Centennial Watershed State Forest
Aspetuck-Hemlock Reservoir Block

Management Plan

Forest Diversity

Even- and uneven-aged forest management techniques, invasive plant control, and promoting softwood and hardwood stands will be used to create a more diverse, multi-aged, and climate resilient forest with diverse structure and species composition.

Climate Change Mitigation

The forests of the Aspetuck-Hemlock Reservoir Block can help mitigate climate change by sequestering and storing carbon in vegetation above and below ground, and as durable wood products used locally and beyond. Promoting forest health and balancing higher sequestration rates with diverse forest structure featuring high carbon storage is essential.

Economic Benefits

Sustainably harvesting forest products like timber, firewood, witch-hazel, and maple syrup from Connecticut's State Forests provide jobs and goods that are sold in the local economy. The State Forests are a model for private forest landowners to consider when managing their own properties

Forest Health and Protection

Managing Connecticut's State Forests helps reduce susceptibility to threats such as invasive plants and insects, allowing them to remain healthy and productive. In this Block, we are actively controlling invasive plant s such as Japanese barberry, multiflora rose, Asiatic bittersweet, and stiltgrass.

Wildlife Habitat

Many of Connecticut's wildlife species, both common and rare, use a wide variety of forested habitats. It is important to provide many kinds of forested habitats for animals that have different needs. Bald eagles, black bears, bobcats, and other wildlife are found here.
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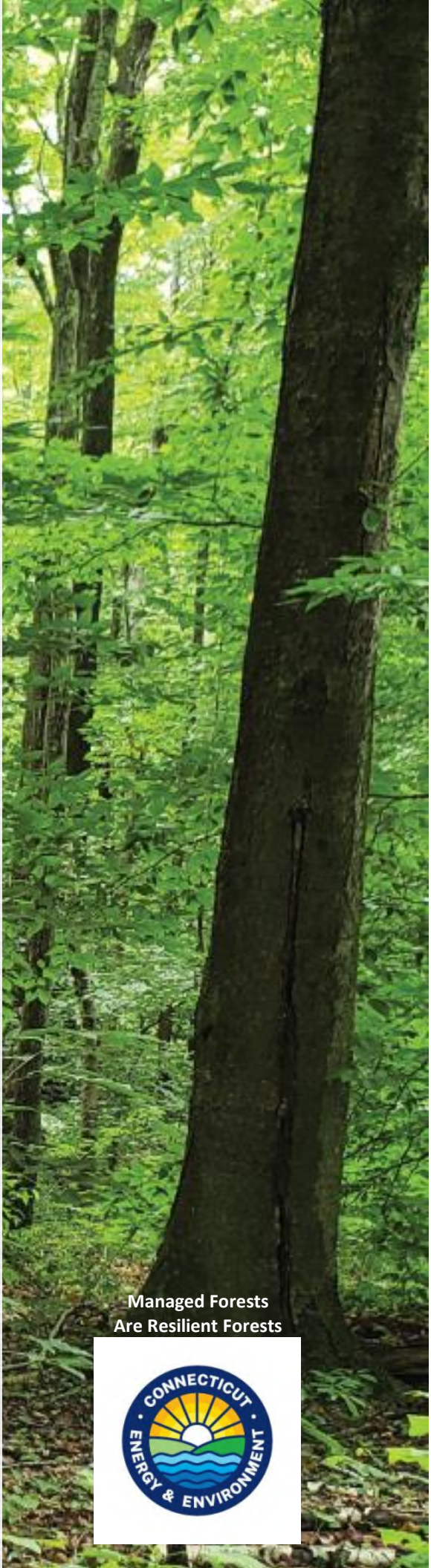
Recreational/Health Benefits

There are about 19 miles of the Blue-Blazed Hiking Trail system running through this Block. Other outdoors activities such as fishing and hunting are permitted in designated areas.

High Quality Drinking Water & Environmental Protection

Connecticut's State Forests provide environmental benefits such as cleaning the air, protecting water quality, and contributing to soil health. Additionally, the Aspetuck-Hemlock Reservoir Block filters drinking water that hundreds of thousands of Fairfield County residents drink. It is vital that this forest be maintained so it can continue to provide this service.



Managed Forests Are Resilient Forests

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The following objectives were considered:

1. **High Quality Drinking Water & Environmental Protection-** To continue to promote and protect high-quality drinking water. Connecticut's State Forests provide environmental benefits such as cleaning the air, protecting water quality, and contributing to soil health.
2. **Forest Ecosystem Health and Diversity** – To create a more uneven-aged and climate resilient forest with diverse structure and species composition by;
    -Using a combination of even-aged and uneven-aged forest management techniques
    -Controlling non-native invasive plants.
    -Promoting a mix of softwood and hardwood stands
    -Forest thinnings to improve individual tree health and species composition
3. **Wildlife Habitat** – Many of Connecticut's wildlife species, both common and rare, use a wide variety of forested habitats. It is important to provide diverse forested habitats for animals with different needs. Some of these habitat types are currently present on the landscape, while others are lacking.
4. **Climate Change Mitigation through Sequestration and Storage** – Connecticut's State Forests can help mitigate climate change by sequestering and storing carbon in vegetation above and below ground and as durable wood products used locally and beyond. Promoting forest health and balancing higher sequestration rates with multi-aged, complex forest structure featuring high carbon storage is essential.
5. **Recreational/Health Benefits** – Connecticut's State Forests provide many recreational opportunities, providing a local and economical way to stay healthy and active.
6. **Economic Benefits** – Sustainably harvesting forest products like timber, firewood, witch-hazel, and maple syrup from Connecticut's State Forests provide jobs and goods that are sold in the local economy. The State Forests are a model for private forest landowners to consider when managing their own properties.
7. **Forest Protection from Certain Natural Disturbances**– Natural disturbance can lead to increased resiliency in forests ecosystems when the forest responds to these disturbances by regenerating itself to a diverse suite of native vegetation. Some natural disturbances in our landscape, however, do not result in a such a forest, or create conditions that do not meet our objectives. Managing Connecticut's State Forests in these cases can help promote resiliency on the landscape.

CONNECTICUT
DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION
2024 through 2044

Bureau of Natural Resources

Division of Forestry

Centennial Watershed State Forest – Aspetuck-Hemlock Reservoir Block
4,785 Acres
Author: Rob Turnbull, CCF #1246

Approvals:

5/10/24

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Contents

A. Location Map

The Aspetuck-Hemlock Reservoir Block of Centennial Watershed State Forest is located in Newtown, Redding, Easton, and Fairfield, Connecticut. The Block occupies roughly 4,785 acres, consisting primarily of mature hardwood forest north of and adjacent to the Aspetuck and Hemlock Reservoirs. This Block is the largest of six major watersheds within the 15,000-acre Centennial Watershed State Forest.

The surrounding landscape is generally suburban with low density residential housing. The Block also abuts Collis P. Huntington State Park in Redding, and numerous preserved properties owned by the Aspetuck Land Trust. Altogether, these lands create the largest contiguous forest in Fairfield County, and provides major water quality, wildlife, climate, and health benefits to the surrounding communities. The Aquarion Water Company's watershed maintenance staff is based at the Aspetuck Environmental Center located in the Block on Rt. 58 in Easton.

(Base Map in map set in Chapter M)

B. Executive Summary

A. The Aspetuck-Hemlock Reservoir Block consists of 4,785 acres of land in Newtown, Redding, Easton, and Fairfield, CT. The watershed provides drinking water for thousands of people in the greater Bridgeport area. The land has a long history of forest management and recreation activities. All activities are overseen jointly by representatives from Aquarion Water Company (AWC), Connecticut DEEP (DEEP), and The Nature Conservancy (TNC), who comprise a managing body called the Conservation Land Committee (CLC).

B. The Aspetuck-Hemlock Reservoir Block features some of the largest tracts of uninterrupted forest in Fairfield County. It is a vitally important habitat for forested species in this region, which is the most densely populated in Connecticut. The majority of these acres feature mixed upland hardwood forests, primarily consisting of dense stands of large and mature oak, maple, birch, pine, and tulip poplar. In most of these forests, there are very few understory trees and only a minor component of midstory trees.

C. The external pressures on the forest are extensive. Deer overabundance, numerous invasive species, novel forest pests and pathogens, and the omnipresent threat of climate change are the biggest issues. Combatting these threats and maintaining the health of the forest in the watershed is vital to the plant and wildlife species that live there, as well as continuing the sequestration of carbon, filtration of drinking water, and health of the nearby human communities.

D. To increase the ecological resilience of the forest in the face of these threats, it is necessary to actively manage certain areas. To improve forest structure, and maintain overstory species diversity:
   - 2,073 acres will be managed actively throughout the next twenty years.
   - 594 acres will be selectively harvested, 1,222 acres will be thinned, and 257 acres will be regenerated with larger openings to increase habitat. Softwood cover will be maintained wherever possible.
   - 2,712 acres of the forest will be managed passively (55% of the total). Of these acres, 1,429 inoperable acres will be designated old forest management sites and will be passively managed.

E. In addition to forest management, action will be taken to lessen the impact of invasive species on the property. These efforts will be targeted on the invasive species focus areas identified in this plan, where non-native plants have inundated entire areas of the forest.

F. Boundary marking will occur on a 5-7 year rotation, with a goal to mark roughly 10 miles of the Block per year. Property encroachments will be dealt with in conjunction with DEEP, Aquarion, and TNC real estate.

G. Maple sugaring activities and firewood cutting will be conducted on a first come-first-serve basis, with both activities permitted through DEEP, by the CLC.

H. Road improvements will be made to woods roads on an as-needed basis, as will improvements to hunting parking areas. These activities will be executed by CLC partners with committee approval.

