activities within each FMZ by Wildlife Management Zone.

5. Forest management planning hierarchy

In the hierarchy of forest management planning on DFW lands, FMZ plans are followed by property level plans (site plans) for each wildlife management area (WMA) within the FMZ (Table 1). Site plans are brief, specific documents that relate landscape-level goals and objectives to individual properties or small groups of adjacent properties. Finally, Ch. 132 Forest Cutting Plans are generated to describe harvesting in actively managed stands on an individual property (Table 1).

Except in the case of rare species protection, the Guidelines are not oriented toward game, non-game or single species management. They provide a state-wide background and reference for DFW forest management planning. The Guidelines recommend the designation of active and passive management areas in order to achieve landscape composition goals. Active management areas are open to sustainable harvesting of wood products to provide young forest habitat and to enhance structural habitat attributes (e.g., snags, den trees, mast-producing trees, coarse woody debris). Passive management areas will include forest reserves that will typically be closed to commercial timber harvesting in order to provide biologically mature forest habitat (generally >150 years old) and to provide control sites for evaluating the sustainability of harvesting conducted in active management areas.

Table 1. The management planning process for DFW forestlands.

DOCUMENT:	DFW Forest Management Guidelines	EOEA Ecoregion Assessments	DFW Forest Management Zone Plans	DFW Site Plans	DFW Ch. 132 Forest Cutting Plans
CONTENT:	Background and general strategy for forest management on DFW lands.	Issues and opportunities for public & private forestland in one or more ecoregions.	Ecoregion-based assessment of forest resources and proposed forest monitoring & management activities to achieve desired future conditions on DFW lands.	Property level prescriptions for active and passive management sites on DFW lands.	Stand level harvest prescriptions for active management sites on individual DFW properties.
AREA COVERED:	State	Ecoregion(s)	FMZ	WMA	Harvest Area
TIME FRAME	Open-ended	Open-ended	20 years	10 years	1 year

II. Introduction

This FMZ plan provides a summary and assessment of forest resources on about 6,654 acres of DFW lands in the Taconic Mountains and Marble Valleys region of Massachusetts (Figs. 5, 5A, 5B, 5C) The plan describes long-term forest monitoring and management goals for DFW lands, and identifies portions of DFW lands where active and passive management will occur over the next few decades (2006-2026). Active management includes activities such as timber sales designed to create or enhance young forest habitat, while passive management includes identification of forest reserves to establish biologically mature forest habitat

The Taconic Mountains and Marble Valleys FMZ consists of two ecoregions which span the two different ecological provinces in Massachusetts (Figs. 2 and 6), and is described in the recent EOEA Berkshire Ecoregion Assessment (Fleming and others 2005). A combination of ecological, socioeconomic, and administrative factors led DFW to group the Taconic Mountains ecoregion (Taconic Highlands and Western New England Marble Valleys associations) in the New England–Adirondack Province, with the Western New England Marble Valleys Association of the Hudson Highlands Ecoregion in the Eastern Broadleaf Forest (Oceanic) Province into the Taconic Mountains and Marble Valleys FMZ (Fig. 6).

The boundary between the New England-Adirondack and Eastern Broadleaf provinces closely parallels what Cogbill et al. (2002) referred to as a “discrete tension zone” that formerly separated northern hardwood and central hardwood forests prior to European settlement. This tension zone corresponds to differences in physiography, climate, and fire regime. The ecoregions within the New England-Adirondack Province will tend to support Northern Hardwood (Beech-Birch-Maple) forest intermixed with White Pine, Eastern Hemlock, and at higher elevations, Red Spruce and Balsam Fir, while all sub-sections in the Eastern Broadleaf Province will tend to support Oak-Hickory forest intermixed with White Pine, some Eastern Hemlock, and in Eastern MA, Pitch Pine and Scrub Oak. However, the post-European settlement view of forests as

commodities to be exploited led to a dramatic and drastic alteration of the forest landscape throughout Massachusetts during the 18th and 19th centuries (Foster et al. 1998). This alteration obscured regional forest patterns like those described by Cogbill et al. (2002) that formerly corresponded to climate, substrate, and fire regime (Foster et al. 1998, Fuller et al. 1998).

Although the original pre-European settlement ecology of this region would seem to imply a different management approach for the Hudson Highlands ecoregion vs. the Taconic Mountains ecoregion, the similar historical land-use throughout these two ecoregions, and the cultural connections of the entire region supports the combination these areas into a single FMZ. Geodatabase processing readily allows tracking of management activities anywhere within the Taconic Mountains and Marble Valleys FMZ by ecoregion and/or by province.

III. Goals and Objectives

The overall goals of the Taconic Mountains and Marble Valleys FMZ plan are to:

- Identify a desired future condition of forest resources that will conserve and enhance native biological diversity on DFW lands within the FMZ.
- Plan forest monitoring and management activities that will support the desired future condition over the next 20 years.

A number of specific objectives support these goals:

- Evaluate impacts of landuse history and natural disturbance processes on forest habitat in the FMZ.
- Summarize current forest resource conditions on DFW lands in the FMZ.
- Establish forest structure and composition goals that define a desired future condition for the FMZ to conserve and enhance biological diversity.
- Identify active and passive management sites on DFW lands that facilitate achieving forest structure and composition goals. Active management sites support sustainable harvesting operations that provide young forest habitat, while passive management sites include forest reserves that are closed to commercial harvesting to provide biologically mature forest habitat.
- Establish biological monitoring and silvicultural prescriptions for active management sites on DFW lands to achieve forest structure and composition goals, and to facilitate comparisons of monitoring results from reserve lands.
- Establish biological monitoring and passive management prescriptions (e.g., invasive plant control, prescribed fire application, public recreation use) for forest reserve areas.
- Plan spatial and temporal applications of silvicultural prescriptions on active management sites.

IV. Landuse History & Natural Disturbance Processes

1. Land-use history and pre-settlement condition

The current even-age forests that dominate the Taconic Mountains and Marble Valleys landscape are the result of historic land use practices followed by farm abandonment. The forest communities and species assemblages that now dominate our forest landscape bear little relationship to the physiographic relationships that dominated the landscape prior to the colonial era (Foster and others 1998). A period of several hundred years may be required before stable

community relationships become reestablished. In fact some plant and animal communities may have been altered beyond the point or threshold that makes the return to a natural community structure and composition difficult or even impossible (Engstrom and others 1999). The fire-adapted communities of the pre-European settlement era that likely occurred in the southern river valleys of the Eastern Broadleaf Forest portion of the Taconic Mountains and Marble Valleys FMZ represent one example of natural communities that may be difficult, if not impossible to restore, at least on a large scale.

Currently, the plant communities in this FMZ are structurally and compositionally very different from those that occurred during the pre-settlement period. In the New England-Adirondack province prior to European settlement, the sides and summits of mountains were typically covered by hemlock, spruce and fir while the greater portion of the uplands was probably dominated by a mosaic of biologically mature, uneven-age northern hardwoods with a more substantial component of American beech than occurs today (Cogbill et al. 2002). Unlike the pre-settlement forest communities, the current forest communities of this ecological region contain proportionately fewer conifers. In addition, the introduction of the Hemlock Adelgid will likely remove most of the remaining hemlock cover, and further exacerbate the recent historical trend toward reduced conifer habitats throughout the Taconic Mountains and Marble Valleys FMZ.

Hemlock was probably the most abundant conifer within the hardwood communities while white pine was scattered occasionally throughout. Most of the rest of the northern hardwood forest community consisted largely of yellow and white birch, beech and sugar maple. Ash and basswood could have been locally important in some areas and oak and chestnut likely occurred primarily on dry ridges or alluvial soils (Bromley 1935). Bromley's speculation that the predominant vegetation of pre-colonial southern New England was not a closed canopy forest, but rather was an open "woodland greatly modified by fire and anthropic factors," probably referred primarily to the Eastern Broadleaf Forest province, with its dominance of oak, chestnut, and hickory species.

Knowledge and understanding reference conditions (the pre-settlement plant community dynamic) and the natural disturbance patterns that shaped those conditions helps land managers to refine silvicultural practices to regenerate native tree species historically adapted to the site, and to emulate natural disturbance process that originally maintained a mix of native species and natural communities. Human impacts (landuse change, introduction of exotic pathogens, etc.) makes it impractical to implement management scenarios that mimic landscape conditions under pre-settlement disturbance regimes. However, it is still prudent to use the range of pre-settlement conditions to evaluate current and future management scenarios. An understanding of the background rates and causes of change in forested landscapes can help to guide conservation efforts on many scales (DeGraaf and Miller, 1996).

However, identification of reference conditions is one of the major challenges for land managers interested in emulating natural disturbance patterns. In the absence of detailed site specific information, but with evidence from the remnant plant populations as well as early recorded observations, it seems clear that harvesting in these northern hardwood plant communities during the settlement period decreased the proportion of conifers relative to hardwoods and probably increased the proportion of yellow birch, white birch, striped maple, pin cherry and aspen relative to the pre-settlement condition (Bromley 1935).

One biologically mature northern hardwood community in southern New England that was not disturbed during the settlement period was characterized in 1913 as being dominated by beech and hemlock in slightly varying amounts but totaling 55% when taken together. Sugar maple (12%), yellow birch (10%), red oak (6%), chestnut (6%), white ash and basswood (7%), black cherry, red maple, black birch and white pine (4%) were the other components of this association

(Nichols 1913 and Lutz 1928, cited in Bromley 1935). Chestnut has since become an understory species due to the Chestnut blight, while sugar maple, red oak, and black cherry have been preferentially harvested since the second half of the 20th century, often through the practice known as “high grading” (Mauri 1998).

2. Natural and anthropogenic disturbances

While biologically mature, uneven-age forests dominated the New England-Adirondack Province landscape prior to settlement, other age classes and seral stages must have also occurred in response to disturbance. Neither anthropogenic fire nor lightning-caused fires are known to have been common pre-settlement disturbances in this region. The finely compacted duff layer that is common to these northern hardwood communities does not dry quickly (Lorimer 2001) and the area is known as the asbestos forest (which is difficult to burn). However, occasional dry season fires cannot be ruled out, and can still occur today during periodic summer droughts.

Within the Eastern Broadleaf Forest Province there remains controversy surrounding the extent of oak woodlands maintained by anthropic fire, but historical and palynological evidence is consistent and suggests that fire-adapted oak woodlands areas probably occurred near Indian habitation along the coast and rivers (Patterson and Sassaman 1988) and in the uplands near major river drainages (Byers 1946). These woodlands represent biologically mature forests with a unique structure that supports early successional understory species (Rawinski 2000). Although there is not strong evidence for anthropogenic fire in the New England-Adirondack Province, research in the similar northern hardwood forests of Ontario, Canada, where burning by First Nations people continued as recently as the latter part of the 20th Century, showed that anthropic fire can dramatically change the species composition of forests (Clark and Royall 1995).

Large and small windstorms were probably the main source of natural disturbance in the northern hardwood and northern hardwood/conifer communities of the New England-Adirondack Province. Small windstorms that take down patches or groups of trees are now, and were probably the most common and frequent form of disturbance for this ecological region. Because large catastrophic wind events that produce large areas of young forest habitat were most likely not frequent in this ecological region, populations of animals that rely on young forest habitat may be adapted to erratic fluctuations in available habit (Lorimer 2001).

Mature forest canopies in New England have historically been disrupted by various natural disturbance events, including wind (e.g., down-bursts, tornadoes, or hurricanes), fire (e.g., lightning strikes and intentional spring fires set by native-Americans), flooding (e.g., beaver impoundments and spring floods along major rivers and streams), and pathogens (e.g., insect infestations) (see DeGraaf and Miller 1996, pp. 6-10 for review). Wind disturbances have occurred historically throughout Massachusetts, with hurricanes being more prominent in eastern Massachusetts, and down-bursts and tornadoes more prevalent in western Massachusetts. Fire was historically more common in the eastern part of the state and in the major river valleys. Beaver flooding occurred throughout the state until beaver were extirpated from nearly all of Massachusetts by 1700 (Foster et. al. 2002) (limited beaver flooding occurs today in all but the southeastern part of the state since beaver were re-established during the 20th century). Pathogens most likely had sporadic historical impact throughout the state, with insects such as the gypsy moth altering forests since the late 19th Century (Forbush 1907)

Historical return intervals for canopy-replacing wind and fire disturbance events vary across Massachusetts, and are generally shortest in the pitch pine-oak barrens of coastal and eastern Massachusetts (40-150 years between severe fires and/or hurricanes), followed by oak-hickory forests (85-380 years between fires and/or wind events), northern hardwood forest (500-1,500 years between wind events and occasional fires), and spruce-northern hardwood forest (230-545 years between wind, insect, and/or fire events) (Lorimer and White 2003). These disturbance

intervals indicate that 10-31% of pitch pine-oak barrens naturally occur as young (≤ 15 year-old) forest, compared to 3-40% of oak forests, 1-3% of northern hardwood forests, and 2-7% of spruce-northern hardwood forest (Lorimer and White 2003).

Patch sizes for individual wind and fire disturbances appear to range from < 1 acre to a few thousand acres, with the majority of individual disturbance patches occurring toward the small end of the range. For example, it has been estimated that the majority of natural disturbance patches in original northeastern forest caused by wind, water, or pathogens commonly occurred in gaps < 0.05 ac (Runkle 1982). However, while the great majority of disturbance patches are relatively small, the few large disturbance patches that do occur account for a substantial amount of all young forest (e.g., $> 40\%$ of total blowdown patch area in northern hardwood forest) and likely provide important young forest habitat for wildlife species that are area-sensitive (Lorimer and White 2003).

Larger patch sizes tend to be associated with more frequent disturbance intervals, but a range of patch sizes occur across all four of the general forest types discussed here. Historically, the largest, individual wind and fire disturbance patch sizes appear to range from about 700 ha in northern hardwood forest to more than 1,000 ha in pitch pine-oak barrens in the northeast (Lorimer and White 2003). Disturbance patterns are spatially non-random, and are highly influenced by soil and topographic features and human settlement patterns (Lorimer 2001). Natural disturbances often overlap and as a result some trees never fully mature before a subsequent disturbance destroys them, while other trees can attain biological maturity if they escape natural disturbance over two or more centuries.

Young forests were extremely common in Massachusetts during the late nineteenth and early twentieth century as abandoned farmland reverted to forest cover. Today, however, only 5% of forestland in the state occurs in a young (seedling/sapling) condition (Alerich 2000). Young forest habitats are presently less common in southern New England than they were in pre-settlement times (Litvaitis 1993, DeGraaf and Miller 1996). Wind events still provide some young forest in Massachusetts today, but the impact of fire and beaver flooding on the landscape have been dramatically reduced following European settlement, fire prevention activities and land development (Askins 2001).

Fire has largely been excluded from the Massachusetts landscape for public safety reasons, and has resulted in the loss of fire-adapted, young forest habitats that formerly occurred in portions of the Eastern Broadleaf Forest Province. It is more difficult to appreciate the loss of young forest and shrubland habitat that historically resulted from beaver flooding because beaver are active on the Massachusetts landscape today, and continually cause problems for people by plugging road culverts and temporarily flooding well and leach fields in residential areas.

Given current problems caused by beaver activity, it is difficult to appreciate the diverse habitats provided by extensive beaver flowages that formerly occupied far greater areas of what is now Massachusetts during pre-settlement times. Beaver activity historically occurred most frequently on lower slopes and along low-gradient streams in Massachusetts (Howard and Larson 1985). These low-lying sites have generally been the focus of human development in Massachusetts, and humans typically exclude extensive beaver activity from developed sites.

We simply do not know the extent of historic beaver-influenced habitats. However, we do know that the Massachusetts Bay Colony in what is now southeastern Massachusetts reported shipments of over six tons of beaver pelts to Britain in the 1620's (Foster et al. 2002). While these shipments likely included some pelts trapped from inland areas, it is still sobering to consider that few or no beaver occur today in many portions of southeastern Massachusetts. Likewise, we know that during the five-year period from 1652 to 1657 fur trader John Pyncheon shipped 8,992 beaver pelts from Springfield, Massachusetts in the Connecticut River drainage (Judd 1857 in

DeGraaf and Miller 1996). In contrast, approximately 6,500 beaver pelts were tagged by all licensed trappers in the entire state of Massachusetts during the five-year periods from 1985-1990, and 1990-1995 (DFW unpublished data). In pre-colonial New York State, beaver-created floodplains occurred on about one million acres, or 3.5% of the state. The extent of these floodplains is now reduced by 65% (Gotie and Jenks 1982 in Hunter et al. 2001).

Historically, as dams were abandoned after beaver food resources (primarily tree bark and twigs) became depleted, the impoundments slowly drained, and succeeded first to wet meadow, and then to shrubland and young forest as former impoundments dried more completely. After adequate woody growth become re-established, beaver typically re-occupied these low-lying sites, built a new dam, and began the dynamic process of habitat modification all over again. Because human development in Massachusetts is concentrated in low-lying areas along rivers and streams where beaver activity is largely excluded, an important source of young forest habitat formerly associated with these sites has been substantially diminished.

Further, pre-settlement forests which formerly occupied what is now developed land likely experienced more frequent natural disturbance than other lands remaining in forest use today. Development following European settlement was focused in low-lying areas along rivers and streams because waterways provided the primary means of transporting goods, and because existing Native American clearings could be readily occupied by European settlers. Forests along waterways were formerly subjected not only to periodic wind, fire, and pathogen events that also impact forests at higher elevations, but also to repeated cycles of ice-scouring and spring flooding (along rivers), or beaver flooding and abandonment (along low-gradient streams). The disproportionate abundance of young forest habitats that likely occurred in previously forested sites that are now developed for human use must be replaced today in somewhat higher elevation forests. Even-aged silvicultural practices can provide ecologically and economically sustainable young forest habitats for wildlife.

Finally, beaver impacts on forests are reduced not only within developed portions of the landscape (e.g., within cities and towns), but also adjacent to infrastructure such as roads that support development. Beaver activity is understandably restricted by humans wherever a road crosses a stream, in order to avoid damage to the road. Beaver activity is typically constrained along a reach of stream above and below the road crossing, and the potential for beaver-generated young forest is correspondingly reduced, regardless of whether or not areas up-stream and down-stream of the crossing are developed or not.

V. Current Forest Resource Conditions

1. The Taconic Mountains and Marble Valleys FMZ

The total area of the Taconic Mountains and Marble Valleys FMZ is just over 309,000 acres. About 64% (nearly 200,000 acres) of the FMZ is forested (Table 2). About 9.2% of the FMZ is wetland according to recent Massachusetts Department of Environmental Protection (DEP) wetlands mapping, including 3.6% forested wetland, and 5.6% non-forested wetland and open water (Table 3 and Fig. 7). About 21% (65,697 acres) of the FMZ occurs as relatively contiguous, unfragmented, or 'interior' forest that is buffered from the negative impacts of some human landuse activities (Fig. 8). Interior forest habitat is generally beneficial to wildlife species such as Jefferson salamander, which benefits from extensive, relatively undisturbed forestlands (Faccio 2003), and songbirds such as the Black-throated blue warbler, Cerulean warbler, and Northern parula warbler, which demonstrate higher reproductive success in larger forest areas than in smaller forest patches (Robbins et al. 1989). It may be that wildlife species that benefit from interior forest habitat are negatively impacted by predators such as house cats, raccoons, and skunks which tend to occur at higher densities where suburban development and agricultural

lands occur adjacent to forest vs. where extensive forest is buffered from development or agriculture.

Table 2. Landuse types in the Taconic Mountains and Marble Valleys FMZ from MassGIS 1999 Landuse aerial photograph analysis.

Landuse	Acres	Percent of FMZ
Forest	198480	64.2%
Crop Land	29296	9.5%
Low Density Residential	18317	5.9%
Pasture	11810	3.8%
Non-Forested Wetland	8214	2.7%
Open Land	7885	2.6%
Medium Density Residential	6649	2.2%
High Density Residential	6438	2.1%
Water-based Recreation	5589	1.8%
Participation Recreation	2775	0.9%
Commercial	2690	0.9%
Urban Public	2176	0.7%
Golf Course	1575	0.5%
Industrial	1495	0.5%
Powerline	1244	0.4%
Mining	1052	0.3%
Transportation	750	0.2%
Multi-Family Residential	639	0.2%
Cemetery	631	0.2%
Waste Disposal	365	0.1%
Urban Open	320	0.1%
Orchard	295	0.1%
Nursery	185	0.1%
Spectator Recreation	122	0.0%
Transportation Facility	94	0.0%
Water-based Recreation	36	0.0%

Extensive forest habitat does not appear to be negatively impacted or fragmented by the ephemeral effects of forest cutting activities according to studies of breeding bird activity. A general pattern appears to be that predation on bird nests increases at the edge of forest fragments, but this does not happen within forested areas that contain ephemeral, internal edges that result from forest harvesting activities. Specifically, no increases in nest predation rates were found in clearcut stands of northern hardwood relative to older stands (Degraff and Angelstam 1993), and no cumulative differences in bird species richness was found across a variety of temporary forest edges between seedling, sapling-pole, large-pole, and sawtimber stands (DeGraaf 1992). Likewise, no elevation in nest predation rates were found in managed (harvested) northern hardwood forests relative to extensive, unharvested forest reserves (DeGraaf 1995). These results indicate that if land remains in forest use, the sustainable harvest of renewable wood products can support local economies, and will not fragment forest bird habitats.

Because of the biological importance of extensive interior forest habitat, DFW will continue efforts to maintain interior forest habitat in the Taconic Mountains and Marble Valleys, especially adjacent to existing DFW lands that currently support interior habitat. In addition to fee acquisition of land, our emphasis will be on permanent conservation of private forestlands, primarily through purchase of voluntary conservation easements using public and private funding sources. DFW feels it is important to understand that timber harvesting, including even age

management within the context of stated landscape composition goals, is completely consistent with conserving interior forest habitats, evidenced by the ephemeral nature of the disturbance as described above for forest birds.

Table 3. Wetlands in Taconic Mountains and Marble Valleys FMZ (based on ecoregion boundaries as of October 2006. DEP wetlands data as of June 2006. DFW parcel data from MassGIS Open Space as of August 2006).