C. History

Current Ownership and Vegetative Condition

Humans have long occupied the lands within the Aspetuck-Hemlock Reservoir Block. Archeological surveys conducted near the Aspetuck River in Easton found evidence of continuous human occupation beginning at least 10,000 years ago (Reeve 2009). The place name, "Aspetuck", a Paugusett Indian term for an area of higher elevation, hints at the long occupation of this area by Native Americans before Europeans settled in the early 1600s (Brilvitch 2007). The Paugusett people, who historically had occupied much of western Connecticut, lived in the area until around the mid-1600's. Using the Naugatuck and Housatonic rivers to navigate inland, they occupied as far north as New Milford and beyond (Brilvitch 2007). This region of Connecticut is unique in that it features an expansive coastal plain; east of New Haven and West of Norwalk, the coast is rockier, and the topography is far less conducive to farming. So, while the Paugusett conducted widespread understory burning to promote game habitat and the growth of useful plants in the forest, they also planted crops such as corn, beans, and squash in widely cleared fields. "Pequonnock" was the name used to refer to the area where Bridgeport now exists, and it means "cleared land" in the language of the Paugusett. In addition to promoting game habitat throughout the forest, and cultivating crops on land, roughly 25% of the states oyster population was said to exist at the mouth of the Housatonic River. The river itself also featured the southernmost run of Atlantic salmon on the continent (Brilvitch 2007). These fertile lands and waters helped grow civilization here, and the area immediately surrounding the long island sound was said to be the most densely populated place in north America before European invasion. At that point, European invasion of New England had introduced various diseases, most infamously smallpox, to the region and the resulting infection led to the collapse of much of Paugusett civilization.

Following the demise of the Paugusett people, occupation by European settlers and their descendants over the last four centuries was largely agricultural based. Stone walls, bounds, wells and foundations, along with the remains of mill sites and dams along the Aspetuck River and its tributary streams, are common remnants of this period. Several roads within the Block exhibit the near-parallel 'eleven o'clock' orientation laid out by British royal surveyors in the early 1700s, as the Town of Fairfield encouraged settlers to move northward into what is now Redding, Weston, and Easton. Some of these same roads were later used by British troops in their campaigns against colonial rebels during the Revolutionary War, including a raid on the city of Danbury in 1777.

In the early 1900s, the Bridgeport Hydraulic Company (BHC) began acquiring land to build public drinking water supply reservoirs and establish undeveloped, forested buffer areas surrounding them. BHC actively managed the lands for wood products after selective harvesting for oak and other valuable timber species began in the mid-1900s and continued until the early 2000s. This harvesting resulted in thousands of acres of good quality timber in today's forests. Old stumps throughout the forest give hints to the management decisions made by previous foresters. In other parts of the watershed, old charcoal mounds still exist as well, albeit surrounded by the mature oaks, maples, tulip poplars, and birches that dwarf the young forests of the charcoal period.

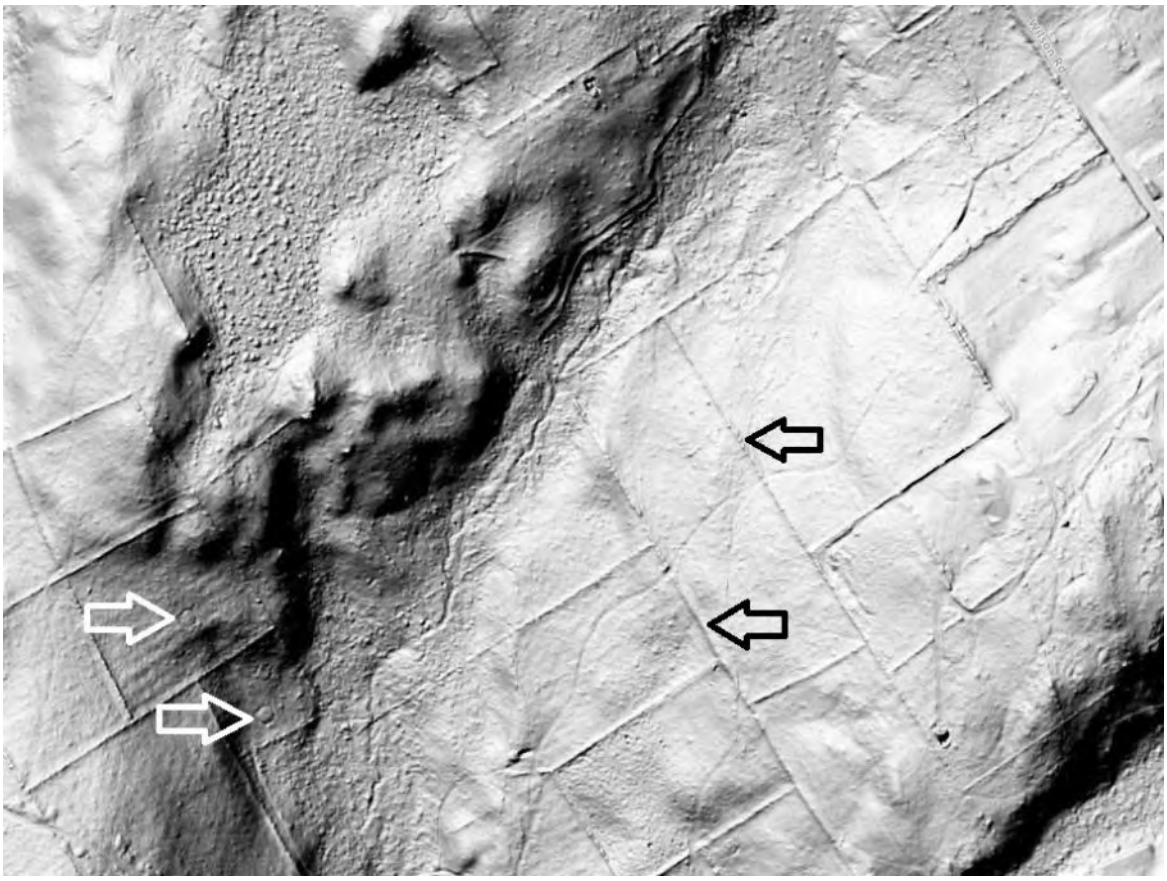

Figure 1. LIDAR images show circular charcoal mounds and linear stone walls

These woodlands are second and third growth forests that regenerated after the cessation of charcoal manufacturing and the abandonment of farmlands in the late 19th and early 20th centuries. Abandoned farmland is by far the most common historic land use found in the watershed today. Few species of trees can grow up through a dense field of arable crops or a pasture of grasses, and white pine is one of them. White pine and eastern red cedar became the dominant trees on these formerly abandoned farms in the late 1800s (Foster & O'Keefe 2000), and by the 1910s, these pine trees became a valuable sawtimber resource. Until the invention of corrugated cardboard in 1930, white pine logs were milled to build shipping containers (Foster & O'Keefe 2000). This became the primary industry driving the second great clearing of Connecticut's forests. After the pine was cut, it did not come back easily, however, as white pine does not sprout from the stump. Hardwood species, such as oak and maple, do prolifically sprout and began to dominate the landscape once the pine canopy was cleared. These "new" hardwood forests, originating as stump sprouts in the 1930s, dominate much of the landscape today, including in the Aspetuck-Hemlock Reservoir Block.

Due in great part to the presence of the public drinking water supply reservoirs, development of privately owned lands within the watershed has been limited and largely restricted to large-lot (2-3 acre) residences.

Forestry practices and other activities in the Aspetuck-Hemlock Reservoir Block by BHC included harvesting timber, milling lumber, producing firewood, planting trees, and growing nursery stock, Christmas trees, fruits and vegetables.

In the early 1920s, BHC developed tree nurseries to reforest former pasturelands and the perimeters of the reservoirs, and for Christmas tree and nursery stock. Initially, most of the nurseries grew red pine (*Pinus resinosa*) for reforestation. At its peak, BHC had about 2,000 acres of red pine plantations.

These plantations were infested by the rapidly spreading red pine scale (*Matsucoccus resinosa*) after the insect was accidentally introduced to the United States during the New York World's Fair in 1939. BHC supplied nursery stock to the Fair and presumably carried the scale insect back to Easton on the same trucks used to haul the BHC- grown trees to New York. BHC's Red pine plantations were devastated by the infestation, and the Company spent the next 15-20 years salvage cutting the plantations and reforesting affected areas with white pine (*Pinus strobus*) and other conifers. Some areas affected by the scale infestation were allowed to regenerate naturally.

Portions of what is now the Aspetuck-Hemlock Reservoir Block supported orchards and vegetable gardens that were ancillary to the nearby Aspetuck Valley Orchard, owned and operated by BHC from 1918 to 1990. In the early 1930s, BHC became the first large scale Christmas tree grower in the area, producing trees for retail and wholesale markets for more than seventy years. Along with cut Christmas trees, nursery stock was balled and burlapped for sale to landscape contractors.

BHC purchased a sawmill located on Route 58 just north of the Aspetuck Reservoir in the 1940s. The sawmill produced lumber for apple boxes, which were made on site for use by the Aspetuck Valley Orchard. It also produced custom cut and dimension lumber for barn siding and flooring.

BHC produced firewood commercially since World War II. Soaring heating oil costs in the late 1970s and early 1980s prompted BHC to expand its commercial firewood operation to produce approximately 2,000 cords annually. During this period, BHC also sold stumpage of approximately 1,200 cords of firewood annually through its homeowner's firewood program. Intermediate improvement cuttings by BHC provided most of the raw wood material for these cordwood programs.

During the late 1970s and the early 1980s, BHC inventoried its forest resources and created a forest management plan that was implemented for approximately ten years. The plan recommended even-aged forest management policy and to manage its timber on a 75-year rotation. In the Aspetuck / Hemlock Reservoir Block, intermediate treatments on 818 acres yielded 2,144,022 board feet (bf) of timber and 1,518 cords of firewood. Of the 2,144,022 bf of timber produced during this period, 1,568,548 were hardwood and 575,474 bf were softwood.

In addition to timber harvesting, there was a deep history of recreation on the property, including hunting and fishing. Deer, pheasant, and small game hunting was permitted in leased areas to the members of four different fish and game clubs throughout the old BHC lands which consisted of residents who paid to have various areas of the property stocked with trout and pheasants. The leases for all four clubs expired when the state bought the lands from BHC.

The Aspetuck-Hemlock Watershed Block comprises nearly a third of the lands conserved in the 2002 purchase and acquisition of rights between BHC and a partnership of DEEP and TNC. The agreement was funded by $80,000,000 in State money and $10,000,000 contributed by TNC. The Aspetuck-Hemlock Reservoir Block is now managed by the Conservation Land Committee (CLC), a coalition of foresters and land management professionals representing Aquarion, DEEP, and TNC.

The Natural Resources Management Agreement (NRMA), which governs how the land is managed, states that the goals for science-based stewardship of this property include:

a. Permanently preserve open space,
b. Protect and provide a safe, reliable, and adequate water supply,
c. Promote a healthy, diverse, and resilient forest capable of providing forest products, clean air, plant and animal habitats, recreational opportunities, and aesthetics,
d. Maintain significant tracts of naturally occurring, mature, diverse, and continuous forest cover,
e. Provide opportunities for public use consistent with the above goals.

Land owned by water companies is regulated by State Statute (CGS25-73c). Land is classified as Class I, II, or III. Class I and II lands are within the watershed of a reservoir while Class III lands are outside the watershed. In the Aspetuck-Hemlock Reservoir Block, AWC owns the Class I land. The State owns the Class II and III land. Both the State and TNC own conservation easements on the Class I land.

Because the Class I and II lands are intermingled on the landscape to such an extent that they cannot be easily delineated in detail on the ground, they are managed as one entity.

On September 16, 2004, Governor M. Jodi Rell officially designated the land as Centennial Watershed State Forest, to recognize its importance in protecting drinking water supplies and to commemorate the 100th anniversary of the State Forest system in Connecticut.

D. Assessment of Resources and Infrastructure

1. Acres

The Aspetuck-Hemlock Block totals 4,785 acres, of which 4,624 are forested. The Block primarily consists of mature hardwood forests. There are also 70 acres of fields, a two-acre gravel pit off of Valley Road in Easton, and a transmission line Right of Way that occupies 11 acres in Easton and Fairfield.

Aside from the Aspetuck and Hemlock Reservoirs, there are 78 acres of water bodies in the Block, with 16 acres of open water ponds and rivers, and about 61 acres of swamps. These areas do not include the forested wetlands, which are reflected in the 299 acres of the red maple/lowland forest type. Livermore Pond in Easton and the Aspetuck River account for the majority of the 16 “water” acres. Lyons Swamp, another significant wetland area, exists between Sport Hill Rd and North Park Ave in Redding. The Aspetuck and Hemlock Reservoir areas are not included in these totals.

Forest Cover Type	Acres
Mixed upland hardwoods	3102
Northern Red Oak	318
Red maple/lowlands	299
Eastern White Pine	296
Red maple/uplands	70
Sugar maple	116
White Oak/Red Oak/Hickory	106
Red maple/oak	99
Yellow Poplar	81
Eastern hemlock	61
Yellow-poplar/white oak/northern red oak	26
Other exotic softwoods	20
Chestnut oak/black oak/scarlet oak	16
Norway spruce	10
Exotic shrubs	5
Total	4624
Water	
Swamp	61
Waterbody	16
Total	78
Other Land Cover Type	
field	70
ROW	11
Gravel Pit	2
Total	83
Grand Total	4785

Table D-1: Breakdown of acres in Aspetuck-Hemlock

2. Access

a. Management Access

Most of the Block is accessible either by roadside parking or woods roads. Many of these gated areas are used as parking for hunters in the fall and winter (specific locations detailed in "Overview Map"). There are numerous state and local roadways that cross the Block. Many of these roads have pull-offs that can be used if necessary. Major byways through the Block include State Route 58 (Black Rock Turnpike), Route 136 (Westport Road), Valley Rd and Wilson Rd in Easton, Sport Hill Rd in Easton and Redding, and Poverty Hollow Rd in Redding and Newtown

While every compartment in the Aspetuck-Hemlock Reservoir Block borders a state or local road (with the exception of compartment 16), this does not necessarily mean the entire property is universally accessible for forest management operations. The highly parcelized nature of this forest means that some parcels are not conducive to logging operations; they are either too small, too wet, or too steep for heavy machinery to enter without damage. While technically every compartment is accessible, there are many areas that are inoperable (shown below in table D-2). As well as inoperable forest acres, water, fields, and ROWs are included in this figure as they will not be subject to forest management.

	Acres
Operable	3355
Non-Operable	1429
Grand Total	**4785**

Table D-2: Operable vs. inoperable acres for forest management in CWSF

b. Access Roads

In addition to the accessible internal woods roads, there are roughly 10 miles of unimproved roads within the Block. Due to their generally poor condition, these derelict roadways are for the most part impassable to vehicles and would require extensive work to become usable for forest management activities.

c. Road Maintenance/Construction

Because woods roads receive the most use, they should continue to receive routine maintenance. Poorly maintained roads are the greatest potential source of sediment inputs to tributaries in undeveloped watersheds. Maintenance includes:

- Storm damage cleanup after high windstorms,
- Cleaning drainage culverts after periods of high winds and significant rainstorms, especially during fall leaf drop,
- Repair of road shoulder drainage gullies, water bars, and drainage dips,
- Regrading of the road surface and resurfacing with gravel where necessary.

d. Rights-of-Way

An Eversource transmission line in the southwest corner of the Block runs mostly parallel with Route 58. This ROW begins behind the Warner Treatment Plant, continues north across Hemlock Road and North Street, and leaves the Forest at Burr Street. This gated ROW is 100 feet wide, most of which is

accessible by four-wheel drive vehicle.

A Tennessee Gas Company natural gas pipeline in the southwestern portion of the Block enters the Forest west of Route 58, passes south of the Warner Treatment Plant, and runs east-west south of the Hemlock Reservoir dam. A portion of this ROW is accessible by four-wheel drive vehicle.

e. Boundaries (miles of bounds, general maintenance schedule)

The Aspetuck-Hemlock Reservoir Block is comprised of 57 separate forested parcels or "compartments." The property boundaries of these compartments have been inventoried in two categories- interior boundary lines and road frontage boundaries. The total footage of interior boundaries is 279,850 feet, or 53 miles. Road frontage boundaries total 196,300 feet, or 37 miles. The interior boundaries are marked by yellow paint and signs. The road frontage boundaries are posted with signs only. Of the 57 forest compartments, 46 had their interior boundaries painted from 2000 to 2002. These interior boundaries totaled 257,350 feet or 49 miles. The boundary marking program is on a five/seven-year schedule, depending on the location of the boundary.

f. Encroachments (Detail # of encroachments known, and solutions)

The Block shares property boundaries with many subdivisions and other residential properties. This means that it is under particularly high pressure from encroaching lawns, landscaping debris and leaf dumping, and encroaching construction, among many other things. Forest managers note encroachments while boundary marking and contact neighbors to resolve such issues. Encroachments are dealt with on a case-by-case basis by all three parties of the CLC State Statute Sec. 52-560a provides for civil penalties for encroachment on state, municipal, or nonprofit land conservation open space.

E. Special Use Areas

1. Lakes and ponds

The Aspetuck Reservoir is a 60-acre impoundment of the Aspetuck River. It is a storage reservoir for the adjacent Hemlock Reservoir, a 437-acre distribution reservoir that is an impoundment of Cricker Brook and its tributaries. The Aspetuck Reservoir also receives flowage, via an underground aqueduct, from the nearby 860-acre Saugatuck Reservoir. In total, the Hemlock Reservoir System receives drainage from nearly 52 square miles of watershed area (Aspetuck Reservoir watershed: 17mi^2, Hemlock Reservoir watershed: 4.8mi^2, Saugatuck Reservoir watershed: 35 mi^2). It is the principal source of drinking water for hundreds of thousands of Fairfield County residents.

There are no other significant lakes or ponds within this Block. Recent beaver activity in Poverty Hollow Swamp, however, has created small, shallow impoundments (1-acre or less) along portions of the Aspetuck River.

2. Rivers and streams

The Aspetuck River is the largest river in the Forest. Because many of the land acquisitions by BHC protected the tributaries to their reservoirs, much of the Aspetuck River's eight-mile length north of the Aspetuck Reservoir flows through undeveloped, forested areas. Ballwall Brook and numerous, unnamed streams flow into the Aspetuck River. Cricker Brook, East Cricker Brook, Morehouse Brook, and several

smaller, unnamed streams flow into Hemlock Reservoir.

3. Cultural sites

Prehistoric sites that may be located within the Forest are mentioned in archaeological reports produced as part of development proposals of private properties adjacent to the Forest. Old cellar holes of abandoned mill buildings, homes and farms, along with ubiquitous stonewalls, are also found throughout the Forest.

4. Recreation and scenic sites – trails and signs

The Aspetuck Trail is a 6-mile public hiking trail that winds through the northern half of the watershed, from Collis P. Huntington State Park in Redding to Rockhouse Road in Easton. Parking areas and trailhead kiosks (with maps) are located at both ends. The trail, opened in 2006, was constructed by volunteers from the Connecticut Forest & Park Association (CFPA). It is maintained by CFPA as part of the Blue-Blazed Hiking Trail System. It includes a one-mile section of Poverty Hollow Road in Redding that has been closed to vehicles by the Town of Redding. It is a popular location for walkers and bird watchers. This section of road, which remains a town-owned public right-of-way, is bordered on both sides for its entire length by the Aspetuck-Hemlock Reservoir Block (Compartments 20 & 22). There are no parking areas at either end of this closed roadway.

Samuel Senior Park (named after a former President of BHC) at Center Road and Morehouse Road in Easton is a 10.1-acre parcel (AH-47) leased in 1963 to the Town of Easton for 99 years. It is maintained by the Samuel Senior Park Association. The park has a system of trails, boardwalks and footbridges for hiking. Parking is available across the street from the Center Road entrance at the Easton Town Hall.

A small parking area is provided for the public at the Aspetuck Reservoir aerator on Route 58 in Easton. For decades, the public has been allowed to view the reservoir and its aerator from a lawn area maintained by Aquarion. A chain link fence separating the lawn from the edge of the reservoir discourages visitors from swimming, wading or fishing in the reservoir. Another small parking area on Center Road, Easton, and the grassy area adjacent to it at the northerly end of Aspetuck Reservoir are frequently used by bird watchers, landscape painters, and photographers.

Dogs, horses, and mountain bikes are not allowed on trails within the Aspetuck-Hemlock Watershed, except for the Poverty Hollow Road portion of the Aspetuck Trail.

All public access in the Forest is regulated by the Connecticut Department of Public Health (Connecticut General Statute Sec. 25-43c).

5. Unauthorized / Illegal Activity

Dogs, other pets, horses, and mountain bikes are not allowed on trails within the Aspetuck-Hemlock Watershed, except for the Poverty Hollow Road portion of the Aspetuck Trail. Any type of motorized vehicle is also prohibited. Fishing outside of the designated fishing areas is also prohibited.

Critical Habitat (State listed rare or endangered plants and animals)

A report from the DEEP Natural Diversity Database (NDDB), dated 1/23/2023, is attached in the appendix. This list of species that is referred to in the NDDB report has not been included to protect Threatened and Endangered Species.

The report noted 11 protected wildlife species in this block including 5 bird species, 3 turtles, two mammals, and one plant. The report also found one plant species that is threatened in the watershed. These animals and their habitat requirements are listed in section H-2.