	Acres	% Total FMZ
Non-forested wetland		
Bog	43	0.0%
Deep Marsh	1,660	0.5%
Open Water	6,189	2.0%
Shallow Marsh, Meadow, or Fen*	2,702	0.9%
Shrub Swamp	6,763	2.2%
<i>Sub-total</i>	<i>17,356</i>	<i>5.6%</i>
Forested wetland		
Wooded Swamp, Coniferous	964	0.3%
Wooded Swamp, Deciduous	6,565	2.1%
Wooded Swamp, Mixed Trees	3,587	1.1%
<i>Sub-total</i>	<i>11,115</i>	<i>3.6%</i>
Total non-forested and forested wetlands	28,472	9.2%
Total area in FMZ	309,136	100.0%
Total DFW Fee land in FMZ	6,654	2.2%

* These wetlands include calcareous fens in the marble valleys that support globally rare species.

2. DFW Lands in the Taconic Mountains and Marble Valleys FMZ

As of August 2006, DFW owns (or co-owns with DCR) 6,654 acres in the FMZ in 22 properties (including 11 wildlife management areas, 7 natural heritage areas, 3 river access areas, 1 wildlife sanctuary, and the Western District headquarters), ranging from 5 acres to over 1,100 acres (Table 4 and Figure 5). Detailed cover type mapping is completed for only 3,639 acres (55%). About 2,169 acres (60%) of mapped DFW lands in the FMZ are forested, including about 1,559 acres of upland forest and 610 acres of forested wetland (Table 5). About one third of DFW forestland in the FMZ qualify as interior forest habitat (Fig. 8). 1830’s potential Primary Forest (Hall et al. 2002) data exists for all but 6 towns in the FMZ, and a total of 59,800 acres (19%) are estimated to have been forested in 1830. About 700 acres of DFW-owned land mapped as forest today were also mapped as forested in 1830 (Fig. 9), and thus may well have been continuously forested since the time of European settlement. The 1830 map delineates areas of land that were noted and mapped as forest at the time of maximum agricultural development in Massachusetts. Primary Forests include sites that may not have been converted to agriculture and that may have remained forested from pre-European settlement until today. Primary Forests, although probably used as woodlots throughout the post-settlement agricultural period may contain relatively undisturbed forest soils, as well as forest communities that may be less disturbed than traditional post agricultural (secondary forest) lands. Approximately 409 acres of currently mapped DFW forestland in this FMZ may represent both interior and primary forest (Fig. 10), although the accuracy of primary forest parcels has not yet been confirmed. Areas delineated as both interior and Primary Forest are considered high priority areas for monitoring and conservation action.

DFW will work to secure voluntary Conservation Easements on private forestlands adjacent to interior forest habitat, and will attempt to examine soil profiles to validate whether or not sites mapped as 1830 forest are truly Primary Forest (this is a relatively expensive and time consuming process which DFW will apply as time and funding permit). DFW will designate lands that qualify as both interior forest habitat and Primary Forest as High Conservation Value Forest (HCVF) as described below in section VII.3.

Aerial photo cover type mapping is summarized in Table 5. The DFW forests are predominantly mid-aged, 60-90 years. Cover-type polygons mapped as forest in the Taconic Mountains and Marble Valleys range from below the minimum mapping unit of 5 acres to 59 acres (Fig. 11), with a median size of 15 acres. The land use history of agricultural conversion and subsequent abandonment described earlier is reflected in the relatively small median polygon size as today's forest polygons often conform to former crop fields and pastures.

As of June 2006, DEP has completed wetlands mapping on the entire Commonwealth of Massachusetts (Table 3). Based on the DEP mapping, 9.2% of the Taconic Mountains and Marble Valleys FMZ is classified as wetland, comprising which 3.6% forested and 5.6% non-forested wetlands. Based DFW cover type mapping 47.4% of DFW lands in the FMZ are classified as wetland, of which 16.8% are forested wetland, and 30.6% are non-forested wetland (Table 5).

Table 4. Acreage for DFW Fee Ownership in Taconic Mountains and Marble Valleys FMZ. FMZ boundary based on ecoregion boundaries as of October 2006. DFW parcel data from MassGIS Open Space as of August 2006.

Site Name	Acres
Agawam Lake WMA	491
Bullock Ledge NHA	16
Chalet WMA*	13
Dolomite Ledges NHA	218
E. Howe Forbush Sanctuary	367
Fairfield Brook NHA	127
George L. Darey Housatonic Valley WMA	797
Green River WMA	493
Hancock WMA	197
Hoosac River Access	5
Hop Brook WMA	386
Housatonic River Access	30
Jug End Fen NHA	62
Jug End State Reservation and WMA (co-owned with DCR)	1171
Kampoosa Fen NHA	68
Konkapot River Access	11
Lanesboro NHA	89
Maple Hill WMA	356
Nordeen Marsh NHA	28
Stafford Hill WMA	454
Taconic Mountain WMA	158
Three Mile Pond WMA	1114
Western District HQ	3
Total	6654

*The majority of these properties occur in the adjacent Berkshire Highlands FMZ.

Table 5. Cover types of DFW-owned land in Taconic Mountains and Marble Valleys FMZ. Upland types mapped and accuracy checked as of 2002. FMZ boundary based on ecoregion boundaries as of October 2006. DFW parcel data from MassGIS Open Space as of August 2006.

Cover Type	Acres	% Total DFW land
Developed upland		
Non-vegetated	3	<0.1%
Developed	26	0.4%
<i>Sub-total</i>	28	0.4%
Non-forested upland		
Abandoned field	176	2.6%
Agricultural	37	0.6%
Abandoned orchard	4	<0.1%
Grass	100	1.5%
Shrubland	10	<0.1%
Uninterrupted Non-forest Upland*	420	6.3%
<i>Sub-total</i>	747	11.2%
Forested upland		
Central Hardwood	261	3.9%
Central Hardwood-Hemlock-White Pine	27	0.4%
Central Hardwood-White Pine	18	0.3%
Hemlock-White Pine	3	<0.1%
Mixed Hardwood	216	3.2%
Mixed Hardwood-Hemlock-White Pine	42	0.6%
Mixed Hardwood-White Pine	17	0.3%
Northern Hardwood	722	10.9%
Northern Hardwood-Hemlock-White Pine	133	2.0%
Northern Hardwood-White Pine	92	1.4%
Pitch Pine/Oak	9	0.1%
White Pine	18	0.3%
Uninterrupted Forested Upland*	2,574	38.7%
<i>Sub-total</i>	4,132	62.1%
Non-forested wetland		
Deep Marsh	92	1.4%
Open Water	197	3.0%
Shallow Marsh, Meadow, or Fen	326	4.9%
Shrub Swamp	522	7.8%
<i>Sub-total</i>	1,137	16.7%
Forested wetland		
Wooded Swamp, Coniferous	101	1.5%
Wooded Swamp, Deciduous	325	4.9%
Wooded Swamp, Mixed Trees	183	2.8%
<i>Sub-total</i>	610	9.2%
Total upland	4,907	73.7%
Total wetland	1,747	26.3%
Total Fee property in ecoregion	6,654	100.0%

*Uninterrupted land will be classified by cover type during the on-going inventory of DFW lands.

DFW forestlands in the Taconic Mountains and Marble Valleys are dominated by northern hardwood forests (Table 5), but also contain a diverse mixture of hardwood and softwood components. While portions of the FMZ historically supported essentially pure northern hardwood (beech-birch-maple) forest in the New England-Adirondack Province, and pure central hardwood (oak-hickory) forest in the Eastern Broadleaf Forest Province (Fig. 6), these distinct forest types have been obscured as a result of landuse history described above. Accordingly, similar portions of DFW lands in both provinces currently support northern hardwood and central

hardwood forest types (Fig. 12). One distinct difference between the provinces is a much higher softwood component in the Eastern Broadleaf, with nearly a third of the forest having a significant proportion of softwood, much of it white pine. By contrast, only 20% of the forest in the New England-Adirondack Province has a significant component of softwood species.

3. Uncommon natural communities

The Natural Heritage and Endangered Species Program (NHESP) has produced a draft *Classification of the Natural Communities of Massachusetts* (Swain and Kearsley 2001). Several of the forested community types identified as uncommon in this document occur in the ecoregions of the Taconic Mountains and Marble Valleys FMZ. Uncommon natural communities associated with the New England-Adirondack Province include Rich Mesic Woodlands, Spruce-Fir Boreal Swamp, and Spruce-Tamarack Bog. In the Eastern Broadleaf Province portion of this FMZ, uncommon communities may include Yellow Oak Dry Calcareous Forest, Hickory-Hop Hornbeam Forest/Woodland, Black Gum Swamp, and fire-maintained oak woodlands/savannahs including Black Oak and Scarlet Oak Forest/woodland. In addition, some of the state's most uncommon types of non-forested natural communities, such as the various calcareous fens, occur in the marble valleys, including sites on DFW lands. Our objective is to locate occurrences of these community types on DFW lands and to maintain them where they occur. Presently, records on occurrence of these uncommon natural communities are incomplete, and DFW is seeking to document occurrences during its on-going forest inventory process.

Of the uncommon natural communities listed above, Rich Mesic Woodland is the community that is most likely to be impacted by timber harvest operations because this community can potentially support high quality/high value northern hardwood timber products (e.g., white ash, sugar maple). For example, harvesting can change forest structure and canopy cover, and non-native invasive plants may be carried into and become established within these communities during harvesting. Invasive plants can displace rare native herbs associated with Rich Mesic forest. More directly, a change in light levels or moisture regimes may negatively impact rare native plant assemblages. Even timber harvests that occur outside of a Rich Mesic community can impact these unique sites if water and nutrient flow into the community is disrupted by rutting up slope of the community. The occurrence of Rich Mesic Woodlands and other priority natural communities are documented during forest inventory activities, mapped using GPS technology, and recorded in a geodatabase maintained by the DFW Forestry Program in Westborough. Accordingly, DFW recently began a comprehensive effort to identify and map all Rich Mesic Woodlands sites on state wildlife lands in the Taconic Mountains and Marble Valleys FMZ so that unique attributes of these sites can be conserved during timber harvest operations.

Existing NHESP records in 2005 documented about 280 acres of Rich Mesic forest on all lands in the Taconic Mountains and Marble Valleys FMZ out of a total of 861 acres documented state-wide (NHESP Unpublished Data). During the winter of 2004-2005, the DFW Forestry Program worked cooperatively with the University of Massachusetts Cooperative Extension Service in Amherst and with NHESP to identify additional, potential rich mesic forest sites on DFW lands. Knowledge of existing rich mesic sites was coupled with attributes such as slope, aspect, landform, bedrock geology, and documented occurrences of rare plant species associated with this community (e.g. Goldie's Fern (*Dryopteris goldiana*), Hairy Wood-mint (*Blephilia hirsuta*), Broad Waterleaf (*Hydrophyllum canadense*), Woodland Millet (*Milium effusum*), and Hitchcock's Sedge (*Carex hitchcockiana*). A complete floristic inventory was conducted at each of these sites using a modified Natural Heritage "Form 3" sample (typically a 15 x 15 m sample plot – see: <http://www.mass.gov/dfwele/dfw/nhosp/nhclass.htm>). Herbaceous and woody plant species typically observed at these newly documented rich mesic forest sites include Sugar Maple (*Acer saccharum*), Basswood (*Tilia americana*), Hophornbeam (*Ostrya virginiana*), Wild Leek (*Allium tricoccum*), Broad-leaved Toothwort (*Dentaria diphylla*), Maidenhair fern (*Adiantum*

pedatum), Blue Cohosh (*Caulophyllum thalictroides*), Glade Fern (*Diplazium pycnocarpon*), and Plantain-leaf Sedge (*Carex plantaginea*), among many other plant species. Observations included new element occurrences of rare plants.

A total of 130 polygons representing over 3,000 acres of potential rich mesic forest were identified on DFW lands in 2005-2006, and about 25% of this occurred in the Taconic Mountains & Marble Valleys FMZ. Field work in 2005-2006 found about 319 acres of rich mesic forest at 35 of the 130 polygons, and about 25% of this occurred in the Taconic Mountains & Marble Valleys FMZ. A total of 444 acres of rich mesic forest has now been identified on DFW lands state wide (125 acres were previously mapped by Natural Heritage, and about 319 acres were mapped in 2005-2006 by the DFW Forestry Program). Any forest harvesting operations that may occur in or near documented rich mesic forest sites will be designed to conserve these communities. High quality examples of this natural community will be established as either patch reserves or as HCVF, as described below in section VII.3.

4. Forest inventory status

A comprehensive forest inventory is currently underway to refine timber volume and growth estimates for DFW lands in this FMZ, and to document species occurrence and abundance of forest herbs and shrubs. To date, inventory has been completed on about 1760 acres, or 42% of the 4132 acres of DFW upland forest in the FMZ. These initial results are expanded to estimate current wood volumes on all DFW lands in the Taconic Mountains and Marble Valleys FMZ in Table 6.

Table 6. Estimated volume of merchantable timber, firewood, pulpwood, cull, and standing snags on 4132 acres of DFW upland forest in Taconic Mountains and Marble Valleys FMZ, based on 44 inventory plots as 11/1/2006. FMZ boundary based on ecoregion boundaries as of October 2006. DFW parcel data from MassGIS Open Space as of August 2006.

Tree Species	MBF	1,000 Cords
Sugar Maple	7969	
Red Oak	3332	
White Pine	2202	
White Ash	1823	
Red Maple	1206	
Yellow Birch	588	
Black Birch	577	
Black Cherry	489	
Hickory	415	
Aspen	408	
White Birch	343	
Beech	192	
Hemlock	143	
Black Oak	90	
Total Sawtimber	19774	

Firewood		31
Softwood Pulp		18
Hardwood Pulp		1
Cull		6
Snags		7
Total Cordwood		62

Initial analysis of this inventory data indicates that there is approximately 4.8 MBF of merchantable timber, 7.5 cords of firewood, 4.3 cords of softwood pulp, 0.2 cords of hardwood pulp and 3.1 cords of cull and standing snags per acre averaged across all upland forest types in the FMZ. The 4.8 MBF/acre of sawtimber on DFW lands in this FMZ appear to be substantially lower than the 6.2 MBF/acre reported for all Massachusetts forestlands (Alerich 2000) and is likely due to cutting of high value timber trees on many parcels immediately prior to state acquisition.

Volume growth is being determined from increment core data collected from about 400 sample plots that will allow DFW to utilize Woodstock™ software to make allowable harvest calculations for state wildlife lands during calendar year 2007. Currently, DFW is only conducting 1-2 harvesting operations annually in this FMZ (see section VII.2), and is operating well below sustainable harvest levels.

VI. Forest Structure and Composition Goals

1. Biodiversity and forest habitat conditions

Preserving biodiversity in temperate forest requires the maintenance of all successional stages (Franklin 1988), and managers should recognize the role of disturbance in maintaining biodiversity (DeGraaf and Miller 1996). Forest managers need to provide a range of habitats at temporal and spatial scales that will support viable populations of all native wildlife species, and this task must be accomplished in a landscape that is being increasingly developed for human use, and that does not resemble any previous historical condition. While it is instructive to examine the historical range of variability associated with natural disturbance regimes (see DeGraaf and Miller 1996, Thompson and DeGraaf 2001), managers should not seek to re-establish conditions from a previous time (e.g., prior to European settlement), but rather should seek to secure a range of conditions in today's landscape that will support viable populations of native wildlife species (DeGraaf and Yamasaki 2003).

Following any disturbance to a forest canopy, the flush of woody and herbaceous vegetation on the forest floor provides food (e.g., berries, browse, and insects) and cover (e.g., shrubs, tree seedlings, and slash) resources for wildlife that is generally lacking in older forest. Wildlife species that prefer young forest conditions have been perceived as habitat generalists (see Foster and Motzkin 2003), but in fact, many wildlife species associated with young forests such as the New England cottontail and chestnut-sided warbler are habitat specialists with specific vegetation structure or area requirements (DeGraaf and Yamasaki 2003). Relatively large (>25 acre) patches of young forest habitat may be necessary to maintain viable populations of mammals associated with young forest (Litvaitis 2001). In addition, Hunter et al. (2001) note that young forest conditions are important for wildlife species generally associated with mature forests. Examples include fledgling and molting adult wood thrushes (*Hylocichla mustelina*) that move from mature

forest to patches of young forest habitat that may provide critical for food and cover resources not typically found near nesting sites.

Young forest communities established by clearcutting can temporarily reduce amphibian numbers (Pough et al. 1987), including the terrestrial-breeding redback salamander (*Plethodon cinereus*) (DeGraaf and Yamasaki 1992 and 2002), the wetland-breeding wood frog (*Rana sylvatica*), and mole salamanders (*Ambystoma* spp.) (deMaynadier and Hunter 1998), which require a moist environment and are not especially mobile. However, a shaded canopy is usually restored within 10 years, redback salamander numbers typically recover to pre-cut levels within 30 years (DeGraaf and Yamasaki 2002), and there is generally no difference in numbers of salamanders in 60-year old second growth forest vs. old growth forest (Pough et al. 1987). Maintaining sustainable populations of amphibians can be compatible with timber harvesting (deMaynadier and Hunter 1995, Brooks 1999).

Throughout Taconic Mountains and Marble Valleys FMZ, only a minority of forest area occurs in a young forest condition at any given point in time, breeding pools are protected during harvesting, and undisturbed forest patches will be available nearby, so the many habitat benefits of young forest can be realized without any substantial threat to populations of mature forest species. Overall, young forests support a great diversity of wildlife species and are a critical component of wildlife habitat at the landscape level (DeGraaf and Yamasaki 2001, 2003).

Vertebrate wildlife species in New England benefit when primarily forested landscapes contain a mix of forest size classes, generally 5-15% seedling (or young forest), 30-40% sapling-pole, 40-50% sawtimber, and <10% large sawtimber (DeGraaf et al. 1992, DeGraaf and Yamasaki 2001). In addition to these development stages, the establishment of biologically mature forest habitat conditions addresses the Division's biodiversity goals because older forest habitat will likely support and benefit a wide variety of invertebrate wildlife species and understory plant assemblages. It may be desirable to maintain 10% or more of forest landscape in a biologically mature forest condition (Vora 1994).

Seedling forest is defined here as areas >1 acre, and preferably >5 acres where >75% of the site is dominated by tree regeneration <1" dbh. While a variety of wildlife species will utilize patches of young forest habitat <1 acre in size (e.g., white-tailed deer) other species rely on larger patches of regeneration that supply abundant food and cover resources (e.g., Golden-winged warbler, Mourning Warbler, Ruffed Grouse, New England Cottontail).

Biologically mature forest is defined as having attained >50% of its maximum expected biological age – generally >150 years for the range of tree species native to Massachusetts. Biologically mature forest is uncommon throughout New England because trees generally reach economic maturity long before they reach biological maturity (60-90 years, vs. >150 years, respectively). To approximate a natural landscape age structure in New England, a portion of forest area should reach 300 years of age (Seymour and Hunter 1999).

As described above in the section on land-use history and natural disturbance processes, fire-maintained woodlands in the Eastern Broadleaf Province are forests with a biologically mature overstory and early successional understory species. These woodlands are characterized by a partially open canopy of scattered, large diameter trees of fire tolerant species (Hawthorne 2004), with an understory maintained by regular fire (Rawinski 2000). Understory vegetation includes both early successional herbs and fire-tolerant shrubs such as the soft-mast-producing blueberries and huckleberries. Although little research has been done on the preference of vertebrate or invertebrate wildlife species for these woodlands, regenerating vegetation after fires has been shown to attract ungulates (Hawthorne 2004) and provides usable habitat for songbirds and other species rely on other characteristics of early-successional shrublands (Lanham et al. 2002).

2. Landscape composition goals

Establishing landscape composition goals is an inexact science, but it is prudent to determine a desired future condition for WMA forestlands based on available knowledge. After considering habitat requirements for both vertebrate and invertebrate wildlife, landscape composition goals for WMA forestlands statewide presently include 5-10% young (seedling stage) forest, 10-15% sapling/small pole forest, 35-40% large pole forest, 35-40% sawtimber forest, and 10-15% biologically mature forest (Fig. 13). Due to the different historical natural disturbance patterns and resulting forest age composition in the forests of the New England-Adirondack Province and the Eastern Broadleaf Forest Province (i.e., more frequent and larger disturbances in the Eastern Broadleaf Forest Province produce more young forest and less mature, undisturbed forest relative to the New England Adirondack Province), DFW will likely manage toward the low end of the composition goal for young forest habitat and toward the high end of late-seral habitat in the New England-Adirondack Province, and toward the high end of the composition goal for young forest habitat and toward the low end of biologically mature forest habitat in the Eastern Broadleaf Forest Province (Fig. 6).

The focus of management on DFW forestlands in the Taconic Mountains and Marble Valleys FMZ is the modification of forest age class composition through active management to create more young forest habitat, and passive management to establish more old forest habitat. DFW seeks to double median stand size from the current seven acres on actively managed sites by combining small, adjacent, relatively homogeneous stands that reflect post-agriculture landscape patterns into larger, more heterogeneous stands defined by landform. While small forest patches can provide viable habitat for many wildlife species, and while several small forest patches may have greater bird species richness than a single large patch, certain species are never found in small patches (Askins et al. 1987, Robbins et al. 1989).

DFW will seek to locate and conserve uncommon natural communities such as Rich Mesic Forest (see Section V.3) that are tracked by the Natural Heritage and Endangered Species Program (see: <http://www.mass.gov/dfwele/dfw/nhosp/nhcommun.htm>). DFW will also seek to maintain and increase the diversity of tree species on harvested sites, and will favor regeneration of species which are being preferentially harvested and/or not commonly regenerated elsewhere in the FMZ. These efforts should provide a range of habitats for flora and fauna that enhance natural community, species, and genetic diversity within this landscape.