6. **Natural Areas:** There are no Natural Area Preserves (as defined by CT General Statutes 23-5a) in the Aspetuck-Hemlock Reservoir Block of CWSF.

7. **Old Forestland Management Sites**

Old forest management sites (OFMS) exhibit specific characteristics including tall trees, vertical stratification, numerous downed logs (coarse woody debris) in the understory, and abundant woody structure in all strata of the forest (understory, midstory, canopy, emergent layer). Some stands in this Block exhibit these unique features.

Stand 0401, north of Hopewell Road and abutting Collis P. Huntington State Park, is beginning to develop some of these features. It also features a portion of the Blue-Blazed Hiking Trail System, and its designation of an OFMS expands similar habitat conditions found within the Park.

Stand 2202, which is bisected by the old Poverty Hollow Road (now a popular hiking trail) features very tall trees and significant vertical stratification. While the species composition of the understory is less biodiverse than the overstory, indicating a possible transition of forest type in the future, there currently is a heavy component of hemlock, American beech, red and white oak, various hickory species, birch, and more. Abundant woody material in the understory and widely distributed structure in the mid and overstory make this stand an excellent OFMS.

These two sites are not the only areas in the Block that will be managed as old forest management sites. They simply exhibit old forest characteristics and are accessible to the public along the Blue-Blazed Hiking Trail System, so they serve as great examples for this forest condition. All 1,429 acres of inoperable forest, in addition to 1,210 acres of operable forest, will be designated as OFMS for the duration of this management plan, amounting to roughly 55% of the Block.

8. **Research Areas**

Hemlock Reservoir has been studied by AWC to determine its limnological and hydrological characteristics, and by the Inland Fisheries Division of the DEEP to assess the growth rates and survivability potentials of certain lake-dwelling strains of brown trout (*Salmo trutta*).

The United States Forest Service (USFS) maintains a long-term forest inventory plot in the Block. There are no restrictions on management activities on the plot.

The Connecticut Agricultural Experiment Station (CAES) is conducting research on Beech Leaf Disease (BLD) with multiple plots located east of the Hemlock Reservoir along Timco Road. This research is directed by Dr. Robert Marra. The goal is to shed further light on how BLD may affect our forests in the face of a changing climate, as well as to identify the basic life history of the pathogen.

While no other research is ongoing within the Forest, the large blocks of undeveloped, contiguous forested areas and the wetland habitats offer prime opportunities to study a wide variety of forest-dependent species.

9. Miscellaneous

There are several potential sugarbush sites in this watershed. Stands containing younger sugar maple pockets are in Compartments 30, 31, 34, and 42. These sites have fertile soils where sugar maple thrives. DEEP leases maple taps to the public through its forest products permitting program.

F. Forest Ecosystem Health and Diversity

1. Landscape Context

The Aspetuck-Hemlock Reservoir Block contains some of the larger areas of contiguous forest in the region. Southern Fairfield County is highly developed and densely populated. Most of the privately-owned parcels surrounding the Forest are less than 5 acres and subject to land use changes that may not include habitat conservation. This Block represents a key core forest habitat for the county.

Other protected ownerships exist in the immediate vicinity. Trout Brook Valley State Park and ALT's Trout Brook Valley Preserve protect 758 acres of mature forest southwest of Flirt Hill. The 1,800-acre Devil's Den Preserve, owned and maintained by TNC, abuts the adjacent Saugatuck Reservoir Block of CWSF. The 1,017-acre Collis P. Huntington State Park abuts compartment 4, to the north of Hopewell Road in Redding, Newtown, and Bethel. These larger preserves, and others across Fairfield County, make up a complex of core forest habitat important to this region.

2. Current Vegetative Condition

The Aspetuck-Hemlock Block is primarily mixed upland hardwood forests, most of which were likely to be classified as "Northern Red Oak" stands the last time inventory data was taken. A lack of management, and an overabundance of deer, has resulted in the ingrowth of black birch, red maple, and American beech into much of these acres, to the point where these three species make up a significant proportion of the basal area of most oak stands. In these mixed upland hardwood stands, red oak is still the dominant canopy species, however white oak, black oak, and hickory species are common as well. In the more mesic and toe-slope stands of the watershed, yellow poplar becomes prominent. The more recently appearing black birch, red maple, and American beech usually occupy more subdominant canopy positions and midstory positions throughout these stands. Some pure northern red oak stands do appear, in greatly reduced abundance from the last inventory.

Red maple lowlands are dotted throughout the watershed where red maple grows to smaller sizes, but in high density on poor-quality anoxic soils. This forest type also encompasses the many perched swamps and vernal pools throughout the "up and down" topography of the larger stands adjacent to the Hemlock Reservoir.

There are far fewer acres of pure eastern white pine stands since the last inventory in the early 2000s. This is largely because the white pine was most likely planted, and these plantations have mostly been regenerating to hardwoods such as black birch as the canopy dies. This is evident where in 2012, Storm Sandy toppled acres of white pines, which grew back as mixed hardwoods.

There are some places where these stands are regenerating to pine, such as in the sandier soils adjacent to both Reservoirs and the Aspetuck River, however it is more common for them to be growing black birch and red maple in the understory.

Sugar maple stands occupy many of the mesic slopes in the watershed. These stands typically exhibit sugar maple at all levels of the forest, from understory to midstory to canopy, and present significant opportunity to develop increased maple sugaring capacity on the watershed.

3. Forest cover types by Percentage

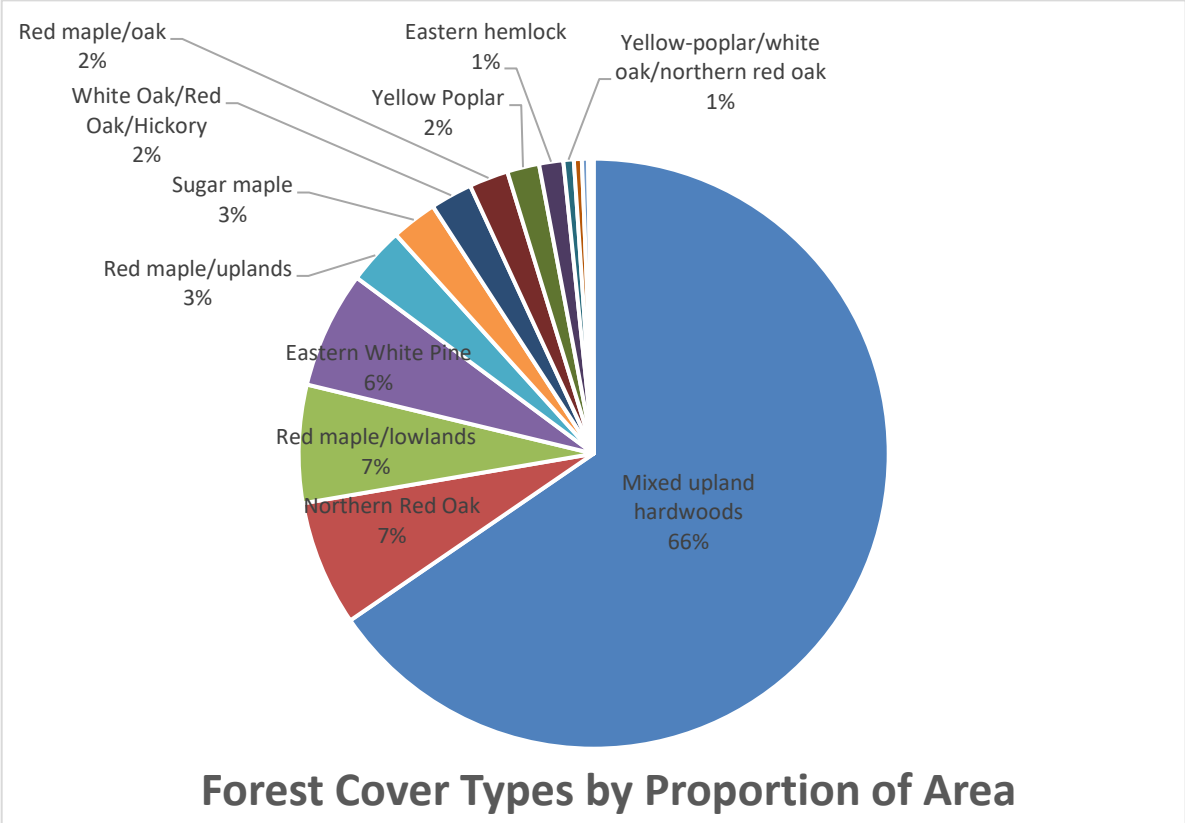

Figure F-1: Forest types and their relative abundance in the Aspetuck-Hemlock watershed

4. Forest type, Size class and Timber Volume

The trees were classified into size classes to describe their structural complexity and inform future management practices. These size classes describe the average size of an entire stand of trees. The size classes are referred to as follows.

Size Classes

☐ *Sawtimber* – Hardwood trees 12-inch dbh (diameter breast height or 4.5 feet off the ground) and larger, and softwood trees 10-inch dbh and larger, that contain at least one 8-foot sawlog.

☐ *Sawtimber - Pole* – Sawtimber-sized canopy trees dominant in the overstory, with a significant component of poles beneath them.

☐ *Poletimber* – Hardwood trees between 5 and 11 inches dbh and softwood trees 5 to 9 inches dbh. These trees are too small for sawlogs, but could be sold as pulpwood, fuelwood, or other small products where such markets exist.

☐ *Saplings* – Trees 1 to 5 inches dbh.

☐ *Seedlings* – Trees less than 1 inch dbh.

Size Class	Acres	% Of total
Forested, No data	35	0.76%
Seedling	4	0.09%
Pole	348	7.52%
Sapling	41	0.88%
Saw	2098	45.34%
Saw-Pole	2102	45.42%
Total Forested	**4628**	

Table F-1: Acres of Aspetuck-Hemlock Reservoir Block broken into size classes. Total represents total number of forested acres.