In the New England-Adirondack Province, tree species that are not being commonly regenerated include red spruce, black cherry, yellow birch, and other species that require large gaps or small clearcuts to provide adequate sunlight for regeneration. In the Eastern Broadleaf Province, these species include oaks (especially northern red oak), and the more southern species group such as the hickories. Where adequate seed trees of these species exist, our objective in actively managed areas will be to regenerate as many different species as possible, with preference given to those that are underrepresented in the landscape relative to the inferred reference conditions. In both provinces, plantations of non-native tree species will be removed to regenerate plant communities that contain a diversity of native species. Successional ("old-field") white pine will be harvested to establish mixed stands of native species. Where mature oaks, hickories, and other fire-tolerant species are present in the Eastern Broadleaf Province, prescribed fire will be used along with timber harvest techniques to regenerate these species while providing habitat for ungulates, songbirds, and other species that use fire-maintained oak woodlands.

In addition to modifying forest age class composition and tree species composition as described above, DFW also seeks to increase diversity of forest stand structure irrespective of age class or species composition by retaining large trees in all stands that will eventually become snags, then coarse woody debris, and that may produce tip-up mounds when felled by a wind disturbance

event. Overall, silvicultural practices on actively and passively managed forestlands will create extensive, heterogeneous forest patches with characteristics of unmanaged forest landscapes.

In summary, forestland managers interested in maintaining and enhancing biodiversity within the Commonwealth's predominantly mature, even-age forest landscape face distinct challenges, including:

- Establish and maintain adequate young forest habitat to support declining populations of native wildlife species associated with these habitats (DeGraaf and Yamasaki 2001).
- Design and conserve areas of extensive biologically mature forests with late-seral species (passive management only) (Askins and others 1987, Litvaitis 1993).
- Increase stand size, diversify species composition, and enhance structural attributes in the relatively small and homogeneous post-agricultural forest stands that presently dominate the landscape in favor of larger and more heterogeneous stands defined by landform.
- Develop management prescriptions that are based upon decisions made with landscape scale information about current resource conditions relative to future desired condition(s).

3. Desired future condition

Accordingly, the desired future condition for DFW forestlands in the Taconic Mountains and Marble Valleys FMZ is best represented by:

- Relatively large (e.g., 10-100 acres) forest stands typically defined by landform and containing a diversity of native tree, shrub, and herb species, as well as a diversity of structural attributes such as snags, den trees, tip-up mounds, and coarse woody debris.
- A compositionally and structurally diverse forest landscape that contains both young forest as well as mature forest elements.

Because more than 80% of Massachusetts' commercial forests are owned by the private sector, the challenge to establish and maintain adequate biologically mature forest habitat at the landscape level can most realistically be met by cooperation between public land managers, private forestland owners, land trusts and other private non-profit groups who are willing/able to work across property and political boundaries at the landscape level. While DFW forestlands and some private non-profit lands can forgo some short term economic return in order to focus primarily on conservation and enhancement of biological diversity, private forestland owners typically need to generate more income to pay property taxes and offset increasing development pressure. This economic reality can make it difficult for private forestland owners to forgo timber income in order to accrue biologically mature forest habitat. Goals for biologically mature forest habitat will most likely to be realized on some combination of public lands, private non-profit lands, and other private lands where landowners are willing to forgo timber income, or have been compensated for lost income through some type of conservation restriction.

On DFW lands, the production of timber products is seen as an additional benefit of forest habitat management. Timber harvests must be consistent with achieving the landscape forest composition objectives described above. Where landscape composition goals have been met, harvests of timber products within a FMZ will not exceed the estimated growth in timber volume for that FMZ. Even where landscape goals require the creation of more young forest habitat than currently exists in a FMZ, harvests of timber products on DFW lands will typically not exceed estimated volume growth.

VII. Active and Passive Management (Land Use Zoning)

The vast majority (>99%) of DFW lands are loosely zoned for either active or passive management. Parking areas and river/pond access sites (<1%) support intensive use but are managed by the DFW District Offices and/or the Massachusetts Public Access Board. Active management sites are open to commercial harvesting of wood products to provide young forest habitat, and to non-commercial cutting and clearing of abandoned agricultural sites to provide open shrubland and grassland habitats for native wildlife species experiencing long-term population declines (abandoned agricultural sites are managed by the DFW Upland Habitat Program [see: <http://www.mass.gov/dfwele/dfw/bdi/uplandintro.htm>] in coordination with the DFW Forestry Program). Passive management sites typically do not support commercial harvesting and primarily include wetlands and forest reserves that provide biologically mature forest habitat. Both active and passive management sites are monitored and treated to control invasive, exotic species, and to apply prescribed burning in fire-adapted natural community types.

Within the Taconic Mountains & Marble Valleys FMZ, <1% (about 28 of 6,654 ac) of DFW lands support intensive use, about 57% (3,773 of 6,654 ac) support active management, and about 43% (2,853 of 6,654 ac) support passive management. Active management sites include all upland sites that fall outside of reserves, and include about 3,073 acres of upland forest and about 700 acres of upland non-forest in this FMZ. Passive management sites include upland portions of reserves and all wetland sites, and include about 1,059 acres of upland forest and 47 acres of upland non-forest in reserve areas (see Section VII.1), about 1,137 acres of non-forested wetlands, and about 610 acres of forested wetlands in this FMZ (Table 5)

The planned sustainable harvest of renewable wood products from active management sites will provide a range of forest age classes across the landscape and help to conserve biological diversity while supporting local economies that manufacture wood products used by all residents of the Commonwealth. At the same time, forest reserves will provide important baseline data on forest structure and composition that result primarily from natural disturbance process. Reserves are a component of primarily forested landscapes where the great majority of land is open to commercial harvesting of renewable wood products, and are discussed in more detail below.

1. Passive management and forest reserves

The EOEA, DCR, and DFW recently completed a three-year process to create a system of forest reserves on state lands in Massachusetts. The need for reserves and the approach for identifying, evaluating, and selecting reserve sites is fully documented on the Executive Office of Environmental Affairs website at <http://www.mass.gov/envir/forest/>. The EOEA webpage describes in detail how and why DCR and DFW created nine large (matrix) reserves and are now in the process of creating numerous small (patch) reserves. By definition, matrix reserves occur in relatively unfragmented forest landscapes, while patch reserves are established on the basis of priority natural communities, rare species, and other site-specific reasons (e.g., steep slopes, highly erodible soils).

Reserves allow people to experience and to understand how forest ecosystems function when timber and other wood products that are normally extracted for human use remain in place. Reserves provide unique recreational, aesthetic, and educational opportunities for the people of Massachusetts. Forest reserves provide reference sites for objective assessment of the sustainability of forest management practices (Norton 1999), and are essential for practicing adaptive resource management (Walters and Holling 1990). Reserves create opportunities for connectivity within the landscape, conservation of species and processes, buffering against future uncertainty, and other hard to measure but valuable functions (Hunter 1996).

One of the nine matrix reserve sites occurs within the Taconic Mountains and Marble Valleys, and contain 770 acres of DFW-DCR lands (Table 7 and Fig. 14). Of the 770 matrix reserve acres, 100% are forested (725 acres of upland forest and 45 acres of wetland forest). In addition, an initial analysis of potential patch reserve sites in the Taconic Mountains and Marble Valleys FMZ identified approximately 860 ac outside of matrix reserve lands at about 100 sites on DFW lands (283 acres of upland forest, 231 acres of wetland forest, 47 acres of upland non-forest, and 299 acres of wetland non-forest). Potential patch reserves on DFW lands will be assessed on the ground through a cooperative effort involving DFW Forestry, Natural Heritage, and District personnel. Final patch reserve locations will be mapped and described in future sites plans for the individual properties covered in this FMZ plan.

Overall, about 1,600 acres (24%) of DFW lands in the Berkshire Highlands FMZ will occur as matrix or patch reserve. However, on a statewide basis, a total of about 15,570 acres (11.5%) of DFW lands will occur in reserves (8,270 acres is matrix reserves, and about 7,300 acres in patch reserves). DFW lands contribute to three matrix reserve sites statewide, two in the Berkshire Highlands FMZ (Chalet and East Branch of the Westfield River reserves), and one in the Taconic Mountains and Marble Valley FMZ (770 acres at the Jug End SR&WMA that is part of the Mt. Washington matrix reserve). Additional information on forest reserves, including reserves on DCR property, is available from the EOEA website at http://www.mass.gov/envir/forest/berkshire_assessment.htm.

Table 7. Matrix reserve sites on DFW lands in the Taconic Mountains and Marble Valleys FMZ.

Potential Reserve Site	DFW Property	DFW Acres
Mt Washington	Jug End WMA	770
Total		770

DFW sought public comment regarding potential reserve sites at a series of public meetings sponsored by EOEA (see: <http://www.mass.gov/envir/forest/>), postings on EOEA and DFW websites, and extensive notification of stakeholders. The DFW Forestry Program considered public comment, and evaluated how potential reserve sites fit with existing DFW forest composition goals. As a result of this process, the DFW Forestry Program Leader recommended to the State Fisheries & Wildlife Board that the Mt. Washington/Jug End reserve sites, a total of 770 DFW/DCR acres, be considered for inclusion in a forest reserve system. The Board ultimately makes all policy decisions relative to DFW lands, and voted to accept this recommendation. DFW will create Conservation Plans for each matrix reserve, which will define acceptable and excluded activities.

The following activities will typically be allowed or excluded from reserves as indicated:

- Regulated hunting, fishing and trapping will be allowed.
- Passive recreation including wildlife observation, hiking, and non-motorized mountain biking will be allowed.
- Motorized vehicles will be excluded. Reserve designation will not necessarily impact snowmobile use under a License Agreement issued by the District Wildlife Manager for designated trails.
- Biological monitoring of species and communities will be conducted.

- Commercial harvesting will typically be excluded.
- Control of invasive, exotic species will be allowed and encouraged.
- Prescribed burning will be applied in fire-adapted natural communities. This may include the use of repeated understory fires that result in some overstory mortality and the creation of an open woodland structure.

In addition to the activities described above, standard Wildlife Management Area Regulations shall apply on both active and passive management sites (Table 8).

2. Active management sites

DFW will devote at least 2,400 acres of upland forest in the Taconic Mountains and Marble Valleys FMZ to even-aged silviculture, and will devote up to 1,732 acres of upland forest to uneven-aged silviculture. In addition, DFW will devote about 700 acres of non-forest uplands (Table 5) to active management of grassland, shrubland, and agricultural habitats.

DFW anticipates a 100-year rotation for even-aged silviculture, and assumes an average duration of about ten years for seedling forest. In order to reach and maintain the landscape composition goal of 5% seedling forest habitat in the Taconic Mountains and Marble Valleys, 37 acres should be regenerated annually on DFW lands using even-aged silviculture (5% of 4,742 forested acres = 237 acres of seedling forest/10 years duration = approximately 24 acres/year, and 24 acres/year over a 100 year rotation = 2,400 total acres).

DFW typically applies either shelterwood with reserve cuts (where 30-50% of the canopy is removed in each of two cuts spaced 5-10 years apart, and where about 10% of the original canopy is retained [reserved] through the next rotation), or aggregate retention cuts (where 80-90% of the canopy is harvested in a single cut, and where 10-20% of the canopy is retained through the next rotation) to regenerate young forest habitat. Shelterwood cuts are typically applied to regenerate tree species such as red oak and white pine, while aggregate retention cuts are typically applied to regenerate tree species such as white birch, black cherry, and white ash. Where appropriate, prescribed burning may be used to apply light surface fires after single-cut shelterwood harvests to improve the regeneration of species such as oak and hickory and to create open woodland conditions. In these cases, a larger portion of the original canopy may be retained (reserved) to keep approximately 25 to 50 square feet/acre basal area of the largest and healthiest trees (Hawthorne 2004).

In addition to regenerating 37 acres/year through even-aged silviculture within the FMZ, DFW could potentially thin an additional 37 acres/year when even-aged stands reach about 50 years of age (half their rotation age). DFW anticipates that these operations would be merchantable thinnings of hardwood firewood and/or softwood pulpwood that would diversify stand structure and favor crown development of individual mast-producing trees (i.e., red oak, white oak, black cherry, American beech).

DFW has not applied uneven-aged silviculture to date, but anticipates using group selection cutting in forest stands regenerated with uneven-aged silviculture, with group size ranging from 0.25-0.75 acres depending on the shade tolerance of tree species desired for regeneration (smaller patches will be used to regenerate shade tolerant species such as Sugar Maple, American Beech, and Eastern Hemlock, while larger patches will be used to regenerate more shade intolerant species such as Black Cherry and White Ash). DFW anticipates a 120-year cutting period defined by a 30-year cutting cycle where 25% of the stand is cut during each entry.

A recent GIS analysis of DFW lands in the Taconic Mountains and Marble Valleys identified sites for potential harvesting operations over the next few decades by selecting stands of

Table 8. Wildlife Management Area Regulations

DFW holds 9 Wildlife Management Areas (WMA), 7 Natural Heritage Areas (NHA), and 3 River Access Areas (Hoosac, Housatonic and Konkapot), and the E. Howe Forbush Wildlife Sanctuary in the Taconic Mountains and Marble Valleys FMZ. All WMAs, NHAs and access areas are open to hunting, fishing, trapping and other outdoor recreation activities. Sanctuaries are more restrictive. Sanctuary booklets are available only from the *MassWildlife* Field Headquarters Office in Westborough.

- No person shall possess any alcoholic beverage except under permit or dump or discard any can, bottle or rubbish.
- No person shall remove vegetation, soil or stones from any WMA except under permit.
- No person shall use excessive speed in driving a vehicle.
- No person, unless under permit, shall drive or possess any vehicle except on roads or trails maintained for public traffic.
- No person shall deface or tamper with any sign, building or equipment.
- No person shall build or maintain a fire without written permission from the Director of the Division of Fisheries and Wildlife (MDFW) or his designee.
- No person shall camp within any WMA without written permission from the Director of the MDFW or his designee.
- No person shall engage in target practicing without written permission from the Director of the MDFW or his designee.
- No person shall use any means other than shotgun or bow and arrow during the pheasant and quail season on areas stocked with pheasant or quail except for hunting raccoons between 9PM and 3AM.
- No person shall hunt on any WMA where pheasant or quail are stocked before sunrise or after sunset during the open season on pheasant or quail, except for the hunting of raccoons between 9PM and 3AM.
- No person shall hunt during the pheasant or quail season on wildlife management areas where pheasant or quail are stocked without wearing a "hunter orange" cap or hat except while night hunting for raccoons or while hunting from a blind or boat.
- No person, except under permit, shall dig or disturb any artifact or archaeological remains.

The Director may make special regulations to handle special situations peculiar to any WMA. Controlled hunts are in effect at certain times on Burns, Delaney and Ludlow WMAs. Contact District Supervisor for details.

Any landowner permitting use of his property for recreation without charging a fee is not liable for injuries to recreational users or their property except in cases of willful, wanton or reckless conduct by the owner (see Chapter 21, Section 17C MGL).

successional white pine on sites that would typically support hardwood forest communities, or mixed white pine-hardwood communities, and by selecting stands that may have been hi-graded prior to public acquisition (i.e., stands of large pole and/or sawtimber trees with open canopies and evidence of recent harvesting). This analysis identified 61 acres in 17 polygons on 5 properties for potential harvesting operations (Fig. 15). The majority of these sites occur on the Three Mile Pond and Maple Hill WMAs (Figs. 5 and 15). These sites are being visited by DFW staff to evaluate and prioritize sites for even-aged and uneven-aged silviculture over the few years.

Due to relatively low staffing levels at DFW (one management forester per >65,000 acres of state wildlife lands), timber harvests have been modest statewide and nonexistent within the Taconic Mountains and Marble Valleys FMZ. Over the past twenty years (1986-2006), no timber sales have been conducted on DFW land in the Taconic Mountains and Marble Valleys FMZ. Several properties were harvested by the previous landowner prior to acquisition by DFW, including the Green River WMA. In 1997, DFW worked out an arrangement with the Williamstown Rural Lands Foundation (WRLF) and Bannish Lumber, Inc. to repair about 2,500' of badly eroded skid road that predated DFW's purchase of the Green River WMA. Gagnon Brothers Logging (vendor for Bannish Lumber, who had purchased timber from WRLF) installed 34 water bars on DFW land, and also felled wind-damaged trees on DFW land near the top of Brodie Mountain along a hiking trail that crosses from WRLF land onto DFW land (WRLF had requested that this work be done to insure the public safety of hikers). A few thousand board feet of merchantable logs and some cordwood were salvaged from the broken trees along the hiking trail on DFW land, but the wood products value was far less than the mitigation value. WRLF basically paid for the work on DFW land in appreciation for our reducing the public safety hazard along the hiking trail. The Forestry Program also hired Clarksburg Construction, Inc. to mitigate erosion problems on 1,500 feet of old logging road and another 500' of associated illegal ATV trail that DFW inherited when we purchased the Hancock WMA in December of 2000 by installing about 17 major waterbars.

The DFW Upland Habitat Program reclaimed 66 acres of abandoned agricultural habitats on the Stafford Hill WMA in the Taconic Mountains and Marble Valleys in February 2005.

Forest harvesting and Upland Program operations on DFW lands are carried out by private vendors through a public, competitive bidding process. All forest harvest operations follow a standard internal DFW procedure (Table 9).

3. High Conservation Value Forests

For a complete discussion of the process for defining High Conservation Value Forests and management practices to protect these values, see the EOE website at : <http://www.mass.gov/envir/forest/>.

Defining and identifying High Conservation Value Forests (HCVF) is a condition of Forest Stewardship Council (FSC) 'Green Certification' of sustainable forestry for Massachusetts' state lands. HCVFs are forest areas that need to be appropriately managed in order to maintain or enhance identified High Conservation Values (HCVs). While all forests provide environmental and social values, the definition of HCVs encompasses exceptional or critical ecological attributes, ecosystem services, and social functions. Under certification, areas identified as HCVFs may be harvested, but management activities must maintain or enhance the HCVs present. For DFW properties, HCVF will include lands outside of Forest Reserves that are open to harvesting.

The FSC Northeastern Region Standards provide guidance on identifying HCVs, and in Massachusetts many HCVs are already identified and mitigated under existing state regulations

Table 9. Checklist of procedures for conducting timber sales on DFW forestlands.

- ✓ Contact appropriate DFW District Manager to coordinate on timber sale administration.
- ✓ Review landcover mapping information (including forest stand condition, wetland location and composition, vernal pool locations, and occurrence of priority natural communities), boundary and road infrastructure condition, Natural Heritage Atlas information, and forest inventory data for the site.
- ✓ Conduct pre-harvest monitoring to determine plant species occurrence and abundance in the forest overstory and understory, to locate rare and/or invasive species, locate wetlands, vernal pools and seeps, and to initiate infrastructure planning for skid roads, landing locations, stream crossing, and harvest area extent. Record GPS waypoints at all appropriate points.
- ✓ Contact Natural Heritage if any portion of site occurs in Priority Habitat for recommended mitigation, and if no Priority Habitat request information on any Element Occurrences of rare species on the site and recommended mitigation.
- ✓ Compose draft site plan for the timber sale area. Include Property Summary (Site name, town(s), FMZ, Wildlife District, Ecoregion, Watershed, stands to be treated, and acres to be treated), access summary, environmental permitting, forest certification considerations, management goals, property description and history, landscape setting, disturbance history (e.g., evidence of wind or pathogen disturbance, excessive browsing by white-tailed deer and/or moose, etc.), biological monitoring, rare species concerns, soil & water quality, historical and cultural resources, recreation & aesthetics, silviculture and references.
- ✓ Review site plan with DFW Forest Project Leader.
- ✓ Submit draft site plan to District and NHESP for review and comment. Incorporate comments.
- ✓ Submit final site plan to Federal Aid.
- ✓ Establish access roads, skid trails, and landing areas according to specifications in the BMP manual.
- ✓ Establish buffer strips along roads, and filter strips along riparian areas as per the BMP manual.
- ✓ Avoid wetland resource area crossings when planning skid trails and access roads whenever possible. Establish and maintain necessary stream and wetland crossings for logging machinery as indicated in the Massachusetts Forest Best Management Practices Manual (the BMP manual) (Kittredge and Parker 1995).
- ✓ Plan harvest near vernal pools according to guidelines for certified vernal pools in the BMP manual.
- ✓ Plan harvest near seeps according to guidelines by Healy and Casalena (1996).
- ✓ Post informational signage on the planned harvest at the roadside interface (typically the landing area) for the harvest to inform the public of the upcoming treatment.
- ✓ Mark timber sale area according to prescriptions in the site plan and corresponding FMZ plan.
- ✓ Complete and submit a Chapter 132 Forest Cutting Plan to the appropriate DCR office. Send a copy of the cutting plan to the appropriate conservation commission(s). Send abutters notice to all adjacent landowners within 200' of harvest area via certified mail.
- ✓ Post information on the planned harvest on the Forestry Program page of the DFW website so that the public can review the appropriate site plan, cutting plan, and biological monitoring data (anticipated in 2007).
- ✓ Draft timber sale contract, review with Forest Project Leader.
- ✓ Mail timber sale prospectus to all vendors on mailing list, and post legal notice of sale in at least one newspaper.
- ✓ Conduct public showing of the timber sale and award contract through a public, competitive bid process.
- ✓ Administer timber sale in full compliance with DFW timber sale contract, Chapter 132 cutting plan and Massachusetts Slash Law.
- ✓ Update website information to include digital photos of the harvesting operation (anticipated in 2007).
- ✓ Ensure that post-harvest access by ORVs is controlled by the use of gates, stones, or other methods to block main roads, and by leaving slash and felled trees in any temporary logging roads.
- ✓ Establish post-treatment biological monitoring as appropriate, including monitoring for the presence of invasive plants. Use monitoring results to modify future harvesting practices as appropriate.

and procedures. The DFW Forestry Program has worked cooperatively with DCR and NHESP to define HCV's for state forest and state wildlife lands. These HCV's include:

Rare Species: FSC principles and criteria state that general forest management should conserve biological diversity and its associated values. In addition to this guidance, FSC identifies "significant concentrations" of rare species as an HCV. In Massachusetts, forest cutting plans for areas in known rare species habitats (Priority Habitats) already undergo review by the Natural Heritage and Endangered Species Program (NHESP), so identifying all forested sites on state lands within NHESP Priority Habitats as HCVFs would put no additional burden on forestry operations and would meet and exceed the rare species protection intentions of the Green Certification document.