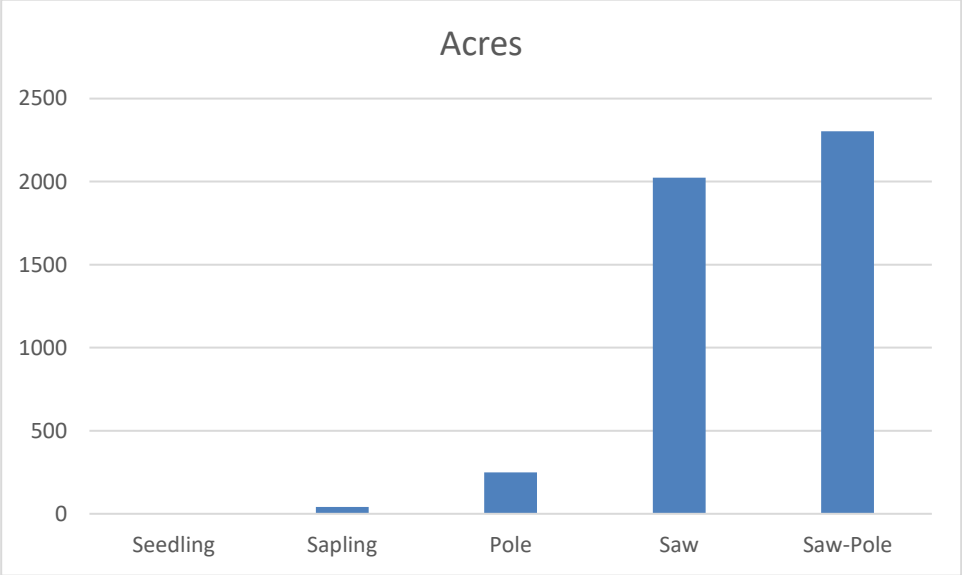

Figure F-2: Acres of Aspetuck-Hemlock watershed broken into size classes (bar chart)

A climate resilient forest should feature a diversity of age classes, however here the forest is heavily skewed towards the sawtimber and saw-pole size classes. These data generally indicate that the forest features an old overstory but lacks a diversity and abundance of trees in the midstory and understory.

Seedlings, saplings, and poles are hard to find on the Aspetuck-Hemlock Reservoir Block. When broken down into forest types, we can see that the structural issues the forests exhibit are not restricted to any particular forest type. The majority of the sapling acres on the entire watershed can be attributed to old Christmas tree plantations that are still growing. Once accounted for those acres (34 total), the only sapling-sized stands occur in the recently regenerated salvage areas associated with the Storm Sandy cleanup in 2012. The widespread lack of a pole size class is also an issue. These mid-sized and mid-aged forests feature important habitats for wildlife and are also the fastest growing stage of forest development, meaning carbon sequestration and water filtration rates are very high. Additionally, a lack of regeneration means that when the canopy dies, no trees are present in the mid and understory to take their place, leaving growing space open for the establishment of invasive species. ***It is vital to maintain a balance of age classes to maintain flexibility in management decisions and to maximize resilience to***

changes in climate. This Block features a forest structure heavily skewed to the older and larger sizes.

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Most of the stands in this Block are overstocked. This indicates that the forest has grown to a point where the density of trees at their current size is too high to avoid mortality in the stand. In these overstocked stands, there are trees whose growth rates are trailing off while they are being "outcompeted" by other trees. Eventually, these trees will die as their neighbors usurp their resources. As the stand becomes very tightly packed, growth rates eventually slow down and can even stagnate until individuals die and more resources are freed up for the remaining trees to utilize.

Forest Type	Acres
Chestnut oak/black oak/scarlet oak	**16**
Pole	16
Eastern hemlock	**61**
Pole	2
Saw	59
Eastern white pine	**296**
Pole	7
Sapling	23
Saw	224
Saw-Pole	43
Exotic shrubs	**5**
Saw	5
Mixed upland hardwoods	**3030**
Pole	186
Sapling	6
Saw	1317
Saw-Pole	1518
Northern red oak	**318**
Saw-Pole	318
Norway spruce	**10**
Pole	2
Saw	6
Saw-Pole	2
Other exotic softwoods	**20**
Pole	1
Sapling	12
Seedling	4
Red maple/lowlands	**299**
Pole	108
Saw	123
Saw-Pole	40
Red maple/oak	**99**
Saw	20
Saw-Pole	79
Red Maple/uplands	**145**
Pole	6
Saw	63
Saw-Pole	76
Sugar maple	**116**
Pole	22
Saw	84
Saw-Pole	11
White Oak/Red Oak/Hickory	**106**
Saw	90
Saw-Pole	16
Yellow poplar	**81**
Saw	81
Yellow-poplar/white oak/northern red oak	**26**
Saw	26
Grand Total	**4628**

Table F-2: Forested acres of Aspetuck-Hemlock Block by size classes and forest type

Stocking Level	Acres
Understocked	29.8
Full Stocking	1079.39
Overstocked	3232.37

Table F-3: Acreage of the Aspetuck-Hemlock Watershed based on their stocking level

Forests of the Aspetuck-Hemlock watershed generally exhibit good quality timber. Thoughtful cutting to improve stand quality throughout the history of the watershed probably produced the current crop of high-quality red oak canopy trees, while the yellow poplar and Norway spruce stands (other exotic softwoods on the table) are simply younger and have not fully undergone the stem exclusion phase of forest development.

Because of the large size of the trees in the Aspetuck-Hemlock Block and the overstocked nature of many of its stands, there is significant board-foot volume in the property's standing timber. Every forest type, except for the xeric chestnut oak hilltop in compartment 50, features an average DBH at or close to the sawtimber minimum, meaning opportunity for timber harvesting is fairly ubiquitous.

The majority of the forest's timber volume consists of hardwood sawlogs such as red oak, black oak, and white oak trees. However, there is significant volume in red maple, and yellow poplar sawtimber as well. Softwood stands, though less common than the mixed upland hardwood stands, also provide significant volume due to their high stocking. Timber quality should be monitored carefully, as many of the stands in the later stages of succession probably feature a significant amount of internal decay that may not be detectable at first glance.

Forest Type	Average Proportion of AGS
Red maple/lowlands	51%
Red maple/uplands	55%
Sugar Maple	70%
White Oak/Red Oak/Hickory	70%
Eastern White pine	75%
Mixed upland hardwoods	78%
Eastern White pine	79%
Eastern hemlock	79%
Chestnut oak/black oak/scarlet oak	80%
Norway spruce	82%
Yellow-poplar/white oak/northern red oak	86%
Northern red oak	89%
Yellow-poplar	88%
Yellow Poplar	89%
Red maple/oak	96%
Other exotic softwoods	97%
Average	**76%**

Table F-4: Average proportion of AGS basal area by forest type

Forest Type	Avg. DBH
Other exotic softwoods	0.0
Chestnut oak/black oak/scarlet oak	10.5
Eastern hemlock	11.2
Northern red oak	11.5
Yellow-poplar/white oak/northern red oak	11.6
Red maple/oak	11.9
Mixed upland hardwoods	12.4
White Oak/Red Oak/Hickory	12.5
Red maple/lowlands	12.8
Eastern white pine	13.8
Sugar maple	13.8
Red Maple/uplands	14.1
Norway spruce	14.4
Yellow poplar	15.0

Table F-5: Average DBH of different forest types on the Aspetuck-Hemlock Reservoir Block

5. Forest Health

The forest health concerns related to the Aspetuck-Hemlock Reservoir Block cannot be overstated. The primary forest health stressors in this forest are the high abundance of deer, the expanding threat of numerous invasive species, and multiple forest pests and pathogens that have been documented in the area. These three primary issues, in some areas, prevent the forest from regenerating itself to a diverse suite of native vegetation. A lack of management, or a failure to actively meet these threats, could lead to reduced biodiversity in these areas, ultimately compromising the forest's climate resiliency.

- *Understory concerns (Wildlife Impacts)*
  While the Aspetuck-Hemlock Reservoir Block provides a great deal of mature forest habitat, there is little or no understory, and there is a definite deer browse line.
  Deer populations exceeding 15-20 per square mile affect regeneration by limiting the composition and quantity of tree seedlings needed to grow a new forest after disturbances to the overstory. Aerial surveys in February 2008, in the nearby Saugatuck Reservoir Block, estimated a range of 29 to 40 deer per square mile. It can be assumed that the deer population is similar in the Aspetuck-Hemlock Reservoir Block. The lack of understory negatively affects wildlife species in many ways, such as ground nesting birds that need low cover to rear their young (Ward 2020). In general, the forest conditions on Centennial Watershed State Forest are somewhat limited for species that require dense pole timber or sapling stage forests.

Figure F-2 – An understory with no trees caused by excessive deer browsing.

From a successional standpoint, a lack of diverse regeneration indicates that the forest will begin to lose tree biodiversity as the forest continues to age. American beech, black birch, and red maple make up most of the trees in the seedling and sapling stages, while the overstory remains more diverse in many stands. This indicates that these three species will begin to dominate the forest as the overstory ages out. A diverse forest is the best equipped to deal with an increasingly unpredictable climate (Thompson et al. 2009) or pest and pathogen outbreaks.

To this end, there are a variety of techniques that will be considered to address understory concerns. Deer fences are a useful tool to put up surrounding smaller patches of regeneration. These fences are temporary and are removed when the saplings inside the exclosure reach a height that is too tall for the deer to browse heavily enough to kill the young tree. These fences require labor to build, and routine maintenance to keep standing. A lower-maintenance option is to establish "slash walls" surrounding certain areas of harvests to effectively act as a barrier to keep deer out of wherever tree regeneration requires protection. These walls are built of logging debris (mostly the tops of trees, sections that are not used as sawtimber) and slowly decompose over time. A slash wall will be constructed to around 10-15 feet tall, and by the time the wall degrades naturally, the saplings inside will be tall enough to survive deer browse.

- *Understory concerns – Water Quality Impacts*

  Healthy, productive forests with identifiable overstory, midstory, understory, and ground cover provide many opportunities for mitigating the kinetic energy of rainfall. Multiple layers of vegetation slow the rate at which raindrops hit the forest floor, causing less erosion of forest soils. The complex canopy structure intercepts rain and snow, delaying peak storm flows, as well as filtering pollutants in the air by leaf surface area. Without this protective natural filter, large amounts of nutrients, sediment, and pollutants can easily wash into the water supply during heavy precipitation.

- *Invasive exotic plants*

  Three primary invasive plant species in this Block are Japanese barberry (*Berberis thunbergii*), Oriental (Asian) bittersweet (*Celastrus orbiculatus*), and winged euonymus (*Euonymus alata*). The secondary invasives present include tree-of-heaven (*Ailanthus altissima*), autumn-olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora)* and shrub honeysuckles (*Lonicera* sp.). When present, these invasive plants must be controlled before any intermediate treatments and regeneration cuts.

  Studies have shown that thickets of Japanese barberry harbor black-legged ticks, the carrier of Lyme Disease and other tick-borne illnesses (Ward.et al).

  Invasive species have occupied large portions of the property, mostly encroaching from nearby ownerships where they are maintained and planted as ornamentals. Collectively, these species are a concern as they block tree regeneration and displace native species. Some invasives also kill existing trees and other vegetation by girdling or smothering them. Invasive species within the Aspetuck-Hemlock Reservoir Block are summarized in Table F-13 and described in the sections that follow. Expanded discussions of each species are also found in Appendix A, Section 6. Native invasives such as hay scented fern and greenbrier, are expanding in many areas due to high deer populations, especially in white pine stands. In total, this Block has around 600 acres of "invasive plant focus areas", where invasive cover is ubiquitous.

Table F-13: Aspetuck-Hemlock Reservoir Block – Invasive Species. This list is NOT complete but does represent the most common species present.

Common Name	*Scientific Name*
Autumn Olive	*Elaeagnus umbellata*
Black swallow wort	*Cynanchum louiseae*
Garlic mustard	*Alliaria petiolata*
Japanese barberry	*Berberis thunbergii*
Japanese honeysuckle	*Lonicera japonica*
Japanese knotweed	*Fallopia japonica*
Japanese stilt grass	*Microstegium vimineum*
Oriental bittersweet	*Celastrus orbiculatus*
Tree-of-heaven	*Ailanthus altissima*
Winged euonymus	*Euonymus alata*

The recommended management goal is to minimize the population where possible and reduce their potential effect on forest health and regeneration.

Before harvesting activities in any stand, invasive species will be located, identified, and controlled. In addition to focusing invasive management in stands that will be harvested, actively eradicating invasive species infestations in other parts of the forest will reduce sources for further spread.

- *Insect and disease concerns*

Numerous forest insects and diseases are present in the Aspetuck-Hemlock watershed, posing various levels of danger to the tree species they target. All of these pests and pathogens will be managed in some capacity on a project-to-project basis. This is NOT an exhaustive list, as new pests and pathogens are discovered frequently over time.

Common Name	*Scientific Name*
Hemlock Wooly Adelgid	Adelges tsugae
Beech Leaf Disease	*N/A*
Asian Longhorn Beetle (nearby)	*Anoplophora glabripennis*
Spotted Lanternfly (nearby)	*Lycorma delicatula*
Emerald Ash Borer	*Agrilus planipennis*
Spongy moth	*Lymantria dispar*
White Pine Weevil	*Pissodes strobi*

Some forest pests that were rampant in the past continue to influence forest composition today. Red pine scale, for example, hit this Block particularly hard in the 1980s and 1990s. Hundreds of acres of red pine plantations were salvaged to avoid the total loss of the timber resource. These stands have since grown back into an array of single-aged mixed hardwoods, and some have been replanted as white pine stands.

The most significant new development is the widespread emergence of BLD in the summer of 2022. The pathogen was first encountered on the watershed several years

ago by the CT Agricultural Research Station. However, during leaf-out in 2022, it became apparent that most of the understory had been afflicted in the large stand east of the Hemlock Reservoir (all stands in compartment 50). This issue should be monitored carefully going forward, beginning in leaf-out 2023 with an assessment of how the under-, mid-, and overstory are handling the disease.

- *Weather-related damage*

  After Storm Sandy, roughly 129 acres of mature white pine blew down and required salvage to capitalize on the value of the wood and speed up the regeneration of the forest. This project was completed in 2013. These stands have since grown into early successional forest habitat but has also been overtaken in many places by invasive species. Storms of varying severity are common, but rarely damage the forest on a stand-wide scale. Aside from the hurricane, smaller magnitude storms occur on a yearly basis in all seasons, causing disturbances to the canopy and altering the forest on a smaller scale. These events include ice storms, strong thunderstorms, heavy rain and snow, and drought. Natural disturbances are not inherent threats to forest ecosystems, rather they have the potential to increase climate resiliency without human intervention so long as the resulting forest grows into a diverse suite of native vegetation. When large scale natural disturbances are coupled with the presence of invasive plant species, deer overabundance, and native pests and pathogens, the forest often does not regenerate to such a condition.

  Drought now occurs more frequently. Drought stress is evident in certain areas in the foliage of overstory trees but has yet to cause widespread mortality anywhere in the watershed. It should be noted that just because widespread mortality has yet to be observed does not mean drought is not having a negative effect. Drought-stressed trees are more likely to succumb to a secondary pest or pathogen, as they are already weakened by the drought stress (Kolb et al. 2016).

- *Disturbance Regimes (Fire)*

  Fire disturbances are largely absent from the Block, except for the infrequent human-caused burn. There were two fires in the nearby Easton and Saugatuck Reservoir Blocks in the summer of 2022. Both were linked to escaped campfires. One fire was put out by DEEP, while another was extinguished by the Trumbull Fire Department.

G. Silvicultural Strategies and Climate Change Mitigation

1. Forest Carbon Science

Forests sequester carbon when individual trees undergo photosynthesis. As they grow, they pull carbon dioxide out of the atmosphere and use it, alongside water, to synthesize glucose that they convert into cellulose and release oxygen as a byproduct. Forests between 30-70 years of age sequester carbon at the highest rate as they are growing faster (CT DEEP web page), while older trees store the most carbon by sheer volume as they are physically larger. So, a young forest is sequestering carbon faster, while an older forest holds more carbon within its trees. When there is more structure in the forest, there tends to be more carbon.

This Block contains significant tracts of mature forest, which likely contain significant amounts of carbon.

Most of the wooded area is between 50-100 years old, and the overstory trees tend to be structurally complex. But, while there are large pools of carbon in the canopy trees, there is also a distinct lack of an understory and midstory in many places. Because the most "carbon-full" forests are those that contain the most structure (Ford and Keeton 2017), it is vital that we maintain a balance of older, larger trees, **and** younger regenerating trees to optimize carbon storage **and** sequestration on the landscape. Increasing vertical stratification with silvicultural activities such as single tree and group selection can enhance both the rate of carbon storage for a given area, while preserving old forest characteristics retains carbon that is already stored. Mature forests account for most of the stands in the Block, so creating younger forests is necessary to increase the overall rate of carbon sequestration.

Recent studies have confirmed that certain forest management activities that encourage late-successional characteristics can enhance carbon sequestration in a forest. Ford and Keeton (2017) have demonstrated that selection harvests that emphasize retention of large trees and coarse woody debris can enhance carbon storage by accelerating biomass development post-harvest, relative to traditional methods of management. These stands featured less standing carbon in the woods than no management scenarios in the short term, however over time the potential exists to increase carbon storage within a stand by conducting such treatments. Carbon optimization, rather than maximization, is the goal.

2. Forest Resilience

The best way to ensure a forest is resilient to multiple long-term stressors is to increase and maintain a diversity of species, age classes, and forest structure across the landscape. Some strategies to maintain such diversity outside of traditional forest management are outlined below.

- Forest Fire

  In the past, fire was a prominent feature of the Connecticut landscape, as indigenous peoples have been using it as a management tool for thousands of years. In more recent times, there is a distinct lack of fire in most places, especially within the Aspetuck-Hemlock watershed. There have been no prescribed burns in the past ten years, and no major wildfire outbreaks either. The climate in southwest Connecticut is generally humid and wet, making forest-floor burns difficult and natural fires infrequent.

  With the onset of increasingly unpredictable drought, however, fire risk does increase. The most likely causes of forest fires in this region are humans. Most of our stands are generally at lower risk for a significant fire, but some of the abandoned conifer plantations could be more susceptible. Stands 4006 and 4205 contain younger exotic spruce and fir, both of which are species that contain resins that are highly flammable. Given the dense nature of these stands, fires could prove to carry much more easily and be catastrophic. Extra care should be taken to manage fire risk in these stands if the issue arises, such as thinning dense plantations and maintaining roads for fire suppression.

  Controlled, professionally applied fire is a useful tool in maintaining the presence of species like oak and hickory. In addition, native lowbush blueberry and other fruiting plant communities sometimes rely on fire to establish, or greatly benefit from its occurrence, similar to the oak. These fruiting plants in a formerly burned area can be excellent sources of food for wildlife. The Paugussett people used fire for this exact purpose. For us, fire could be a useful way to maintain certain aspects of our forest biodiversity.

- Insects, Disease, and Timber Salvage Guidelines

  As mentioned above, insects and diseases can prove lethal to certain tree species if left unmanaged. The emerald ash borer, for example, can kill an entire stand of white ash in a very short period. While a certain amount of dead standing wood is vital for wildlife, an entire stand of dead standing wood is a threat to those who walk in the woods, a higher fire risk during warm periods, and will slowly but surely release carbon to the atmosphere on a stand-wide scale as the trees decompose. We must be diligent in our management of the insects and diseases listed in the previous section, and act quickly to authorize salvaging operations to try and curtail their spread if possible.

  A salvaging operation for white ash occurred in the nearby Saugatuck Reservoir Block in 2016. Some of the ash trees were dead but had died recently enough so that the timber had not lost value. About 223,000 bf of timber came out of that stand, the vast majority of it ash. In this case, as in many cases, the best thing to do for the stand was to open up the forest for increased sunlight to allow for the ash to establish as seedlings and regenerate. Because the emerald ash borer only attacks trees over 2" DBH, the young seedlings and saplings survived and maintain the ash component in this stand. This example will serve as a model for future salvaging operations.

  Timber salvage on this watershed should occur when there is a widespread and imminent threat to the health of a given stand, and if harvesting individual trees would be effective at halting the spread of the pest/pathogen. Additionally, salvaging should be conducted if capitalizing on the value of the wood is a priority for that stand. This can include presalvaging white ash to avoid emerald ash borer spread, or pre-salvaging oak if an outbreak of spongy moth (*Lymantria dispa*r) occurs. In both these cases, harvesting timber pre-emptively will serve to increase the vigor of the trees left behind, increasing their chances of survival, but also to regenerate the stand so that widespread mortality is avoided, and a new cohort of individuals can be established to ensure the continuity of forest cover in the watershed. Thorn et al. (2018) does show that salvaging dead timber could reduce the biodiversity of certain groups of organisms, if certain measures such as dead wood retention are not taken. Salvaging operations in this Block should strive to minimize the negative effects.