Rare Ecosystems: HCVFs are intended to include forest areas that are in or contain rare, threatened or endangered ecosystems. The FSC Northeast US region report on HCVF standards recommends using natural communities with abundance ranks of S1, S2 or S3 by the state's Natural Heritage Program as the rare ecosystems. In Massachusetts, most S1-S3 community types are disturbance sensitive, and were included in the areas NHESP recommended as being in reserves. Those S1-S3 types that were not recommended for reserves need some conditioned, occasional management, and thus may be appropriate for designation as HCVF since management that maintains or enhances HCVs is allowed. Designation of S1 and S2, and good quality examples of S3 types outside reserves as HCVF is warranted for conservation of these unique communities. NHESP has not focused on identifying priority natural communities on existing conservation lands, therefore **further inventory on state lands** and reporting of natural communities would improve NHESP's information about the occurrences of the different types, their condition, and their protection status. Accordingly, the DFW Forestry Program has identified potential and actual rich mesic forest (S3) sites on state wildlife lands (see section VII.3), and plans to identify potential and actual S1 and S2 communities as well.

Landscape Level Ecosystems: An additional biodiversity HCV is "large landscape level forests contained within or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance." Including 'A' ranked occurrences of the more common types of natural communities from the NHESP database as HCVFs would be a way to meet this part of the broad definition of HCVFs. DCR and DFW have already determined that existing Old Growth will be in forest reserves. Reserves already include many of the common forest types for their ecoregions which could cover at least part of the need for representatives of the large types. Any forest types not represented in reserves could be represented on state lands outside reserves that are relatively unfragmented (i.e., provide interior forest habitat), and have been continuously forested since pre-settlement times (commonly referred to as '1830s forest'). Such areas could be designated as HCVFs (for areas without maps of 1830s forest, interior forest alone might be used).

Watershed Protection Forest: Forest areas that provide basic services of nature in critical situations, such as watershed protection or erosion control are an additional HCV. Watersheds that contribute to drinking water supplies are a particular HCV that has been addressed by DCR's Division of Watershed Protection on the Quabbin, Ware River, and Wachusett watersheds. There are other (primarily municipal) water supply areas on DCR lands, and perhaps on DFW lands, that should be identified as HCVFs, with the management of these areas focused on water supply protection, according to regulation and BMPs.

Forest Areas Critical for Subsistence of Local Communities: These are intended to be key hunting or foraging areas for endemic communities for which there is no alternative food sources, and are unlikely to occur in Massachusetts. FSC comments that they do not occur in the United

Kingdom, since it is a highly developed area where most of the population has alternative sources of food. The Northeast working group suggests that is true for the northeast US as well.

Forest areas of special cultural or religious significance: DCR and DFW should initiate a process similar to what has already been done in the area of the Southeast BioReserve to identify and interact with local groups, particularly with indigenous peoples, to ascertain culturally sensitive areas. There are regulations and DCR and DFW have policies about consultation with the Massachusetts Historical Commission which is responsible for historic and archeological sites, for review of cultural sites including archeological sites, graveyards, cellar holes, and stone walls (see Section XII). In addition, the state archeologist maintains a list of known archeological sites and has provided DCR with maps of areas that meet particular modeling criteria for likely use by Native Americans before European settlement. DFW will generate similar maps, and if mapped areas are not included as reserves, they will be included as HCVF until their actual status is determined from site visits.

4. Biological Monitoring

All DFW upland forestland is currently being inventoried to determine timber volume, condition, and growth rate, as well as forest community composition. Sampling is being conducted on a 10 x 40 chain grid (one sample plot for every 40 acres) and consists of tree sampling at each sample point to facilitate allowable harvest calculations, and Natural Heritage Form 3 sampling in each stand with one or more sample points to document herb and shrub species composition, as well as vegetation structure and volume of coarse woody debris (see:

<http://www.mass.gov/dfwele/dfw/nhosp/nhclass.htm>).

In addition to this comprehensive inventory, individual harvest sites are monitored for plant species composition prior to and after harvest activities so that harvest goals for regeneration of particular tree species and structural habitat conditions can be assessed. Pre- and post-harvest monitoring provide data on occurrence and abundance of plant species in the forest overstory and understory, and emphasize location of both rare and invasive plant species.

Sites that contain rare species are managed in compliance with science-based restrictions for the species or communities in question (e.g., the Conservation Management Practices that have been developed by Natural Heritage and EOEA: <http://www.mass.gov/dfwele/dfw/nhosp/cmpdraft.htm>). Where there is insufficient knowledge of the effects of timber harvesting, management is designed to impact only a portion of the area and information from subsequent monitoring provides additional guidance for future activities.

Sites that contain invasive exotic species are managed by using mechanical and/or chemical means to reduce or eliminate those species. Follow-up monitoring after timber harvests is used to detect any reoccurrence, and additional control measures are taken when necessary.

Site monitoring is conducted by DFW Forestry Program staff and/or qualified ecologists hired as temporary vendors. Following completion of the comprehensive inventory on any forest reserve sites, periodic re-inventory will be essential to document forest structure and composition. At present, DFW anticipates re-visiting sample locations in reserves once every ten years.

The Massachusetts Executive Office of Environmental Affairs (EOEA) in collaboration with faculty and students at the University of Massachusetts and scientists from private conservation groups are developing a long-term ecological monitoring (LTEM) program to measure and analyze critical environmental indicators on state-owned lands. Data will be collected in reserves where no timber harvesting is allowed as well as in sustainably managed forests. Information obtained from this monitoring program will be used to guide environmental and conservation policies and to inform on-the-ground forest management decisions. Data from the reserves also will serve as the reference condition for the study of environmental disturbances such as climate

change and atmospheric deposition, insect infestations, pathogens, and catastrophic wind or damaging ice and snowstorms.

The LTEM program will respond to questions such as: Will harvesting this forest negatively affect water quality or wildlife? Is climate change causing changes in the composition or functioning of unmanaged reserves? In what ways are invasive species affecting biological diversity? As of July 2006, the proposal is to base the monitoring on several data sets: landscape scale forest type and canopy gaps from aerial photographs; plot scale CFI data including tree species, DBH, status (including snags, and woody debris) and additional measurements; and plant scale temporary plots for rare herbaceous plants, lichens, and invasive species. The specific questions to be answered by analysis of data collected in reserves include: Has the reserve forest shifted to late successional species and uneven-aged structure over time? What is the role of natural disturbance in shaping the forest landscape? What is the location, distribution, and area of openings caused by disturbances – wind, insects, fire? What is the regeneration response in areas affected by natural disturbance? Are non-native species increasing or decreasing in reserves?

As of the date of this FMZ plan, there were several outstanding questions regarding monitoring methods: Is there any systematic bias in the past treatment history of CFI plots? Is the density of CFI plots sufficient to provide statistically reliable descriptive data about the condition of the forest ecosystem? Is the data set that is currently collected at CFI plots sufficient? Should selected populations of rare, invasive, or important indicator species be monitored off CFI plots? Are currently available aerial photos appropriate for measuring canopy gaps? Should animal population measurements be part of monitoring or research? Should we monitor populations of certain taxa every year throughout the reserves and active management areas in order to assess long-term trends or should we select specific habitats that have developed over time within the reserves and active management areas and conduct short-term research studies on the relationship of species to habitats?

5. Environmental Permitting:

All forest management on DFW and other state-owned lands in Massachusetts is subject to a variety of Federal and Massachusetts laws and regulations. Many of these regulations are focused on preventing damage to water and wetland resources, while others protect endangered species and cultural resources, or prevent accidental fire damage (Appendix I (from Berkshire Ecoregions Assessment at: <http://www.state.ma.us/envir/forest/>)). The full text of Massachusetts General Laws is available at www.state.ma.us/legis/legis.htm).

In particular, all DFW timber sales comply with permit requirements of the Massachusetts General Law (MGL) Chapter 132 (The Forest Cutting Practices Act), Chapter 131A (Massachusetts Endangered Species Act), and specific components of MGL Chapter 131, The Wetlands Protection Act which requires Forest Cutting Plan review by the Massachusetts Natural Heritage & Endangered Species Section staff for any forest harvest operation that coincides with Estimated or Priority habitat for rare species. All DFW timber sales that do not fall within estimated or priority habitats are voluntarily submitted to Natural Heritage for review of potential element occurrences (EO's) of rare species that are not reflected in the estimated or priority data layers. Mitigation practices that are recommended by Natural Heritage to conserve rare species are implemented.

6. Boundary condition and maintenance

A GIS analysis of DFW lands in the Taconic Mountains and Marble Valleys FMZ determined that there are about 130 miles of boundary, including about 17 miles of road frontage, surrounding the approximately 6,654 acres of DFW and DFW-DCR lands in the FMZ. A geodatabase has been developed to track and prioritize boundary work on all DFW lands with a

goal of having all boundaries marked by 2010. A detailed set of boundary marking guidelines were put in place in 2005 to standardize boundary marking materials and methods on DFW lands, and call for all DFW boundaries to be blazed and painted and for GPS waypoints to be recorded at all boundary corners.

VIII. Rare Species Protection

All active management sites are reviewed for occurrence of Natural Heritage Priority Habitats (Table 10) and rare species element occurrences (Table 9). Mitigation recommended by Natural Heritage for conservation of rare species is reflected in the site plan and cutting plan.

Property	No. of Polygons	Acres
Agawam Lake WMA	6	332
Bullock Ledge NHA	1	15
Chalet WMA	3	1
Dolomite Ledges NHA	4	67
E. Howe Forbush Sanctuary	1	124
Fairfield Brook NHA	3	76
George L. Darey Housatonic Valley WMA	22	721
Green River WMA	8	136
Hoosac River Access	1	5
Hop Brook WMA	8	361
Housatonic River Access	2	15
Jug End Fen NHA	3	62
Jug End State Reservation & WMA	7	390
Kampoosa Fen NHA	1	49
Konkapot River Access	1	11
Lanesboro NHA	1	54
Maple Hill WMA	3	192
Nordeen Marsh NHA	1	28
Stafford Hill WMA	3	130
Three Mile Pond WMA	1	150
Total	80	2919

The BioMap Project (NHESP 2001) created a statewide map of potential rare species and natural community habitat known as BioMap Core (Fig. 16). The BioMap Supporting Natural Landscape is defined as the portion of the landscape that connects many smaller but important Core habitat areas (see: <http://www.mass.gov/dfwele/dfw/nhosp/nhbiomap.htm>). The Supporting Natural Landscape in this FMZ provides essential corridors for plant and animal movements. This critical habitat connectivity as well as the long-term open space protection provided on WMAs will serve to enhance the long-term viability of rare species, common species and natural community associations.

All rare species (animals and plant) habitat as well as unique communities and Primary Forest are targeted by the Guidelines as well as this Plan as high priority areas of conservation action. At the earliest possible stage, all management prescriptions are informally reviewed with a member of

the Natural Heritage and Endangered Species (NHESP) staff prior to implementation in an effort to keep all field staff up to date on the status of rare plants, animals and communities over time. All management activities are formally reviewed by NHESP staff (for a second time) during the Forest Cutting Plan (MGL Chapter 132) review process just prior to harvest. All NHESP recommendations for the protection of rare plants and animals or priority communities are incorporated into the management prescriptions.

Vernal pools represent an important habitat for biodiversity protection and occur throughout this FMZ. Because some animals are completely dependent upon vernal pools for part of their life cycle, the list of these “obligate” ephemeral vernal pool species includes many rare species. *The Massachusetts Aerial Survey of Potential Vernal Pools* (NHESP, 2001) identified 785 potential vernal pools (PVPs) and 57 vernal pools have been certified within this Taconic Mountains and Marble Valleys FMZ (see: <http://www.mass.gov/dfwele/dfw/nhesp/nhcvp.htm>, or <http://www.mass.gov/dfwele/dfw/nhesp/vpcert.pdf>).

All PVP sites on DFW lands in the Taconic Mountains and Marble Valleys will be or have been visited by DFW staff and vendors to determine whether or not PVPs are in fact functional vernal pools. In addition, pre-harvest biological monitoring (Table 9) is designed to identify any functional vernal pools that are not already part of the DFW Forestry Program geodatabase. All vernal pools on Division property are afforded the same protection as a certified vernal pool during harvest activities (Fig. 17). These pools, as well as upland habitat that surround each pool, will be protected during harvest activities.

IX. Non-timber forest products

The production of non-timber forest products is not currently a management objective in the Taconic Mountains and Marble Valleys FMZ.

X. Water and soil quality

Through the use of Massachusetts Forestry Best Management Practices, DFW strives to protect the quality of wetland resource areas and integrity of forest soils. DFW requires temporary bridges at annual stream crossings during harvesting operations, and frequently requires the use of forwarders for transportation of wood products to landing sites. Pre- and post-harvest monitoring of forest herbs, shrubs, and tree regeneration help DFW to verify that soil and water quality are fully conserved.

XI. Forest recreation and public access

All WMAs in this FMZ are open to the public for hunting, fishing, trapping, hiking and mountain biking. Few trails are maintained within the Wildlife Management Areas, however, many woods roads, skid roads, and foot trails exist. Forested portions of state wildlife lands typically provide opportunities for dispersed public recreation throughout hundreds or thousands of acres. Each WMA has a parking area that is seasonally accessible by pickup trucks or similar vehicles.

Motorized vehicles are excluded from all WMAs beyond the mapped parking areas. Exceptions are made only by the issuance of special use permits for limited periods of time, for example, logging equipment for timber harvest operations and seasonable snowmobile use on designated trails maintained by members of established snowmobile clubs. These uses are only allowed if they promote our other management objectives. Special use permits for the Taconic Mountains and Marble Valleys FMZ are issued by the District Manager for either the Western Wildlife District or the Connecticut Valley Wildlife District, depending on the location of the use.

A project is underway to map via GPS all road features, motor vehicle, trespass, boundaries, and other property elements. DFW is developing standard practices to help minimize the conversion of temporary logging tracks to illegal ORV trails. These include blocking access after timber harvests with gates, stones, or other methods, as well as other techniques such as the strategic placement of slash, and the use of large berms and ditches where appropriate.

XII. Conservation of historic and cultural resources

As noted in Appendix XII of the Berkshire Area Ecoregion Assessment (see: http://www.mass.gov/envir/forest/berkshire_draft/appendix_12.pdf), cultural resources are protected from state and federally funded or approved activities under various laws, including but not limited to:

- M.G.L. Ch 9 ss 26-27c as amended by St 1988 c. 254.
- M. G. L. Chapter 38, section 6B (Massachusetts Unmarked Burial law)
- Massachusetts Environmental Policy Act (MEPA).
- Section 106 of the National Preservation Act of 1966.

To comply with these laws, the DFW Forestry Program, in coordination with the DFW Federal Aid Coordinator submits forest management site plans to the Massachusetts Historical Commission (MHC) for harvesting in areas of potentially high archaeological sensitivity. Areas of potentially high archaeological sensitivity are defined by MHC as having slopes of 5% or less, well-drained soil, and distance to a fresh water source of 1000 feet or less. Other factors include aspect with an eastern component and non-rocky/stony microtopography. In addition, the Department of Conservation and Recreation has offered to have their chief archaeologist review DFW site plans to compare them with the Massachusetts Historical Commission's database of 7,000 pre-European historic sites.

DFW attempts to minimize potential impacts on cultural and historical resources by including provisions in timber sale contracts that restricts operation of heavy machinery to dry or frozen conditions, prohibits skidding of wood products to landing sites, and requires a forwarder to transport wood products to landing sites. These provisions seek to minimize disruption of the soil profile below the organic surface layer. In addition, DFW seeks to locate landing areas >50' from cellar holes, and/or on abandoned agricultural sites (which have previously been disturbed) within potentially sensitive archaeological sites. Further, historical and cultural resources such as stone walls, cellar holes, and mill sites are mapped and protected during harvesting operations. DFW seeks to utilize existing openings in stone walls for transporting wood products during harvesting operations, and limits creation of new openings in stone walls to situations where new openings will help avoid the need for a stream and/or wetland crossing.

XIII. Public outreach and comment process

This FMZ plan will be provided in draft form to the public via the Division's web-site and will be announced to the public through EOEAs contacts with town conservation commissions and conservation organizations in the Commonwealth. Public meetings will likely be scheduled for sometime in January, 2007, at times and places to be announced to present a summary of this draft FMZ plan and to solicit oral comments on the plan. Further, written comments on this draft plan will be received by DFW until February 16, 2007. Send comments to the DFW Forest Project Leader at the DFW Field Headquarters, 1 Rabbit Hill Road, Westborough, MA 01581. Public comments will be reviewed and addressed before submitting a revised plan to DFW Senior Staff and the Fisheries and Wildlife Board.

XIV. Legal status of the forest and its resources

Division property is owned by the Commonwealth of Massachusetts under Article 97 of the Constitution, Section 15 of Chapter 15 of the Acts of 1976, Section 2(26) and 8 of Chapter 21A as amended pursuant to Chapter 79 and other laws and acts. The Division also holds conservation easements on some privately owned land, but those forestlands are not managed by the Division and may or may not be subject to Division Forest Management Guidelines. Individual site plans identify any specific easements, restrictions, or leasing arrangements on Wildlife Management Areas.

XV. FSC Required Element Tracking

FSC certification of sustainable forest management on DFW lands requires that specific elements be covered in management planning documents. The required FSC elements, and the portion of the draft FMZ plan where the elements are addressed are presented in Appendix III.

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Appendix I. Summary of Environmental Permitting Requirements

Federal and state laws regulating forest management activities on DFW lands (Prepared by DCR Forestry Staff, and copied from Berkshire Ecoregions Assessment at: <http://www.state.ma.us/envir/forest/>).

- 1). Section 404 of the Clean Water Act of 1977 required the US Army Corps of Engineers to control any activities resulting in dredging or filling of waterways, a responsibility that has since been passed on to state agencies.
- 2). Section 319 of the Federal Clean Water Act Amendments of 1987 tasked the MA DEP with the development of Best Management Practices to control non-point source pollution associated with timber harvests.
- 3). Section 6217 of the Federal Coastal Zone Act Amendments of 1990 deals with non-point source pollution that affects coastal regions, requiring MA CZM to address problems associated with timber harvests. All harvesting activities in the state are assumed to have the potential to affect the coastal zone, and are therefore subject to Section 6217 requirements.
- 4). The Source Water Assessment Program, required by the federal Safe Drinking Water Act Amendments of 1996, requires the MA DEP to assess potential threats to drinking water supplies and determine the susceptibility of supplies to these threats. Forest Operations is among the potential threats identified, though the focus of concerns was on "unregulated logging" (i.e. logging that falls outside the jurisdiction of the Forest Cutting Practices Act, described below).
- 5). MGL Chapter 48 (Fires, Fire Departments, and Fire Districts), especially Sections 16 thru 20 relative to the handling of slash that results from timber harvests in order to minimize fire danger.
- 6). MGL Chapter 30, Sections 61-62 (Environmental Impact of Projects, etc. Conducted by Agencies) and the Massachusetts Environmental Policy Act (MEPA) regulations (301 CMR 11.00) seek to limit or prevent negative impacts on the environment of the Commonwealth through a review procedure that requires impact reports for activities that exceed certain thresholds. Revisions to MEPA regulations, effective July 1, 1998 determined that MEPA review is not required for forest harvest operations provided that a Chapter 132 Forest Cutting Plan has been filed. A few exceptions exist. An Environmental Notification Form (ENF) and other MEPA review may be required for any non-bridged crossing 1,000 or fewer feet upstream of a public surface drinking water supply for the purpose of forest harvesting activities (bridged stream crossings do not trigger this review). While many projects that occur within a designated Area of Critical Environmental Concern (ACEC) require MEPA review, forest cutting that occurs in an ACEC under a Chapter 132 Cutting Plan is exempt from this review. Forest cutting undertaken *without* a Cutting Plan (e.g., because less than 25 thousand board feet or 50 cords are to be cut) may be subject to MEPA review if it alters an area in excess of 25 acres or occurs within an ACEC.
- 7). MGL Chapter 131, Section 40 (the Wetland Protection Act), which subjects any activity that alters, dredges, fills, or otherwise harms wetlands to strict regulation.
- 8). MGL Chapter 132, Section 40-46 (the Forest Cutting Practices Act) and 304 CMR 11.00 require filing of a Cutting Plan for any timber harvest that exceeds 50 cords or 25 thousand board feet, except when clearing for public utilities or highways, maintenance cutting in pastures, cutting for the non-commercial use of the landowner, clearing land for cultivation or pasture, or

change of use cutting (e.g. clearing house lots or mining gravel). (Note that all of these exceptions are subject to Chapter 131 and other environmental legislation). The act and regulations apply to timber harvests on public or private lands, and address wetland protection, wildlife habitat and rare species habitat, and provide minimum environmental standards to which all regulated timber harvests must adhere. Chapter 132 also requires licensing of foresters and loggers who work in Massachusetts. If a Cutting Plan has been filed for a harvest, this harvest is exempt from the procedures required by Chapter 131 and is instead subject to wetland and environmental review by the DCR Service Forester assigned to the region.

9). 314 CMR 4.00 (Massachusetts Surface Water Quality Standards) provides additional protection for Outstanding Resource Waters with exceptional socio-economic, recreation, ecologic or aesthetic values such as public drinking water sources. This protection extends to 304 CMR 11.00 cutting practices regulations, for instance by requiring that stream crossings by logging equipment within 1,000 feet upstream of a public water supply must use a temporary bridge or undergo MEPA review.

10). Federal and Massachusetts endangered species laws and regulations. MGL Chapter 131A (Massachusetts Endangered Species Act) prohibits the taking of any listed MA species. DCR Service Foresters are required to compare a proposed harvesting area on a Cutting Plan to the atlas of listed species habitats provided by the Natural Heritage program, and to contact NHESP for protection guidelines if these overlap.

11). Federal and Massachusetts laws for preservation of historic or prehistoric cultural resources do not apply until sites have been officially listed in the State or National Registers of Historic Places, or have been officially documented to contain prehistoric resources of significance. No sites exist to date within Massachusetts state-owned forestland. However, agency mandates for the protection of such sites, and minimum standards are evolving. Among these and the many other laws and regulations that may impact forest management activities in Massachusetts, the Forest Cutting Practices Act and regulations are the most prominent set of rules that affects forest management on state (and private) forestland. The Massachusetts standard upheld by this act is among the three or four most stringent in the nation, in the company of regulations in the states of Oregon, California, and Maryland. Listed below are some of the minimum environmental standards of these regulations that apply to forest management on all state-owned (as well as private) forests.

1. All trees to be cut (or, in some situations, to be left as seed sources) must be designated by marking, or by a detailed description in the forest cutting plan of the size, species, and quality of trees to be cut and the percentage of the basal area (stocking of trees) to be removed. Management objectives and silvicultural methods must be identified in the cutting plan.

2. Regeneration cuts (including selection system, shelterwood, seed tree, and clear cuts) require either the presence of 1,000 or more viable stems of regeneration per acre, the planting or direct seeding of this many trees, or verification that this condition will be met naturally within five years or fewer. The vast majority of management objectives are met through natural seeding. Intermediate harvests (thinnings) must meet minimum standards for residual stocking.

3. Seed tree and clear cut silvicultural systems also have additional requirements. Seed tree cuts are subject to specific requirements for the number and size of overstory trees left behind. The maximum clear cut opening size is ten acres unless the source of the regeneration is seeding from surrounding stands, in which case the maximum size is five acres. Clearcuts larger than these limits require an approved justification stating the ways in which environmental effects will be reduced, or environmental benefits enhanced by a larger opening size. As noted above, clearcuts in excess of 25 acres may require the filing of an ENF.

4. Filter strips are required along all water bodies and certified vernal pools. The width of these strips is at least 50 feet, but increases with slope for streams wider than 25 feet, ponds 10 acres or greater, designated scenic rivers, and along Outstanding Resource Waters and their tributaries. Also, for all water bodies where the filter strip is 30% or greater in slope, the minimum width increases to 100 feet or to the point between 50 and 100 feet at which the slope drops to less than 30%. Clearcuts are not allowed within the filter strip, with some exceptions. Cutting in filter strips is limited to 50% of the basal area and the trees left behind must be healthy and well distributed. Equipment is not allowed to operate within the filter strip except to access an approved stream crossing.

5. Roads must be designed, mapped, constructed, and maintained according to standards of drainage, erosion control, and slope limitations.

6. Landings must be placed at a sufficient distance from wetland and water resources, must be designed and built properly to limit erosion, must be kept free of trash, and must be stabilized at the end of use.

7. All regulated wetland resource areas must be accurately mapped in the cutting plan and logging is subject to a wide array of restrictions, including where, when, and how equipment is allowed to work on or near wetlands.

8. Stream and wetland crossings are required to meet minimum Best Management Practices (see Kittredge, D.B. and M. Parker, 1995. Massachusetts Forestry Best Management Practices Manual, available through DCR/DSPR Regional offices), with stronger restrictions for stream crossings within 1,000 feet upstream of a public water supply reservoir.

The above is not a comprehensive listing but rather examples that illustrate the regulations for those unfamiliar with the Forest Cutting Practices Act. The full text of these regulations is available online at www.state.ma.us/dem/regs/304011b.htm.

**Appendix II. Summary of Public Comments from Scheduled
Public Meeting in December 2006.**

(To be completed)

Appendix II. FSC Required Element Tracking

FSC Element	Requirement	FMZ Plan section
7.1.a.1	The following management objectives have been identified:	
7.1.a.1.a	Timber products	VI.1
7.1.a.1.b	Conservation of biological diversity	VI.1-2
7.1.a.1.c	Non-timber forest products	IX
7.1.a.1.d	Water and soil quality	X
7.1.a.1.e	Forest recreation and public access	XI
7.1.a.1.f	Conservation of historic and cultural resources	XII
7.1.a.1.g	Public outreach and comment process	XIV
7.1.b	Description of forest resources to be managed, environmental limitations, land use and ownership status, socioeconomic conditions, and profile of adjacent lands	V, XV
7.1.b.1	Management goals, objectives, and policies are justified by the description of resources to be managed and environmental limitations	VI
7.1.b.2	The management plan identifies the legal status of the forest and its resources (e.g., ownership, usufruct rights, treaty rights, easements, deed restrictions, and leasing arrangements).	I.1-2, Table 9
7.1.b.3	The management plan identifies relevant cultural and socioeconomic issues (e.g., traditional and customary rights of use, access issues, recreational uses, and employment issues), conditions (e.g., composition of the workforce, stability of employment, and changes in forest ownership and tenure), and areas of special significance (e.g., ceremonial and archeological sites).	XI, XII, XV
7.1.b.4	The management plan incorporates landscape-level considerations within the ownership and among adjacent and nearby lands, including major water bodies, critical habitats, and riparian corridors.	I.3-5
7.1.c	Description of silvicultural and/or other management system, based on the ecology of the forest in question and information gathered through resource inventories.	VII.2
7.1.c.1	Silvicultural prescriptions have a primary objective of perpetuating a sustainable forest ecosystem based on ecological parameters such as soil types, past harvest history, natural community types, and successional trends.	VII.2
7.1.d	Rationale for the rate of annual harvest and species selection	VI.1-2

7.1.d.1	The management plan includes data on growth, yield, stocking, and regeneration (see Criterion 5.6.a). The rate of annual harvest and species selection is based on levels described in 5.6.b.	VI.1-2
7.1.e	Provisions for monitoring forest growth and dynamics	VII.3
7.1.e.1	The forest owner or manager describes in the management plan how they will comply with the requirements of Principle 8.	VII.3
7.1.f	Environmental safeguards based on environmental assessments.	VII.5
7.1.f.1	The forest owner or manager describes in the management plan how they will comply with the requirements of Criterion 6.1.....	VII.5
7.1.g	Plans for the identification and protection of rare, threatened, and endangered species.	VII.5, VIII
7.1.g.1	The forest owner or manager describes in the management plan how they will comply with the requirements of Criterion 6.2....	VII.5, VIII
7.1.h	Maps describing the forest resource base including protected areas, planned management activities, and land ownership.	Figures
7.1.h.1	The management plan includes maps of the forest's characteristics, such as: relevant landscape-level factors; property boundaries; roads; timber production areas; forest types; topography; soils; riparian zones; springs and seeps; wetlands; archaeological sites; cultural and customary use areas; locations of and habitats for sensitive, rare, threatened, and endangered species; representative samples of existing ecosystems, and designated High Conservation Value Forests	Figures
7.1.i	Description and justification of harvesting techniques and equipment to be used. Note: The Working Group considers this Sub-Criterion sufficiently explicit and measurable. Indicators are not required.	VII.2, X, XII
7.2	The management plan shall be periodically revised to incorporate the results of monitoring or new scientific and technical information, as well as to respond to changing environmental, social and economic circumstances.	I.5
7.2.a	Relevant provisions of the management plan are modified in response to environmental and anthropogenic influences (e.g., road damage, depletion of timber and non-timber resources, air pollution, illegal harvests, insects and disease, etc.) as documented by monitoring.	I.5
7.2.b	The forest owner or manager reviews and revises the management plan every ten years at a minimum.	I.5
7.3	Forest workers shall receive adequate training and	XIII

supervision to ensure proper implementation of the management plan.

7.4 While respecting the confidentiality of information, forest managers shall make publicly available a summary of the primary elements of the management plan, including those listed in Criterion 7.1. XIV

Certification Conditions

2002.3	Forest Inventory	V.4
2002.4	Road Inventory	VII.6
2002.5	Long-term Access	VII.7
2002.6	Ecological Reserves	VII.1
2002.7	High Conservation Value Forests	V.2, VII.3

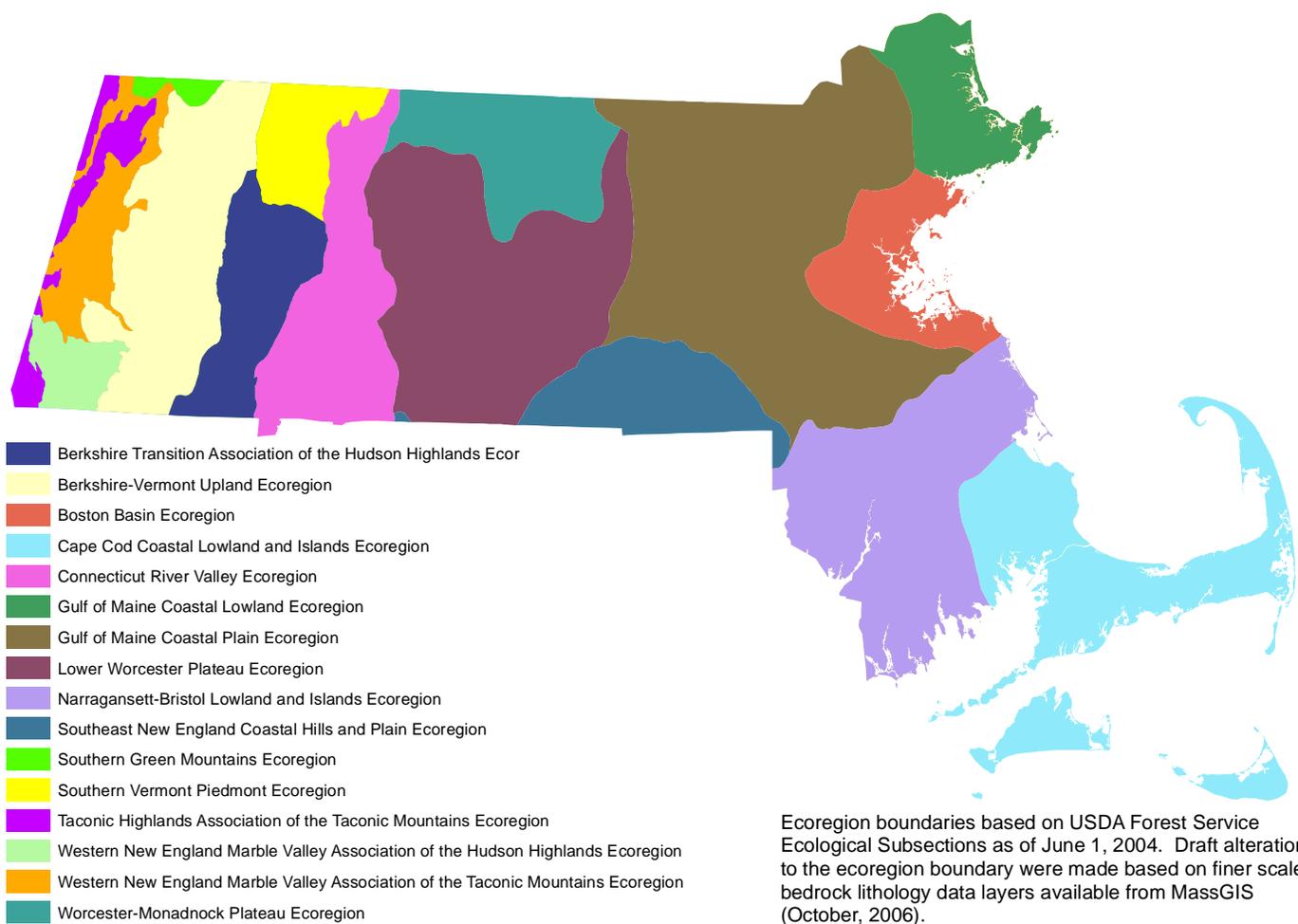


Figure 1. Massachusetts Ecoregions, based on USDA Forest Service Ecological Subsections

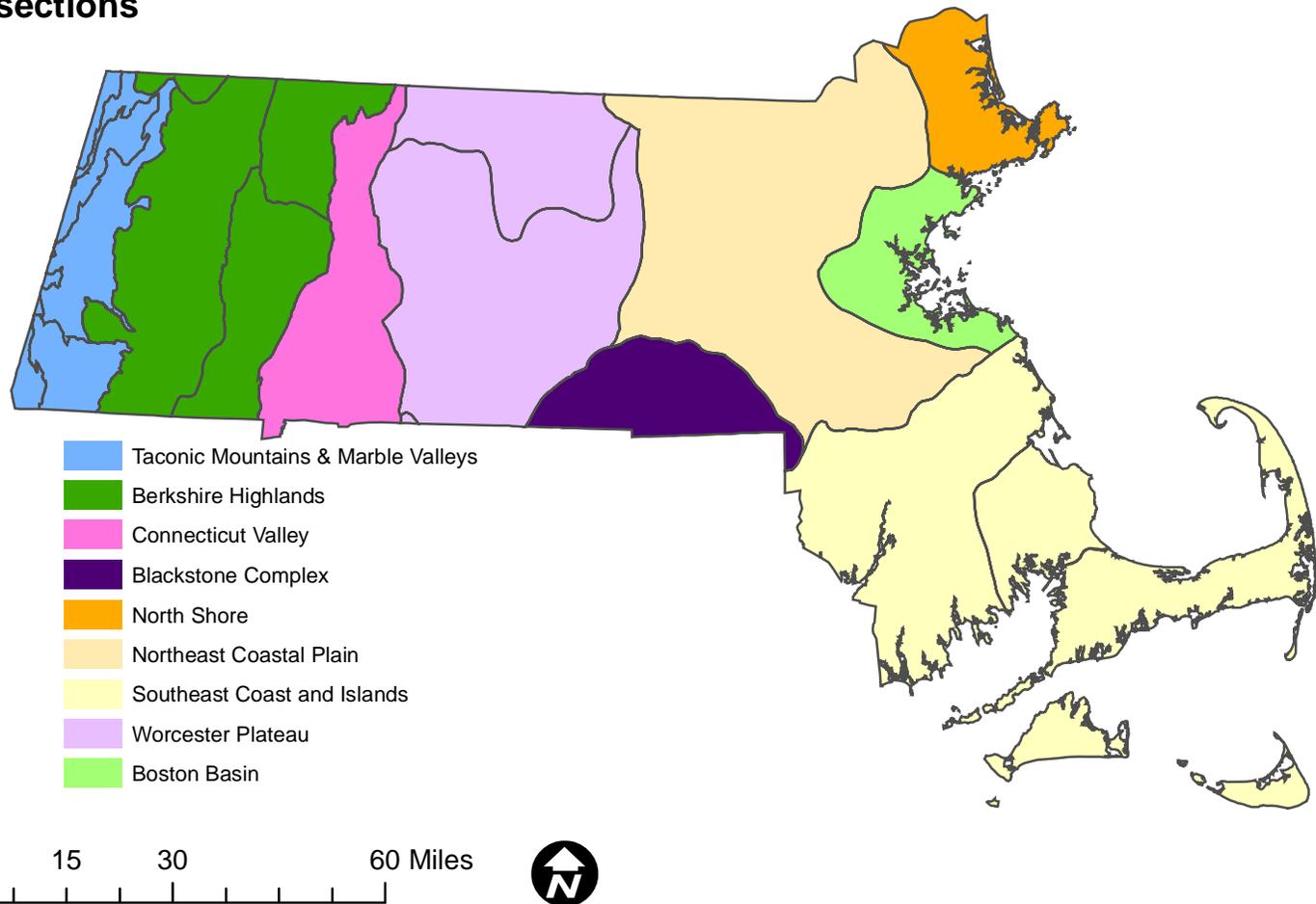


Figure 2. DFW Forest Management Zones with internal ecoregion boundaries shown

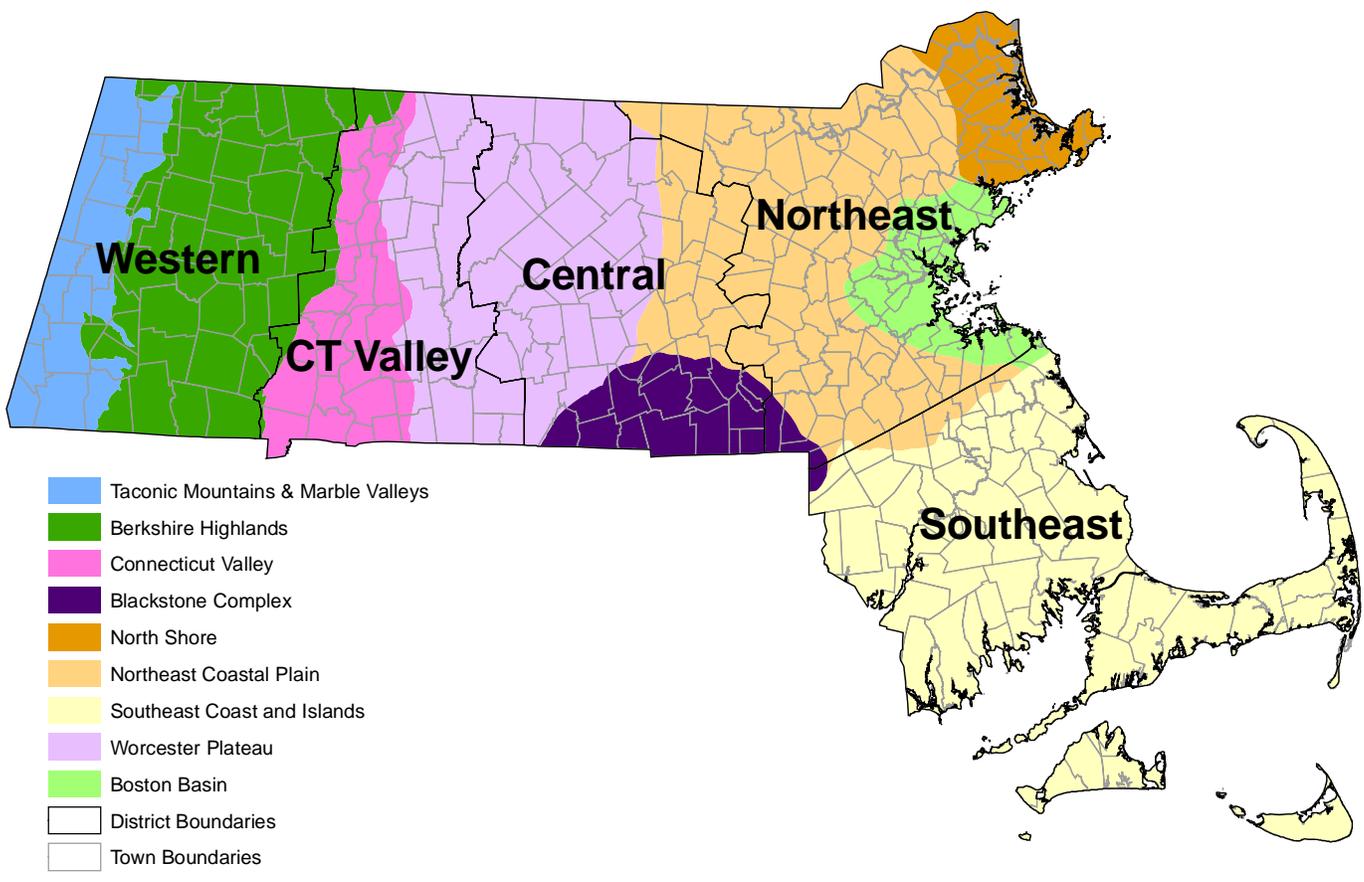


Figure 3. DFW Forest Management Zones and Wildlife District Boundaries

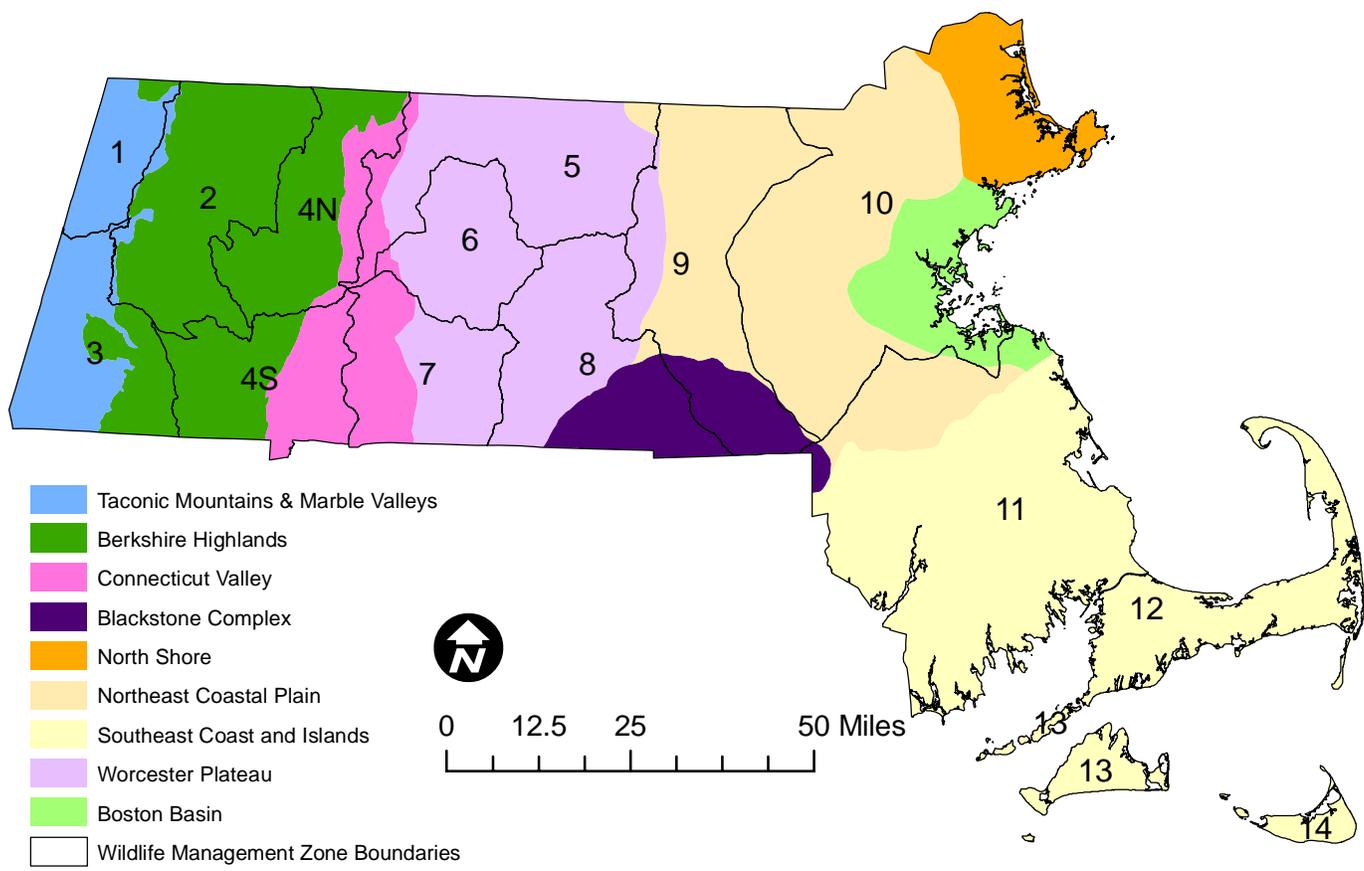


Figure 4. DFW Forest Management Zones and Wildlife Management Zone Boundaries

- DFW Properties in the TMMV FMZ
- Conservation Easement
- DFW Properties outside of the TMMV FMZ
- Permanently protected open space
- TMMV FMZ
- Major Hydrologic Features
- Town Boundaries

GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

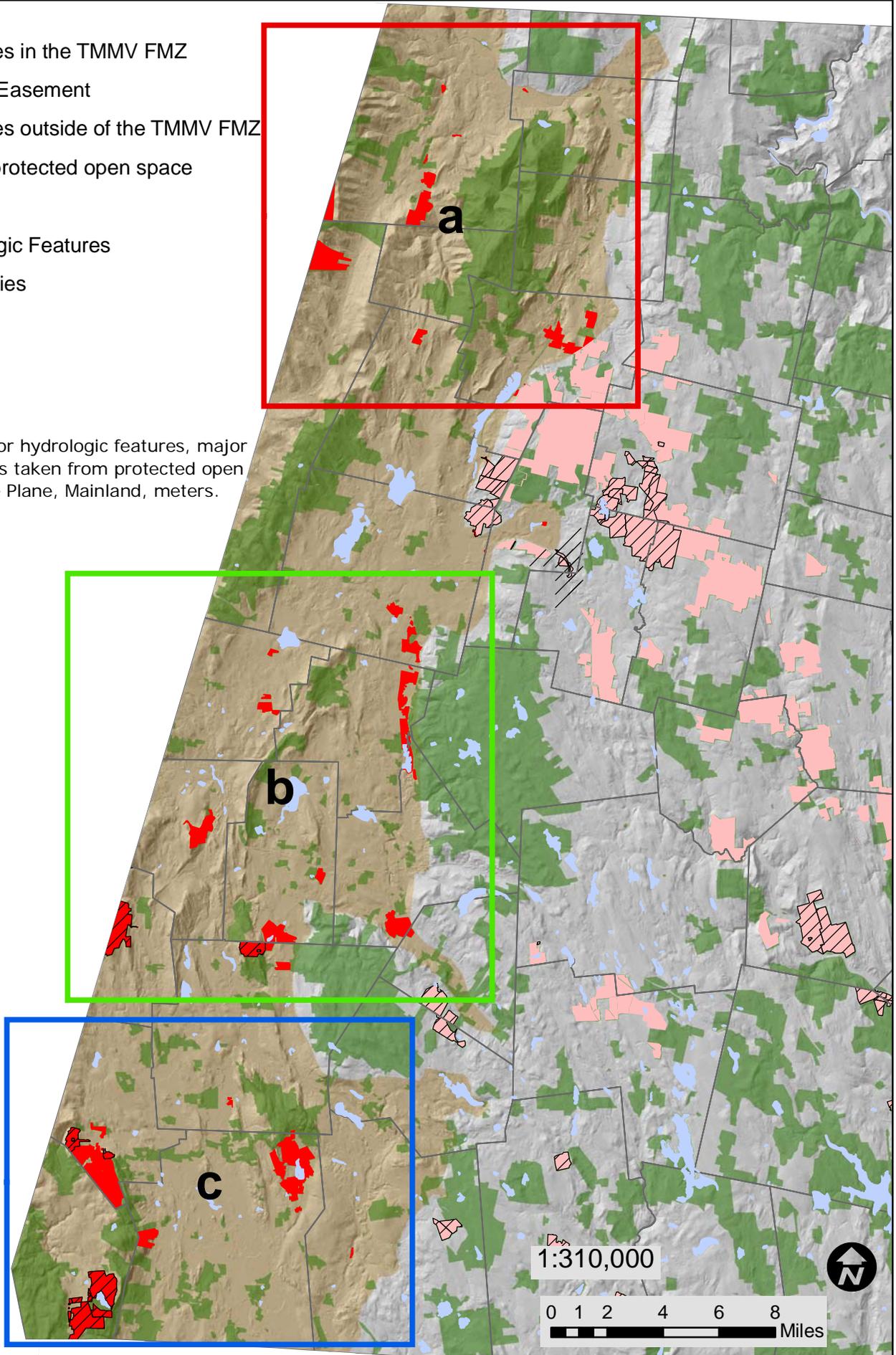
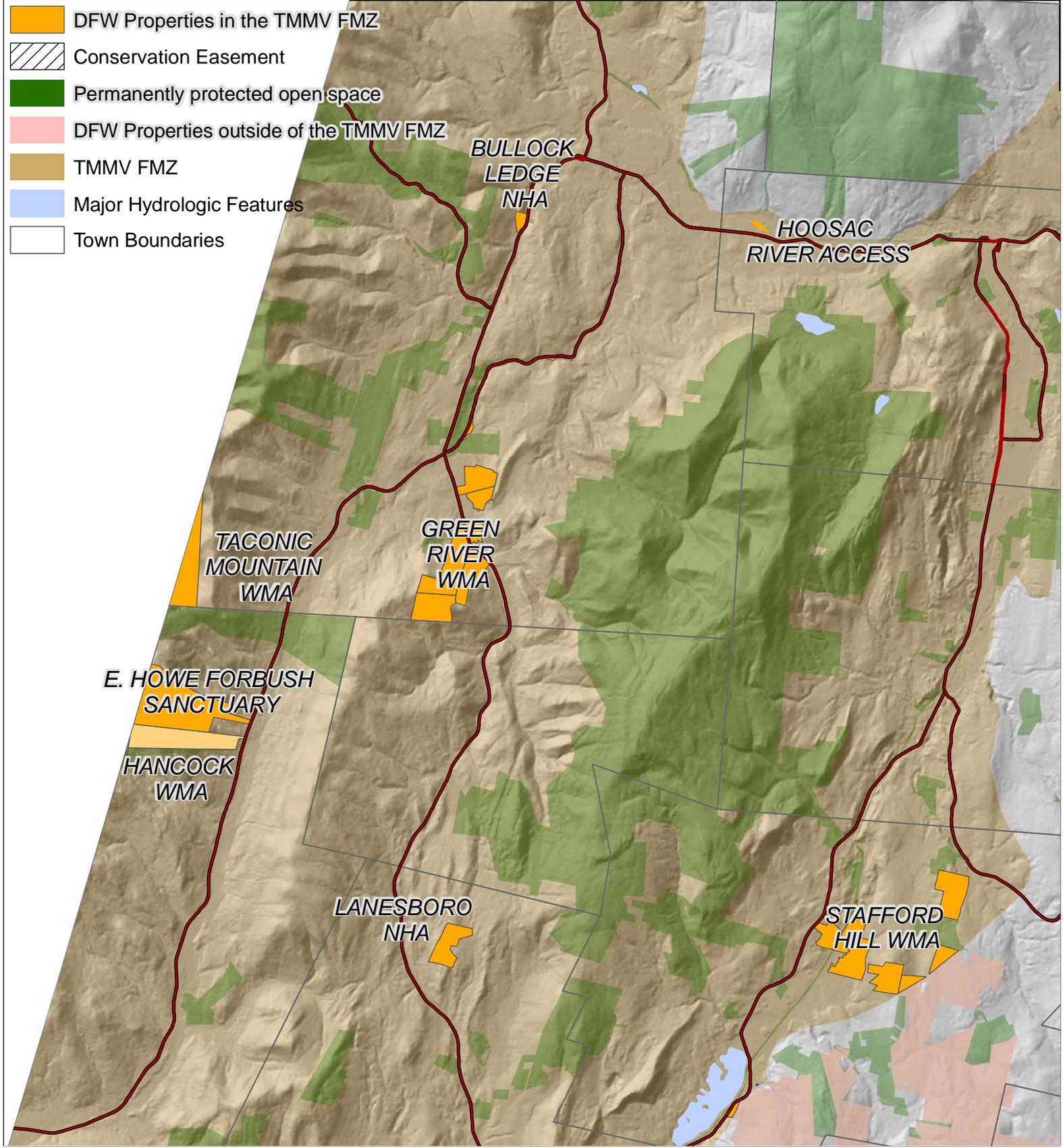


Figure 5-Key. Taconic Mountains and Marble Valleys Forest Management Zone (TMMV FMZ) (Key to larger scale property maps shown in boxes a, b, and c)



GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

* DFW Properties shown in different shades of orange to help distinguish adjacent properties

1:100,000



0 0.45 0.9 1.8 Miles

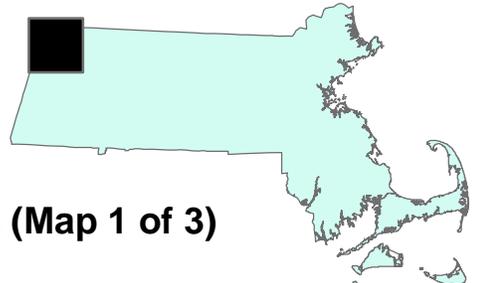
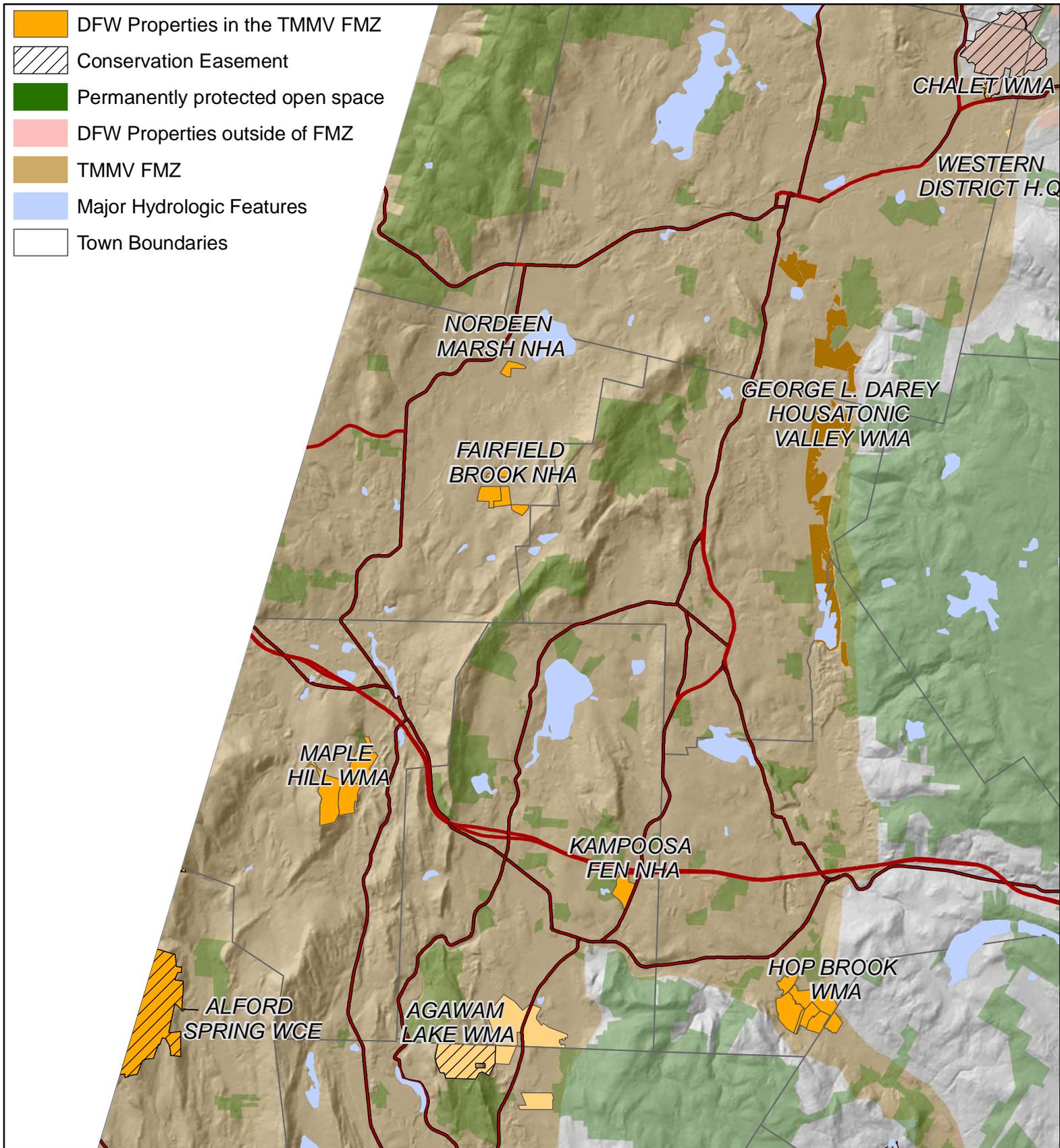


Figure 5-a. Taconic Mountains and Marble Valleys Properties (Map 1 of 3)



GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

* DFW Properties shown in different shades of orange to help distinguish adjacent properties

1:125,000



0 0.5 1 2 Miles

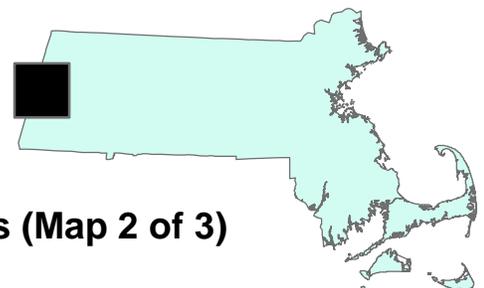
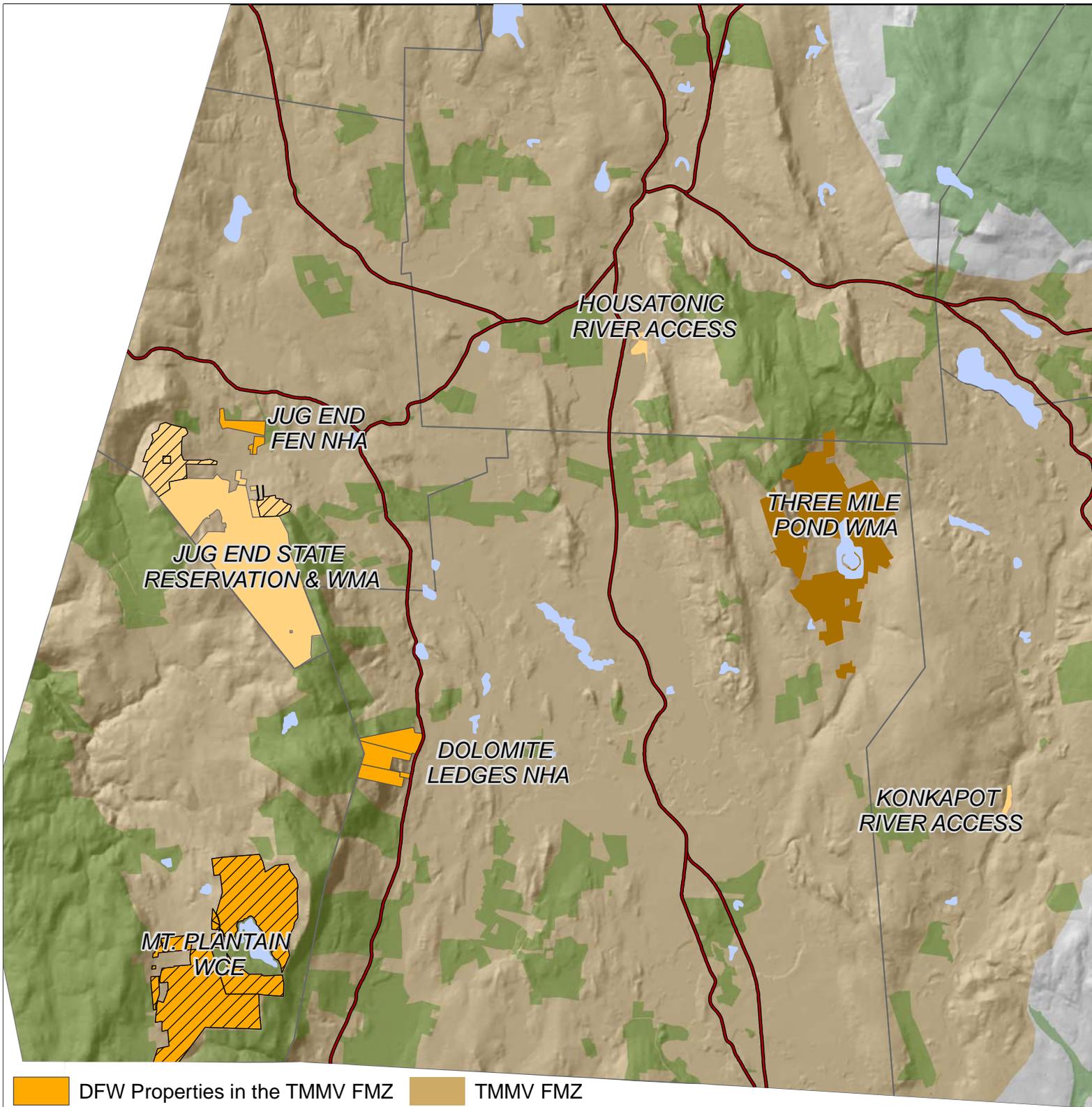


Figure 5-b. Taconic Mountains and Marble Valleys Properties (Map 2 of 3)



- DFW Properties in the TMMV FMZ
- TMMV FMZ
- Conservation Easement
- Major Hydrologic Features
- Permanently protected open space
- Town Boundaries

GIS Data: MassGIS (major hydrologic features, major highways, DFW properties taken from protected open space). All data MA State Plane, Mainland, meters.

* DFW Properties shown in different shades of orange to help distinguish adjacent properties

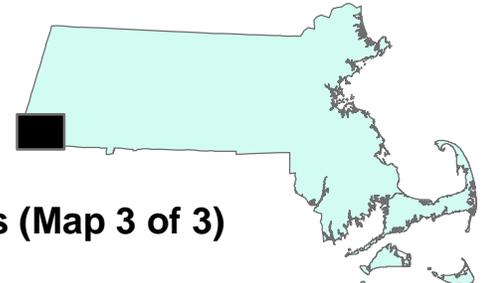
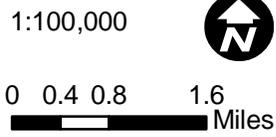


Figure 5-c. Taconic Mountains and Marble Valleys Properties (Map 3 of 3)