- Encouraging Mature Forest Growth

  Encouraging mature forest habitat is vital to maintaining a climate-resilient watershed. Mature forest is characterized generally by older trees that contain significant structure in all strata of the forest, a higher diversity of tree ages, species, and sizes, and a higher component of dead trees (Ford and Keeton 2017). This type of habitat can be achieved by both allowing a forest to mature on its own as long as it is healthy and has the right species mix, and by using single tree and group selection techniques to open up small gaps throughout a younger forest to accelerate the development of these features. The gaps fill in with established seedlings of nearby mature individuals, creating more structure beneath the canopy. Well planned selection activities can successfully speed up the development of mature forest structure by introducing a new age class into the woods and by enhancing the growth of the trees already there.

3. Expectations: Next 100 years in Succession

Future forest conditions can be projected with modeling, and by observing what trees are growing in the understory. With this in mind, one can expect the Aspetuck-Hemlock watershed to undergo significant changes in its forest composition in the future. Due to a lack of tree species diversity in the understory, it is likely that the forest canopy will homogenize in the future without management. DEEP and AWC foresters will implement a variety of forest management techniques to address this issue and create a diverse and resilient forest moving forward. Additionally, forest health issues will be addressed decisively with management to maintain and improve the current forest cover.

4. Management System Guidelines (Exemplary forestry and even vs. uneven-aged) acres of each

In Centennial Watershed State Forest as a whole, one of our aim is to preserve diverse forest habitats by maintaining a steady component of early successional habitat and young forest, while maintaining a large proportion of the forest in the mature size classes. In addition, we also seek to establish no management reserve areas. Ultimately, in the areas subject to management, we hope to secure sustainable forest products while providing for high tree diversity, wildlife habitat, carbon storage, and other values that are compatible with sustaining a living filter for high water quality**.** Such a forest will be resilient to changes in climate as well. It should also be mentioned that the 2012 document "Forest Management Guidelines for CWSF", prepared by consulting foresters Ferrucci & Walicki, Inc., calls for a similar proportion of young forest on the landscape (Ferrucci & Walicki 2009), as do a set of recommendations given to the CLC from the then-CT DEP (Department of Energy and Environmental Protection) regarding the same plan (unpublished, 2009).

The proportion of size classes in CWSF is heavily skewed towards sawtimber. Table G-1 represents the number of acres of each size class of OPERABLE acres in the watershed only, as these are the acres that will be subject to forest management over the duration of this plan.

Forestry Work Plan				
Size Class	**Current Acreage**	**% Of total**	**Target % of total**	**Target Acreage**
Seedling	4	0.13%	5%	167
Sapling	188	5.6%	15%	503
Pole	64	1.9%	15%	503
Saw	1650	49.2%	20%	671
Saw-Pole	1446	43.1%	20%	671
Old forest reserves*	1429		25%	839
Total Forested, Operable	**3355**			
Total Forested Acres	**4785**			

Table G-2: Forestry guidelines for operable acres of the Block. Size class acreages in this table represent operable acres only, except for OFMS. All inoperable acres will be designated old forest management sites
*Old forest management sites include all inoperable stands and numerous operable stands that will receive no management in the duration of this plan

These numbers provide a loose framework to work towards in CWSF. Even if these exact proportions are never attained, however, we will be working toward one of our goals in the forest; to increase and maintain species diversity and increase the diversity of forest age classes. The climate resiliency of the forest will increase as a result.

Trees in CWSF will be managed on a 100-year rotation. It is recommended that central hardwood forests be regenerated at a rate of roughly 1% of the total acreage per year, so that by the end of a 100-year rotation there would be an ample diversity of size classes. The forest would theoretically feature stands aged 1-100 if 1% were regenerated every year, with size class area proportions corresponding directly to stand ages (i.e., saplings are typically between 3-15 years old and would thus account for 12% of the landscape cover at the end of a 100-year period).

Even vs. Uneven Aged Management

Over the next 20 years, 594 acres of CWSF will be managed using uneven-aged silvicultural strategies (selection regeneration harvests), while 1,479 acres will be managed using even-aged strategies (257 acres of even-aged regeneration and 1,222 acres of forest thinnings. It is important to note that two-thirds of the acreage that is being regenerated will undergo selection harvests, meaning that over time we are encouraging the great majority of stands to be multi-aged instead of even-aged. This favoring of multi-aged stands will contribute to the forest's overall climate resilience. A variety of stands of different ages and size classes across the landscape (not all mature forests) will be more resilient to catastrophic disturbances such as spongy moth and hurricanes.

5. Sustainability (acres or % harvested per management period)

As detailed above, regenerating 1% of the total forested area per year would result in a more sustainable forest structure over time. This means regenerating 34 acres of forest annually for the next 100 years if the goal was to treat the entire forest. This strategy would leave over 1,000 acres of old forest management sites that will undergo little to no management, as well as move the forest to a healthy and climate resilient structure over time. This would mean regenerating roughly 680 acres over the term of this management plan; however, we are setting a slightly higher goal of 851 acres.

6. Silvicultural Practice and Treatments

In addition to the regeneration treatments discussed in sections G4 and G5, **forest thinnings** provide three key benefits to the watershed:

1.) Thinnings maintain high growth rates within a stand by opening up growing space for the residual trees. A fast-growing tree pulls more nutrients out of the soil, so a thinning can optimize a stand's ability to act as a living filter.

2.) Thinnings help to maintain biodiversity by selecting residual trees of as many species as possible in the stand in question.

3.) By encouraging high growth rates and increasing the resources available to each individual tree, thinnings can increase the ability of trees to fight forest pathogens. All three benefits hold true even in older trees as shown by Ward (2002). Accordingly, 1,222 acres of forest thinnings are prescribed in addition to regeneration treatments.

Timber stand improvement is a method of forest thinning that targets younger stands, before they are commercially viable. Thinning a young stand to a certain spacing (determined by species composition) can maintain high tree growth rates at a crucial point in the stand's development where growth typically slows. Once the crown closes in a stand of saplings, meaning all available space in the stand is occupied by growing trees, the stand stalls somewhat as certain trees "out-muscle" others for the slightest advantage over their neighbors. Eventually, the "winners" manage to slightly overtop their immediate neighbors and end up overtopping them as they take off vertically and continue growing again. TSI can speed up this process by thinning the stand manually and allows the forester to pick the composition of the resulting stand instead of simply leaving it to the forces of nature, thus ensuring the maintenance of

tree biodiversity. Generally, TSI accelerates the growth of the stand into maturity. TSI is recommended in multiple stands within the Aspetuck-Hemlock watershed (see Chapter L, work plans).

7. Adaptive Forest Management & 10 Year Update Process

The DEEP and the CLC understand the nature of forest management as it occurs as part of a dynamic landscape. Management actions are often affected by outside variables which influence the outcome of resource decisions. The CLC reserves the right to reasonably change our management approach as environmental change and resource needs warrant. Some of these changes may be associated with biological factors such as insect and disease, or population outbreaks. Increased unauthorized motorized recreation which erodes trails and roads may require action unforeseen during the composition of this plan. Additionally, environmental conditions such as hurricanes or record-breaking precipitation may additionally affect resource condition and work requirements. The CLC and our colleagues in DEEP, Wildlife and Fisheries, evaluate circumstances and use an adaptive-management philosophy and additionally reserve the right to address unforeseen circumstances should they arise during the tenure of this forest management plan.

Regardless of any catastrophic disturbance or drastic change in forest condition, this plan will be reevaluated in 2034, halfway through the management plan term. Each stand will be assessed qualitatively to gauge any change in condition that may require alteration of the work plan. The managing foresters will make necessary changes, and the CLC will make amendments to the management plan if they are required. The CLC will write and submit a memo to all three member parties detailing their decisions either to make said changes, or to maintain the plan as originally written.

H. Wildlife Habitat

1. Current Habitat Diversity

Most of the Aspetuck-Hemlock Reservoir Block is mature deciduous forest habitat, with a mix of hardwood and softwood stands, small openings within Christmas tree and open field areas, and a network of various wetland types and watercourses.

2. Critical Habitat

A preliminary review by the DEEP's NDDB in January 2023 for the Aspetuck-Hemlock Reservoir Block produced the following list of Federal, or State Endangered, Threatened, or Special Concern Species in the vicinity of this property. Each species comes with specific recommendations for the maintenance and establishment of their habitat, as well as best practices for their protection. It should be noted that each timber sale conducted in this Block will undergo individual NDDB and, if necessary, federal IPaC (Information for Planning and Consultation from the US Fish & Wildlife Service) impact assessments to ensure the protection of threatened and endangered wildlife.

Scientific Name	Common Name	State Protection Status	Compartment of Concern
Taxa			
Haliaeetus leucocephalus	Bald Eagle	Threatened	Aspetuck and Hemlock Reservoir buffer
Buteo platypterus	Broad-winged hawk	Special Concern	28
Toxostoma rufum	Brown thrasher	Special Concern	30, 32, 34, 40, 42, 43, 58
Accipiter gentilis	Northern goshawk	Threatened	34, 35
Aegolius acadicus	Northern saw-whet owl	Special Concern	1
Myotis septentrionalis	Northern Long-eared bat	Endangered, **Federally Endangered**	1, 5, 4
Lasiurus borealis	Red bat	Special Concern	1, 5, 50, 56, 57, 58
Terrapene Carolina	Eastern Box Turtle	Special Concern	Throughout
Clemmys guttata	Spotted turtle	Special Concern	1, 5, 7, 8, 10
Glyptemys insculpta	Wood turtle	Special Concern	23
Plants			
Rotala ramosior	Toothcup	Threatened	Hemlock Reservoir

3. Actions needed for Increased Diversity and Critical Habitat

There are opportunities to maintain and enhance habitat throughout this Block. There is an existing mix of hardwood and softwood stands, small openings within Christmas tree and open field areas, and a network of various wetland types and watercourses. This current framework whereby we use a mix of even and uneven-aged management to maintain forest diversity is a good starting point from which to increase diversity using the recommended timber management program. In addition, opportunities to maintain early successional habitat should be explored.

4. Hunting and Trapping

A hunting program for white-tailed deer is administered by Aquarion. Seven thousand eight hundred sixty-seven (7,867) acres of CWSF are open to bowhunting across the Saugatuck, Aspetuck-Hemlock, Easton, Means Brook, and Far Mill Reservoir Blocks. Included in this area are 3,474 acres open to shotgun hunting.

A limited number of permits to hunt these areas are made available to the public via the Connecticut DEEP lottery each year.

In addition, 662 acres in compartments 34, 35, 38, 41, and 43 are currently under review by DEEP for additional bowhunting areas. This land is the former Aspetuck Game Club lands, where hunting and fishing were a regular occurrence in the past.