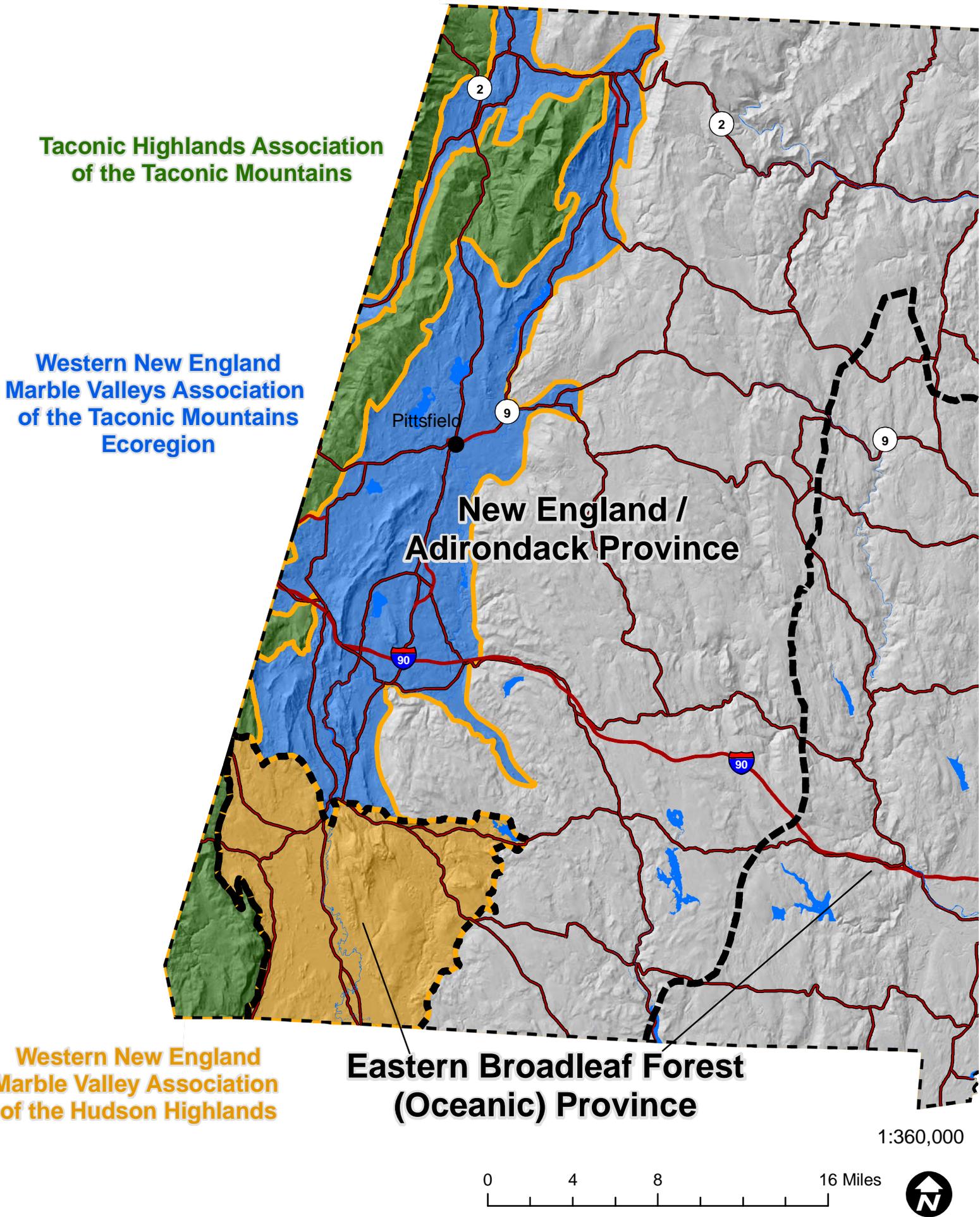
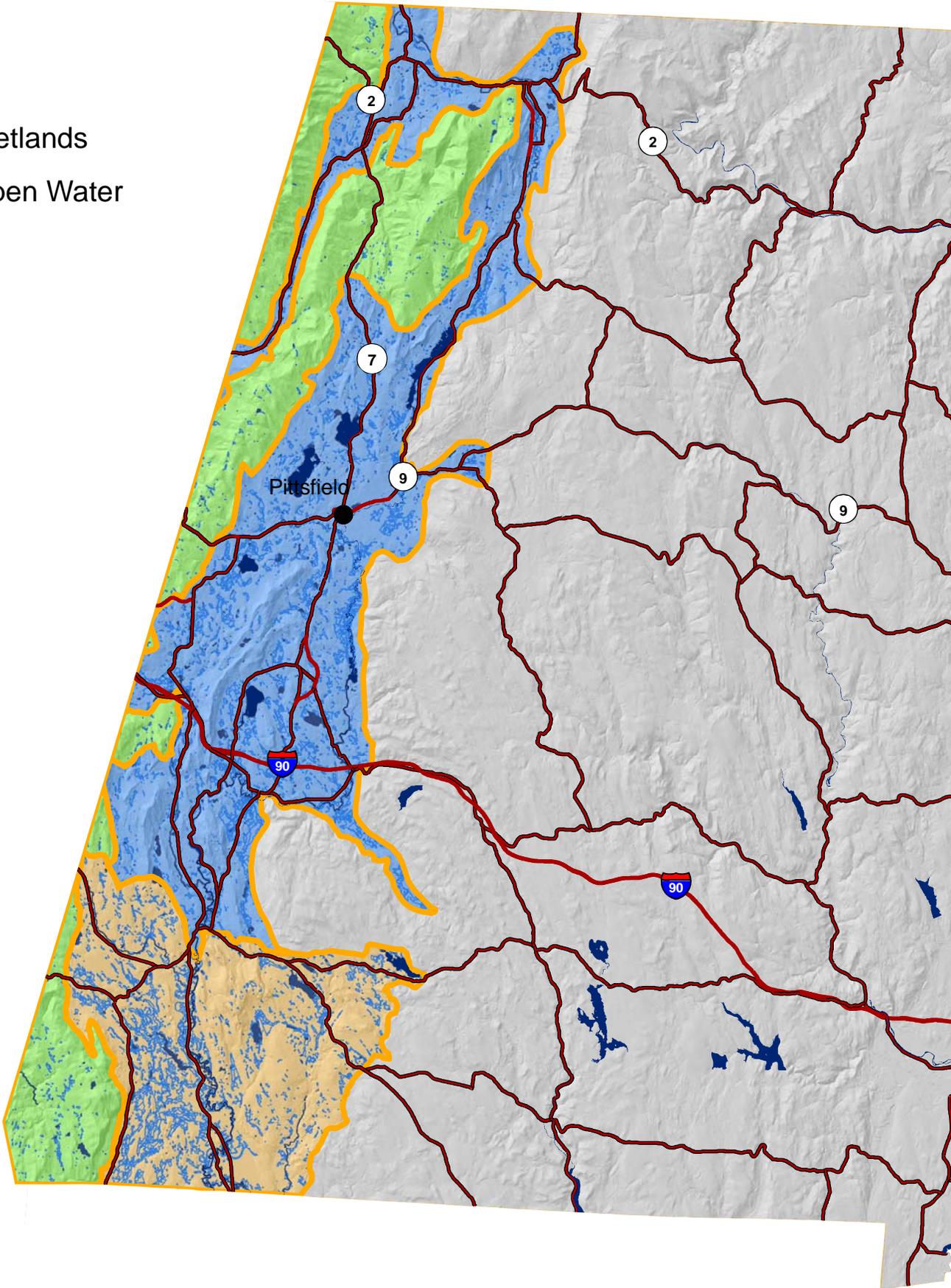


Figure 6. Ecological Provinces, regions, and associations within the Taconic Mountains and Marble Valleys FMZ

Wetlands
Open Water



1:360,000

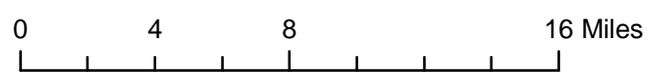


Figure 7. DEP wetlands in the Taconic Mountains and Marble Valleys FMZ

- Interior Forest
- DFW Fee Properties
- Other Permanently Protected Open Space
- Modified USDA FS Ecoregions, October, '06

0 2 4 8 Miles

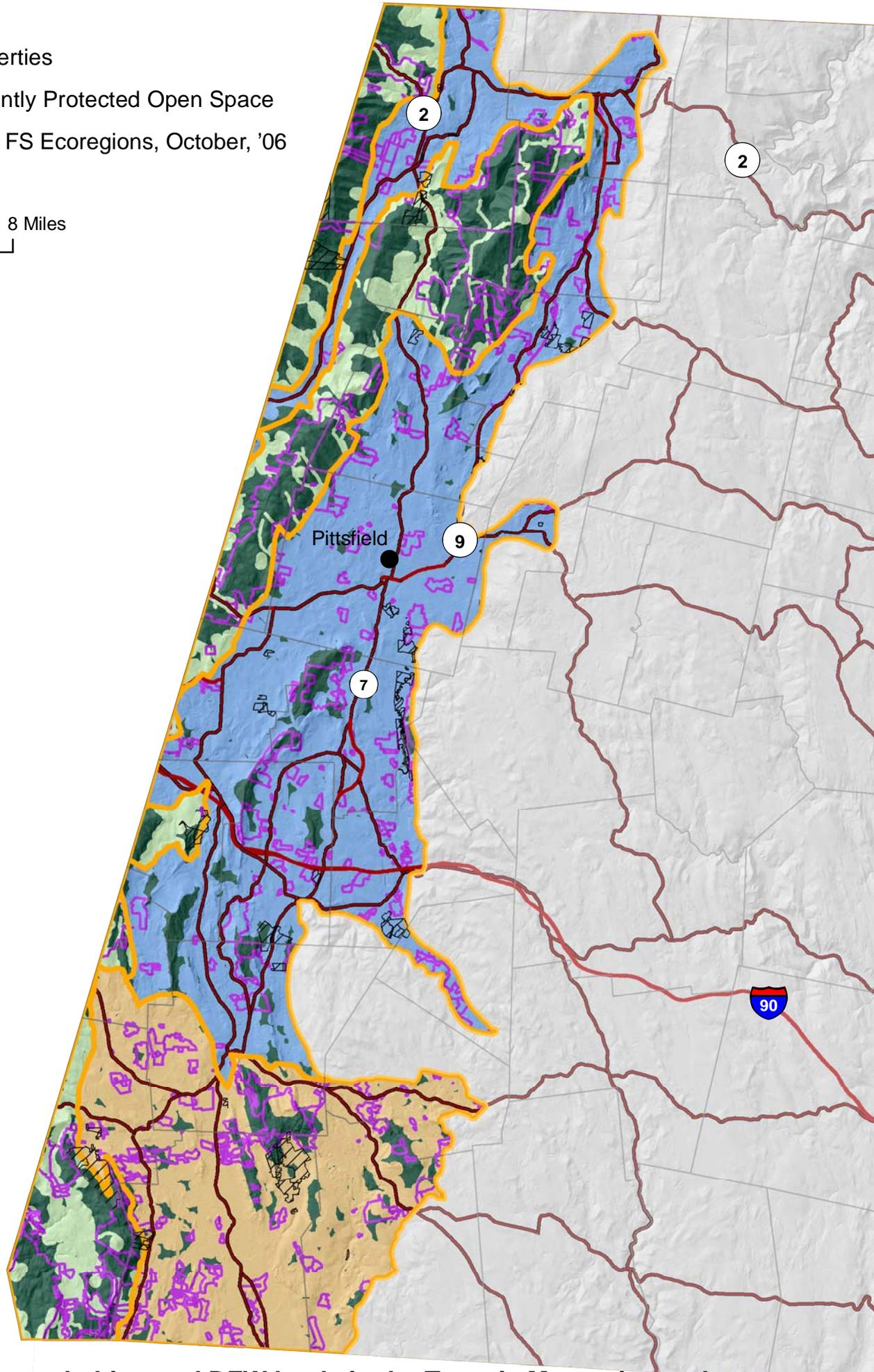


Figure 8. Interior forest habitat and DFW lands in the Taconic Mountains and Marble Valleys FMZ.

-  DFW Fee Properties
-  Other Permanently Protected Open Space
-  Known Forest Cover in 1830
-  Towns with no 1830s forest data
-  Modified USDA FS Ecoregions, October, 06

0 3.5 7 14 Miles

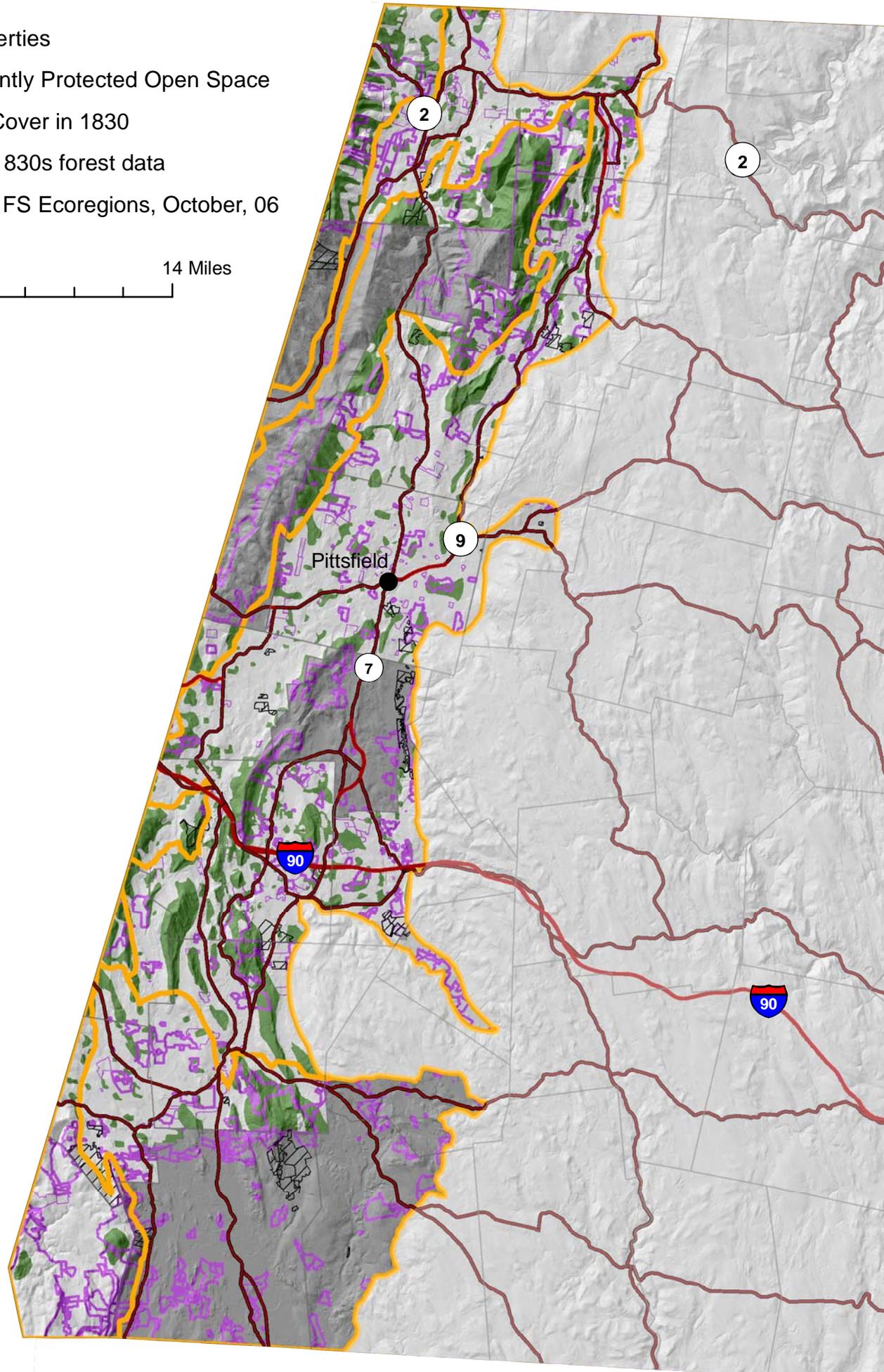


Figure 9. Known 1830 forest cover in the Berkshire Highlands FMZ (from Hall et al. 2002).

- DFW Fee Properties
- Interior forest and Primary forest
- Permanently Protected Open Space
- Town Boundaries
- Modified USDA FS Ecoregions, October, '06

0 3 6 12 Miles

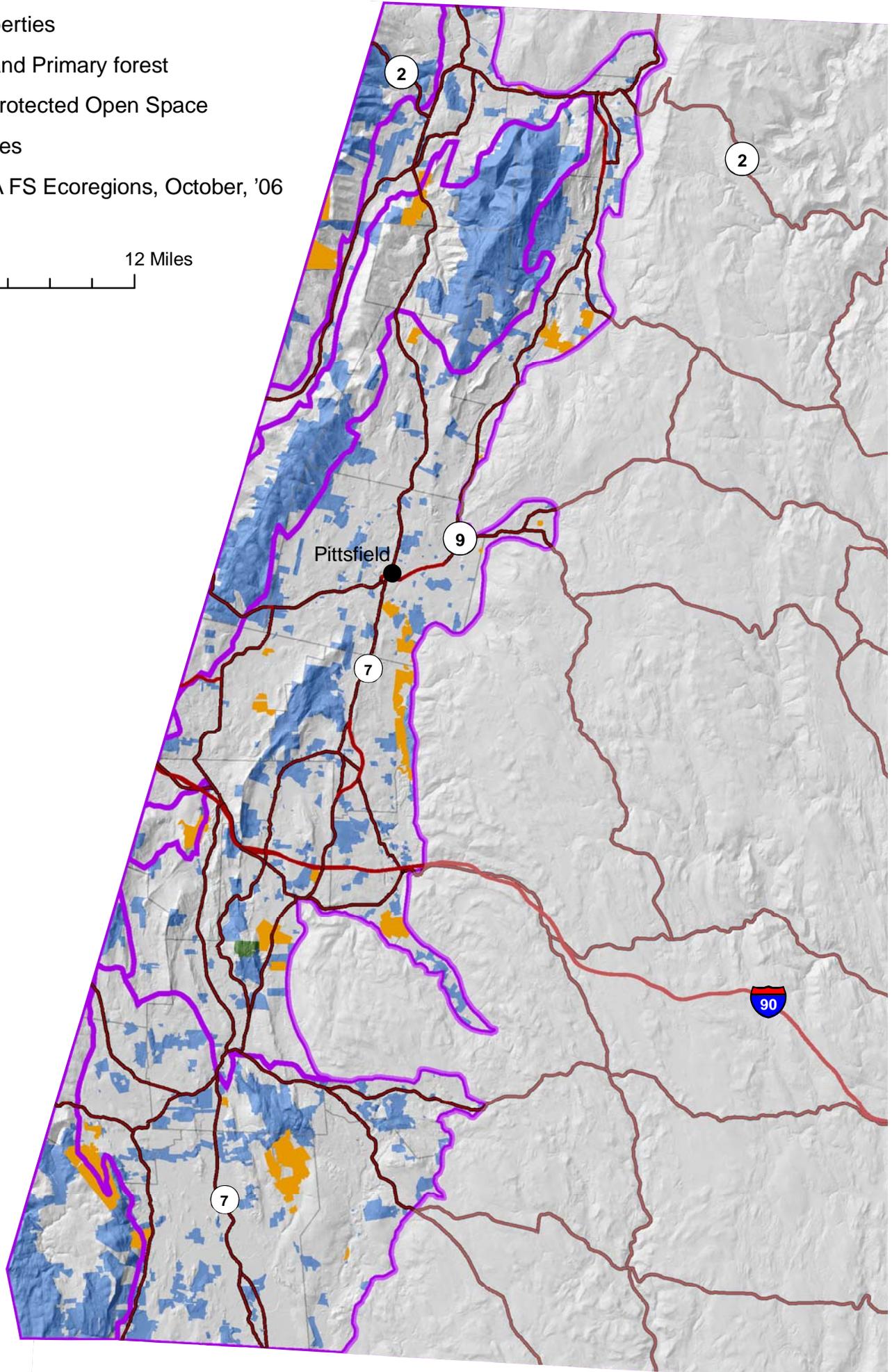


Figure 10. Overlap of interior and primary (1830) forest on DFW lands in the Taconic Mountains and Marble Valleys FMZ (1830 forest from Hall et al., 2002)

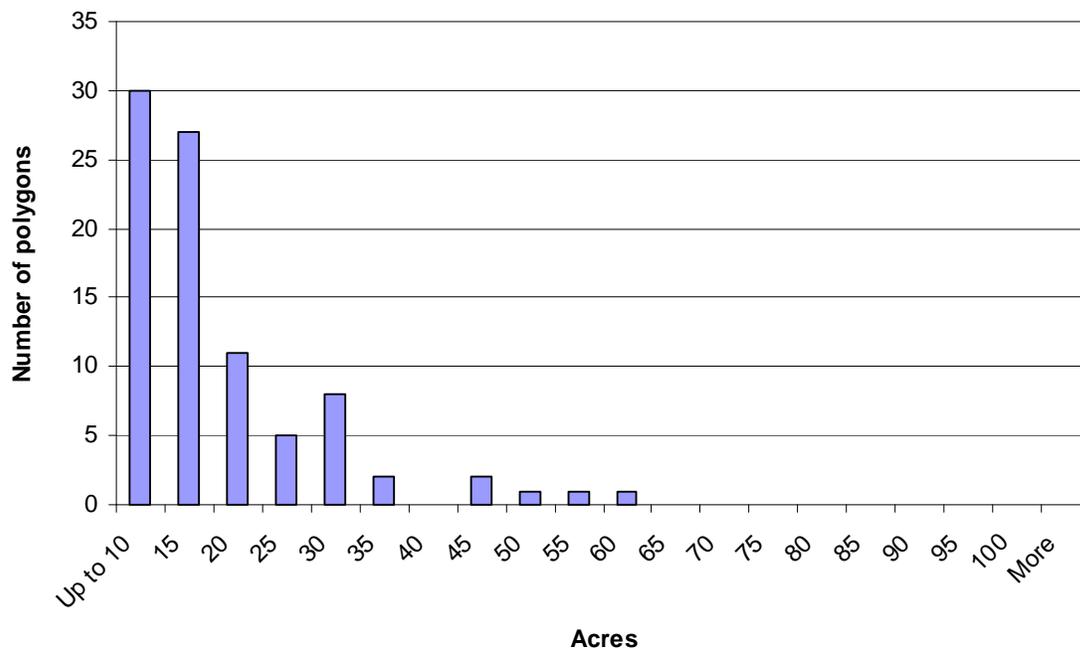


Figure 11. Forest polygon size for DFW lands in the Taconic Mountains and Marble Valleys Forest Management Zone. Minimum mapping unit is 5 acres.

Entire Taconic Mountains and Marble Valleys FMZ

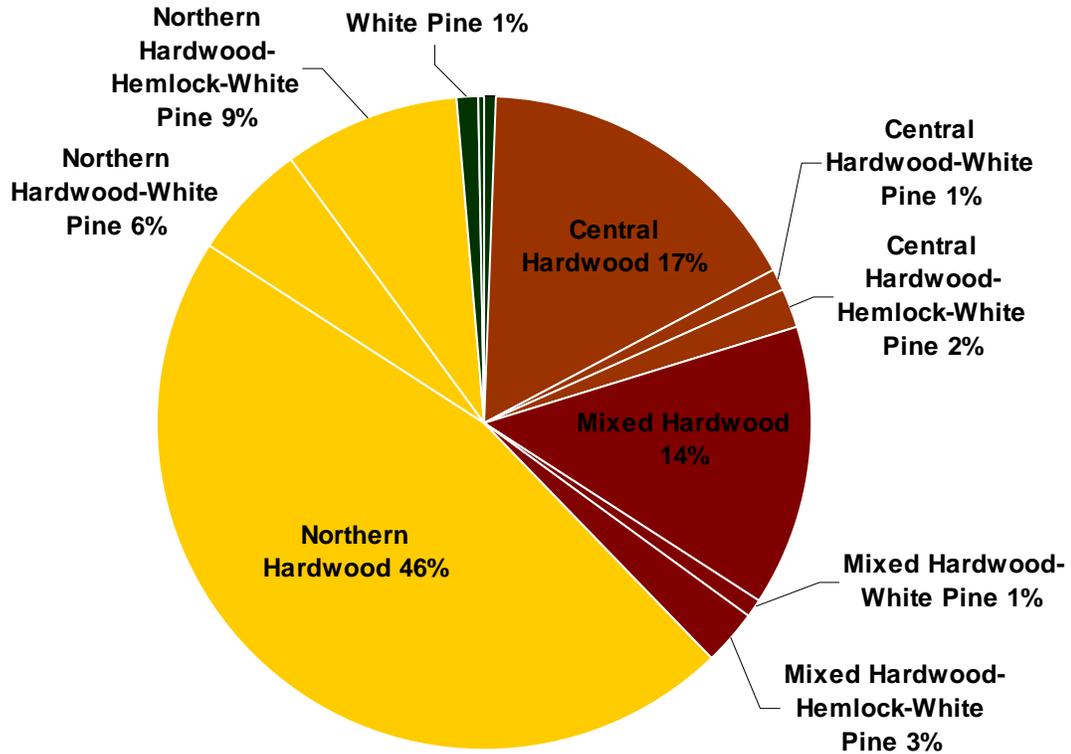
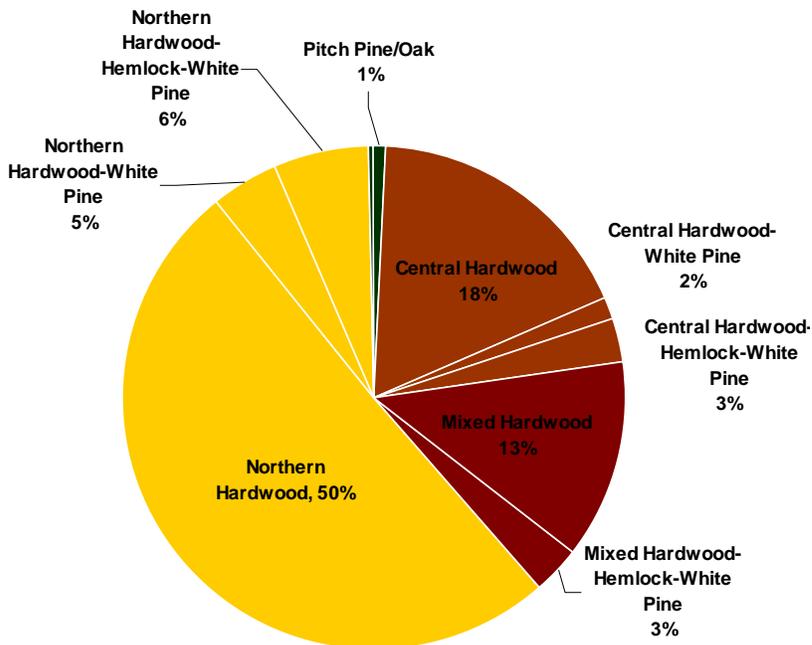
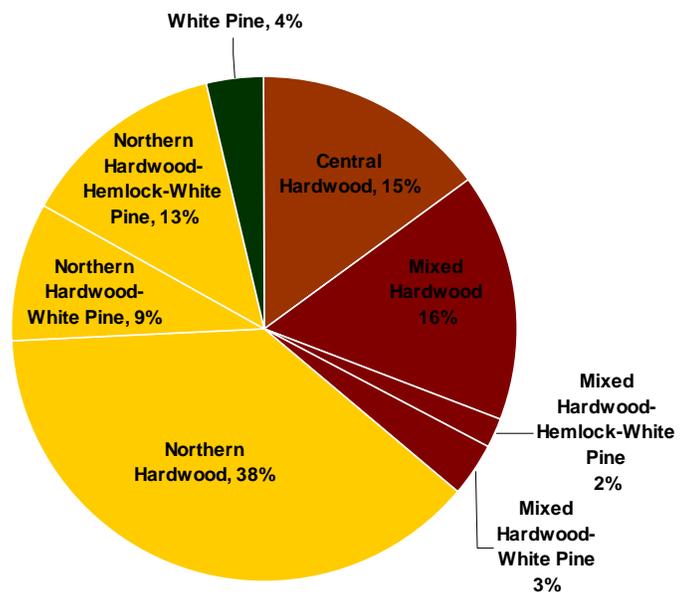


Figure 12. Upland Forest Types on DFW properties in the Berkshire Highlands FMZ overall (above), in the portion of the FMZ in the New England-Adirondack Province (bottom left) and in the portion of the FMZ in the Eastern Broadleaf Forest Province (bottom right).

New England-Adirondack Province



Eastern Broadleaf Forest Province



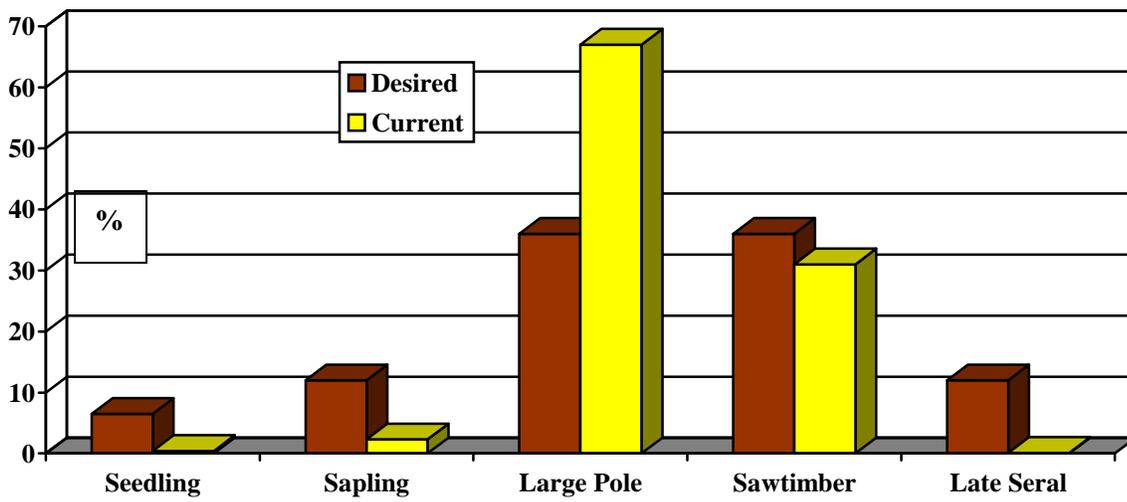


Figure 13. Forest landscape composition goals for DFW lands in the Taconic Mountains and Marble Valleys FMZ by forest age and size class.

- DFW Lands in large forest reserves
- Other DFW Fee Properties
- Permanently Protected Open Space
- Modified USDA FS Ecoregions, October, '06

0 3 6 12 Miles

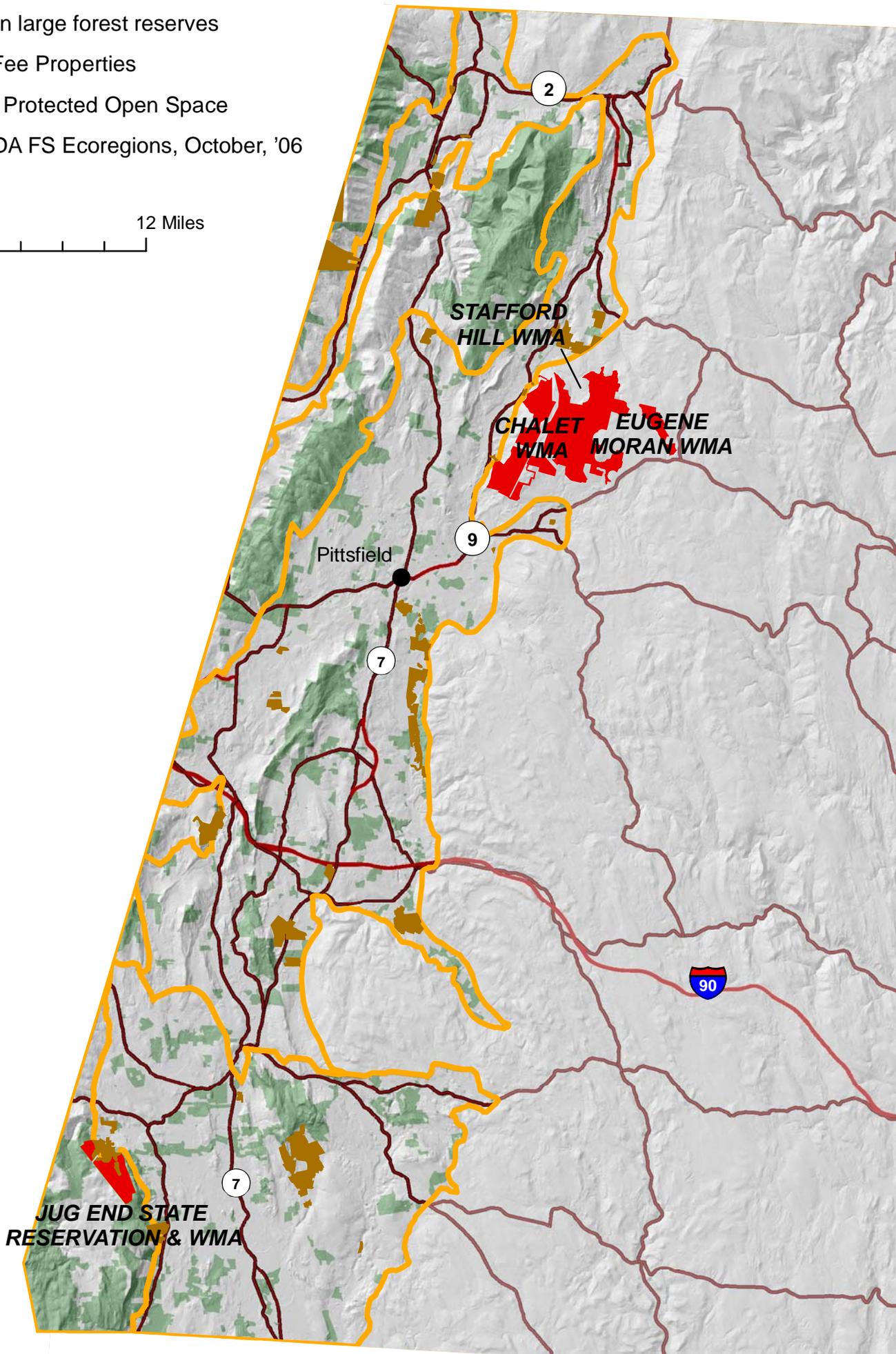


Figure 14. DFW lands in large forest reserves within the Taconic Mountain and Marble Valleys FMZ

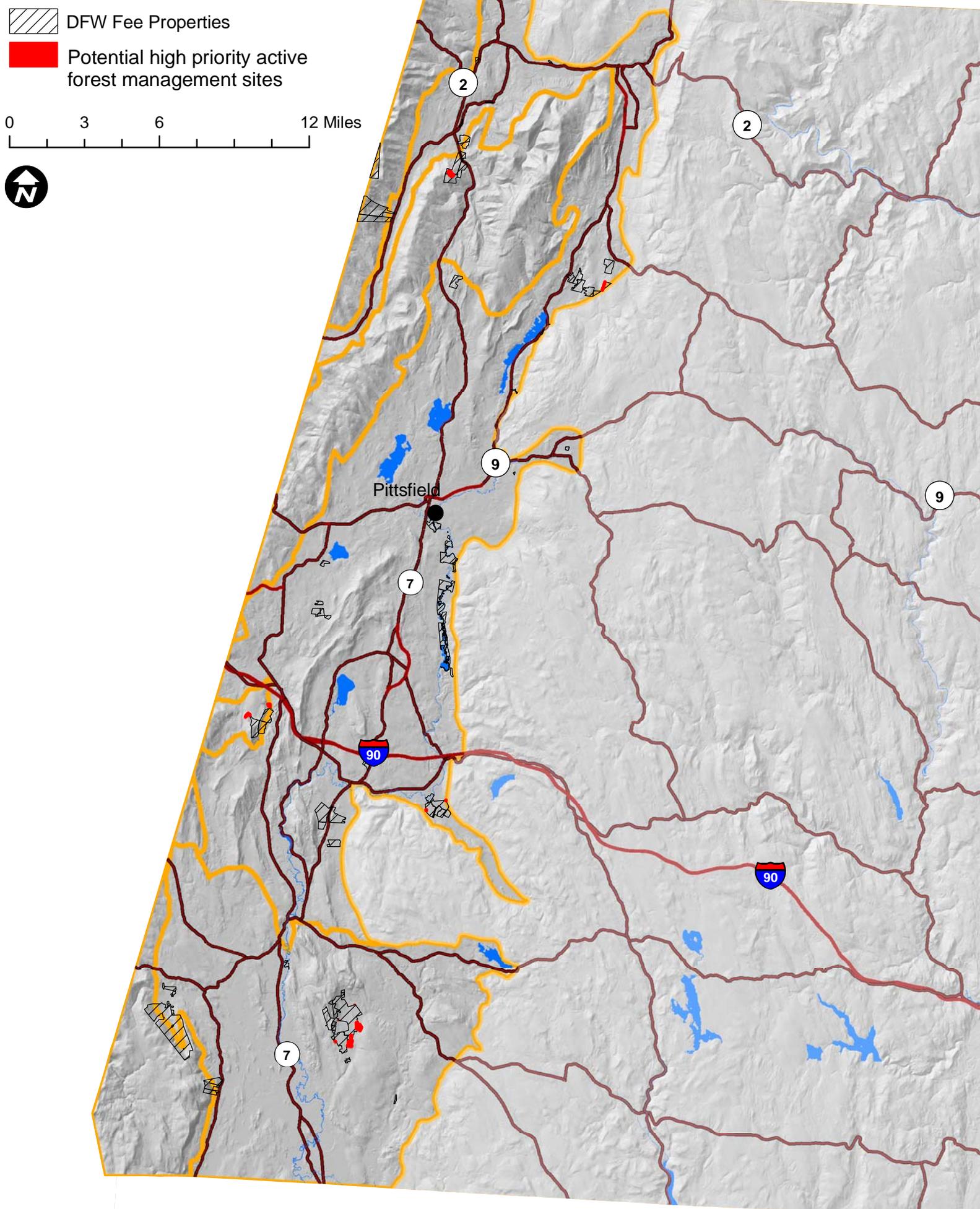


Figure 15. Potential high priority active forest management sites on DFW lands in the Taconic Mountains and Marble Valleys FMZ.

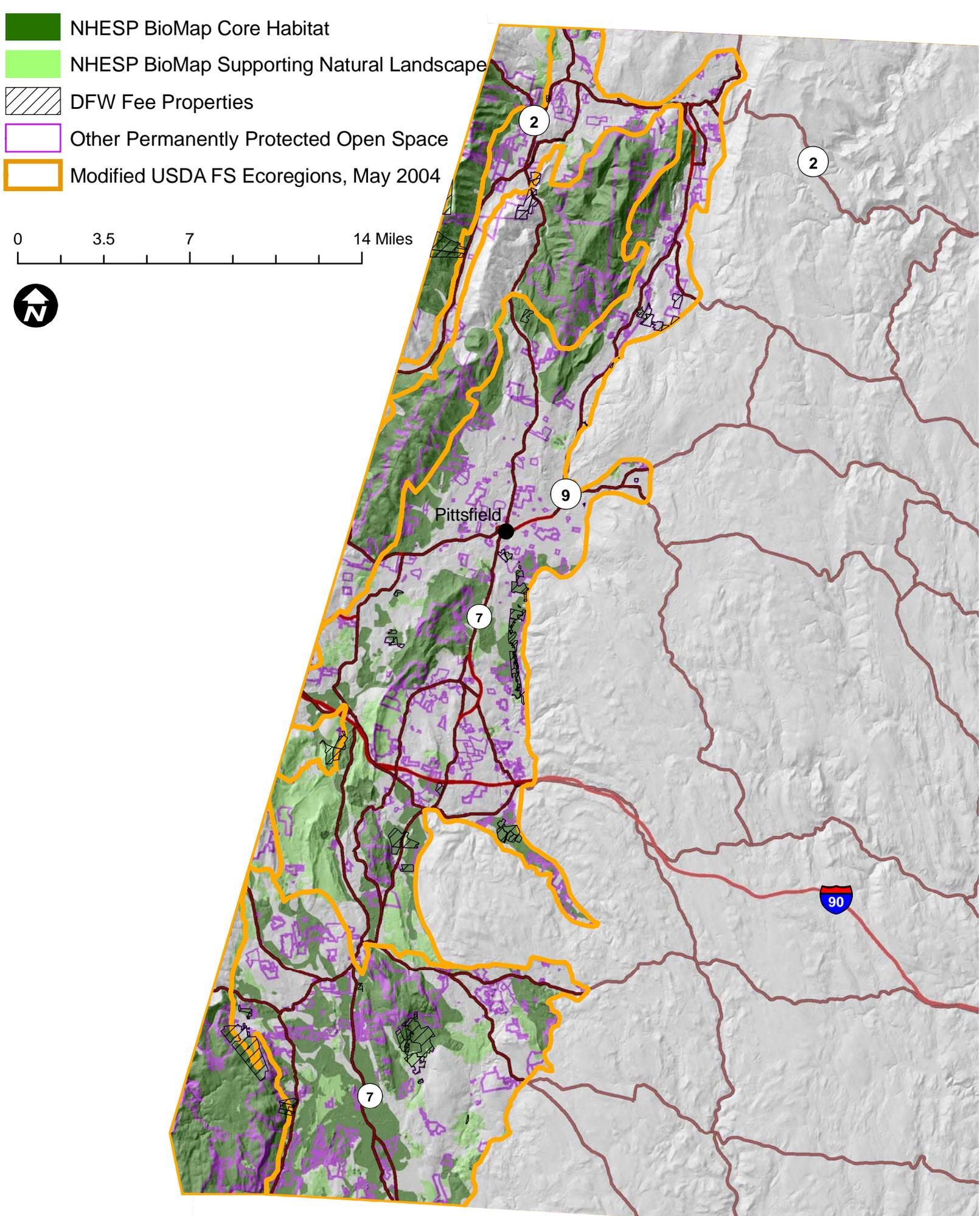


Figure 16. BioMap lands in the Taconic Mountains and Marble Valleys FMZ

- DFW Fee Properties
- Modified USDA FS Ecoregions, October, '06
- Known Functional Vernal Pools on DFW Land

0 3.5 7 14 Miles

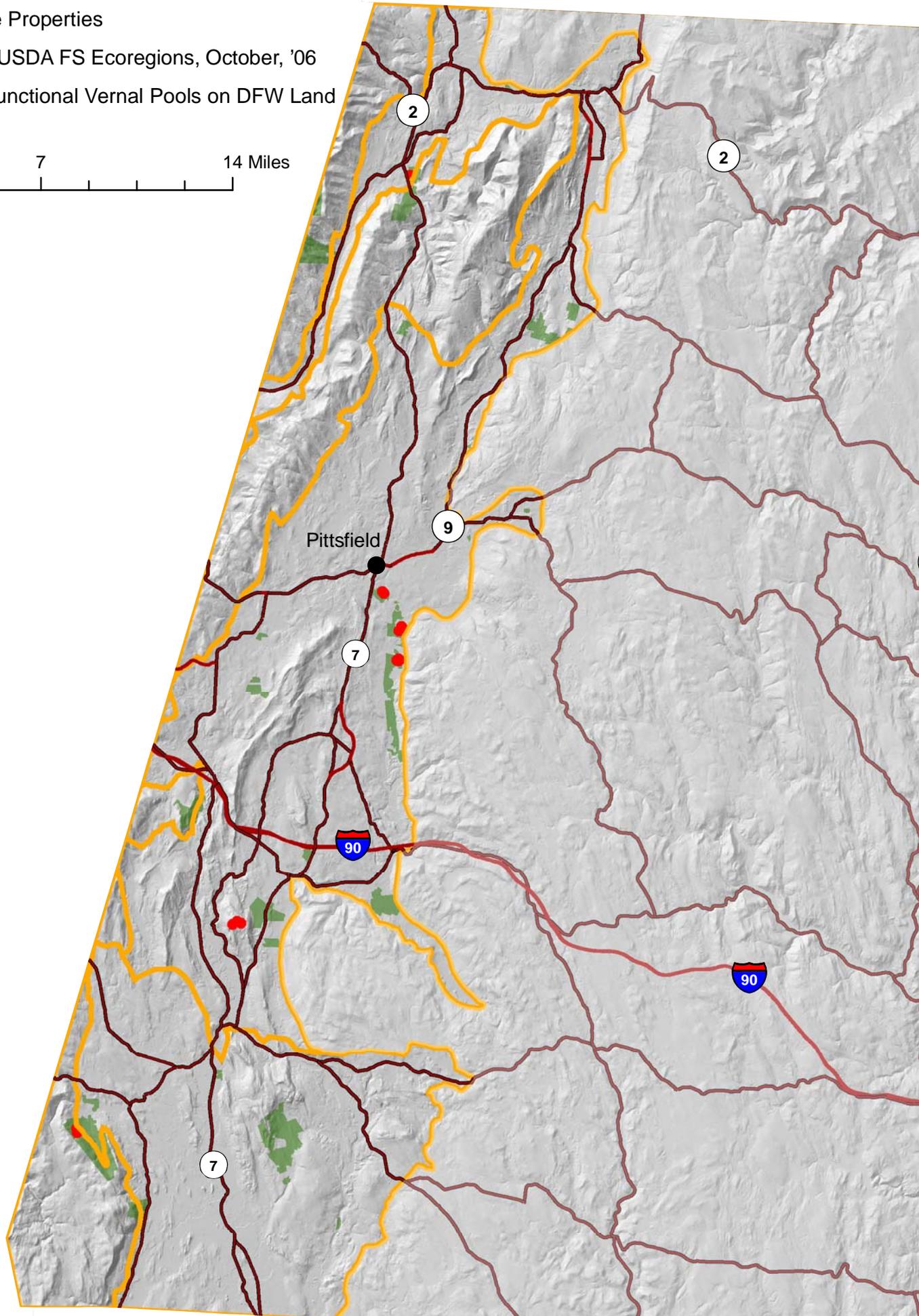


Figure 17. NHESP certified and known functional vernal pools in the Taconic Mountains and Marble Valleys FMZ