5. Fisheries Habitat and BMPs

The main stem of the Aspetuck River and its tributaries are typical of other similarly- sized streams within rural to moderately developed watersheds in Connecticut. Their overall species assemblages and diversity are average to good. The mainstem Aspetuck has good habitat for adult and juvenile trout, and both brown trout and brook trout (*Salvelinus fontinalis*) are known to successfully reproduce in the river, particularly in its upper reaches. Due to a certain degree of degradation of spawning and egg incubation habitat, higher than ideal water temperatures, 'flashy' hydrology and frequently very low summer period water levels, however, the Aspetuck River does not appear to be capable of supporting a significant fishery based solely on wild trout reproduction. The mainstem Aspetuck should be able to support stocked adult trout in most years, and may be adequate to grow stocked fry and fingerlings to catchable size. The small Aspetuck tributary known locally as 'Trupp Brook' contains sufficient wild trout and intact trout habitat to offer a modest opportunity to promote wild trout fishing opportunities in association with the development of a Trout Management Area (TMA) for the Aspetuck River.

The most effective way to preserve aquatic habitats in a timber harvest is through the strict adherence of forestry BMPs for water quality. There are a litany of practices and techniques laid out in CT DEEP's booklet; "Best Management Practices for water quality while harvesting forest products". These ideas will be referenced and enforced whenever forestry operations are planned on CWSF. These practices can include the establishment of 100-foot no-cut buffers around perennial streams, establishing water bars on skid trails and truck roads on a slope, reseeding areas of exposed soil that are near watercourses, and filling in ruts that may have resulted from heavy equipment. Additionally, wetland stands will be considered inoperable.

I. Economic Benefits

1. Connecticut Forest Economy

CT DEEP estimates that the forest products economy in Connecticut accounts for nearly 16,000 jobs and $3 billion of output annually. The growing and harvesting of sustainable wood products can be a vital tool in the fight against climate change. Maintaining a robust forest economy in Connecticut is essential to promoting these markets. CWSF can play an important role by providing an additional source of wood for local sawmills. Locally sourced wood is better for the environment in that it has a smaller carbon footprint than wood from other places. With over 70% of the state's woodlands in some sort of private ownership (Peracchio 2020), keeping these mills open and functioning also presents an opportunity to smaller landowners who may be interested in managing their woodlands.

In addition to traditional lumber products, CWSF can provide numerous other economic benefits. For example firewood, in wholesale quantities and in smaller lots, is a local source of residential heat, replacing fossil fuels. Maple syrup production is a small but growing industry in Connecticut, and numerous areas of Centennial provide the opportunity to establish a sugarbush.

J. Public Involvement

Copies of the plan were sent to the Conservation Commissions of Newtown, Fairfield, Redding, and Easton for review. Presentations were made to the Fairfield, Redding, and Easton Commissions at their request. Fairfield Conservation Commission voted to approve the plan on 11/15/2023.

The plan was also sent to the Aspetuck Land Trust, the Redding Land Trust, the Newtown Forest Association, the Connecticut Forest and Park Association, and Highstead Arboretum.

Comments were received from these organizations and the plan was revised accordingly.

The CLC approved the plan at its meeting on 12/4/2023.

K. Management Goals

1. **High Quality Drinking Water & Environmental Protection-** To continue to promote and protect high-quality drinking water. Connecticut's State Forests provide environmental benefits such as cleaning the air, protecting water quality, and contributing to soil health.
2. **Forest Ecosystem Health and Diversity** – To create a more uneven-aged and climate resilient forest with diverse structure and species composition by;
    - -Using a combination of even-aged and uneven-aged forest management techniques
    - -Controlling non-native invasive plants.
    - -Promoting a mix of softwood and hardwood stands
    - -Forest thinnings to improve individual tree health and species composition
3. **Wildlife Habitat** – Many of Connecticut's wildlife species, both common and rare, use a wide variety of forested habitats. It is important to provide diverse forested habitats for animals with different needs. Some of these habitat types are currently present on the landscape, while others are lacking.
4. **Climate Change Mitigation through Sequestration and Storage** – Connecticut's State Forests can help mitigate climate change by sequestering and storing carbon in vegetation above and below ground and as durable wood products used locally and beyond. Promoting forest health and balancing higher sequestration rates with multi-aged, complex forest structure featuring high carbon storage is essential.
5. **Recreational/Health Benefits** – Connecticut's State Forests provide many recreational opportunities, providing a local and economical way to stay healthy and active.
6. **Economic Benefits** – Sustainably harvesting forest products like timber, firewood, witch-hazel, and maple syrup from Connecticut's State Forests provide jobs and goods that are sold in the local economy. The State Forests are a model for private forest landowners to consider when managing their own properties.
7. **Forest Protection from Certain Natural Disturbances**– Natural disturbance can lead to increased resiliency in forests ecosystems when the forest responds to these disturbances by regenerating itself to a diverse suite of native vegetation. Some natural disturbances in our landscape, however, do not result in a such a forest, or create conditions that do not meet our objectives. Managing Connecticut's State Forests in these cases can help promote resiliency on the landscape.

L. Work Plans

1. Silvicultural Operations Schedule

Over the next 20 years, the following stands will be treated using even-aged, uneven-aged, and forest thinning techniques;

Uneven Aged		
Acres	**Stand #'s**	**Prescription**
36	501	Selection Harvest
276	1101	Selection Harvest
10	1102	Selection Harvest
2	1803	Selection Harvest
7	3108	Selection Harvest
24	3201	Selection Harvest
41	3801	Selection Harvest
44	3804	Selection Harvest
51	5005	Selection Harvest
34	5014	Selection Harvest
28	5015	Selection Harvest
5	5017	Selection Harvest
21	5018	Selection Harvest
15	5020	Selection Harvest
594		

Table M-1: List of stands to be treated with uneven-aged forest management techniques.

Even-Aged		
Acres	**Stand #'s**	**Prescription**
15	3003	Shelterwood-Establishment Harvest
4	3004	Invasive removal/Planting
9	3102	Invasive removal/Planting
79	3402	Shelterwood-Establishment Harvest
99	5008	Shelterwood-Establishment Harvest
8	5010	Shelterwood-Establishment Harvest
6	5011	Shelterwood-Establishment Harvest
32	5013	Shelterwood-Establishment Harvest
5	5019	Shelterwood-Establishment Harvest
257		

Table M-2: List of stands to be treated with even-aged forest management techniques.

Thinnings	
Acres	**Stand #**
32	102
3	103
45	502
5	506
24	1106
11	1107
8	1108
27	1301
26	1302
132	1801
33	2001
5	2003
5	2101
8	2204
30	3005
38	3103
29	3104
25	3107
39	3110
2	3114
3	3117
2	3202
5	3203
5	3204
3	3301
77	3302
3	3304
6	3305
70	3306
12	3501
12	3505
10	3510
5	3802
5	4002
151	4102
54	4301
9	4302
150	5004
8	5009
2	5012
103	4311
1222	

Table M-3: List of stands to be treated with thinnings.

2. Prescribed Fire

There are no plans for prescribed burns in the Block. Prescribed fire is a useful management tool in promoting the growth of young oak-hickory forests, so CLC will consider prescribed fire if the opportunity arises.

3. Forest Product Permits

Forest product permits for firewood and maple sugaring will continue to be administered as the requests come in. Areas where both firewood is readily available, and cutting would benefit the forest are stands 1301, 1302, 102, 1005, 2210, 3104, 3106, 3207, 3402, 3510, 4904, and 5701.

Maple sugaring permits would be suitable for stands 102, 1107, 2901, 3005, 3205, 3103, 3101, 3402, and all stands in compartment 42. Other suitable stands may develop over the duration of this plan, and these stands may be opened up if possible.

4. Invasive Treatments

There are numerous areas of dense invasive species cover, and these areas are depicted in the "invasive species focus areas" map. This map only highlights areas where invasive species are particularly abundant; nearly every stand in the watershed is under some degree of invasive pressure.

Each timber harvest on this watershed should be preceded by a treatment of all invasive plants within the sale area and in the immediate surrounding vicinity to avoid the establishment of non-native plants in the newly opened growing space once the harvest is complete.

5. Road Work

Roadwork will occur on an as-needed basis. Hunting areas require new layers of gravel in the short term, and Timco Road requires grading and new layers of gravel in many places. Roadwork will be prioritized based on where log trucks will need access. Aquarion will continue to maintain access to these roads by clearing downed trees and making sure they are passable for trucks and other emergency vehicles. Major upgrades for old logging roads that are not essential for water infrastructure access will be completed as required to conduct forest management activities and will be completed in consultation with the CLC and associated contractors.

6. Other Infrastructure Improvements -culverts, gates, boundary surveys

Culvert and gate maintenance will be completed as necessary to facilitate the management activities laid out in this plan, or in the case that an emergency arises. Maintenance activities will be discussed and planned by the CLC.

Boundary marking will occur on a regular basis and be conducted by Aquarion and DEEP foresters and

other staff. There are 53 miles of interior boundaries and 37 miles of road frontage boundaries. The interior boundaries will continue to be marked by yellow paint and signs on a five-year rotation, amounting to roughly 10 miles per year split between the available staff. Specific locations of boundary marking will be determined by CLC partners according to the order in which the boundaries were last marked, and as part of a larger boundary marking scheme that encompasses all of CWSF. Boundaries will also be marked on an as-needed basis according to specific issues related to property encroachments and trespassing.

Surveys for property boundaries will be conducted on an as-needed basis.

7. Forest Pest and Pathogen Monitoring

CLC members, including Aquarion and DEEP foresters, will continue to monitor forest pests and pathogens as they work in the watershed. Newly located affected areas will be documented on an as-needed basis by the CLC, and proper control/eradication/prevention measures will be discussed.

Spotted lanternfly identification cards will be handed out to hunters on CWSF to increase awareness of the pest.

Areas where BLD is rampant (including most mixed upland hardwood stands) will continually be monitored for tree mortality. Widespread mortality has not yet occurred as of the writing of this plan, 3 years on from the first detection of the pathogen.

8. Non-Commercial Forest Products Work

Timber stand improvement (TSI) is recommended in the following stands;

Timber Stand Improvement	
Acres	**Stand #**
17	2203
35	2210
3	3106
5	3207
3	3208
2	4006
2	4201
6	4205
0.5	4310
73.5	

9. Hazardous Trees

Hazard trees are dealt with on situation-specific basis according to the land class where the tree is located.

M. Forest Map Set (Begins Next Page)

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

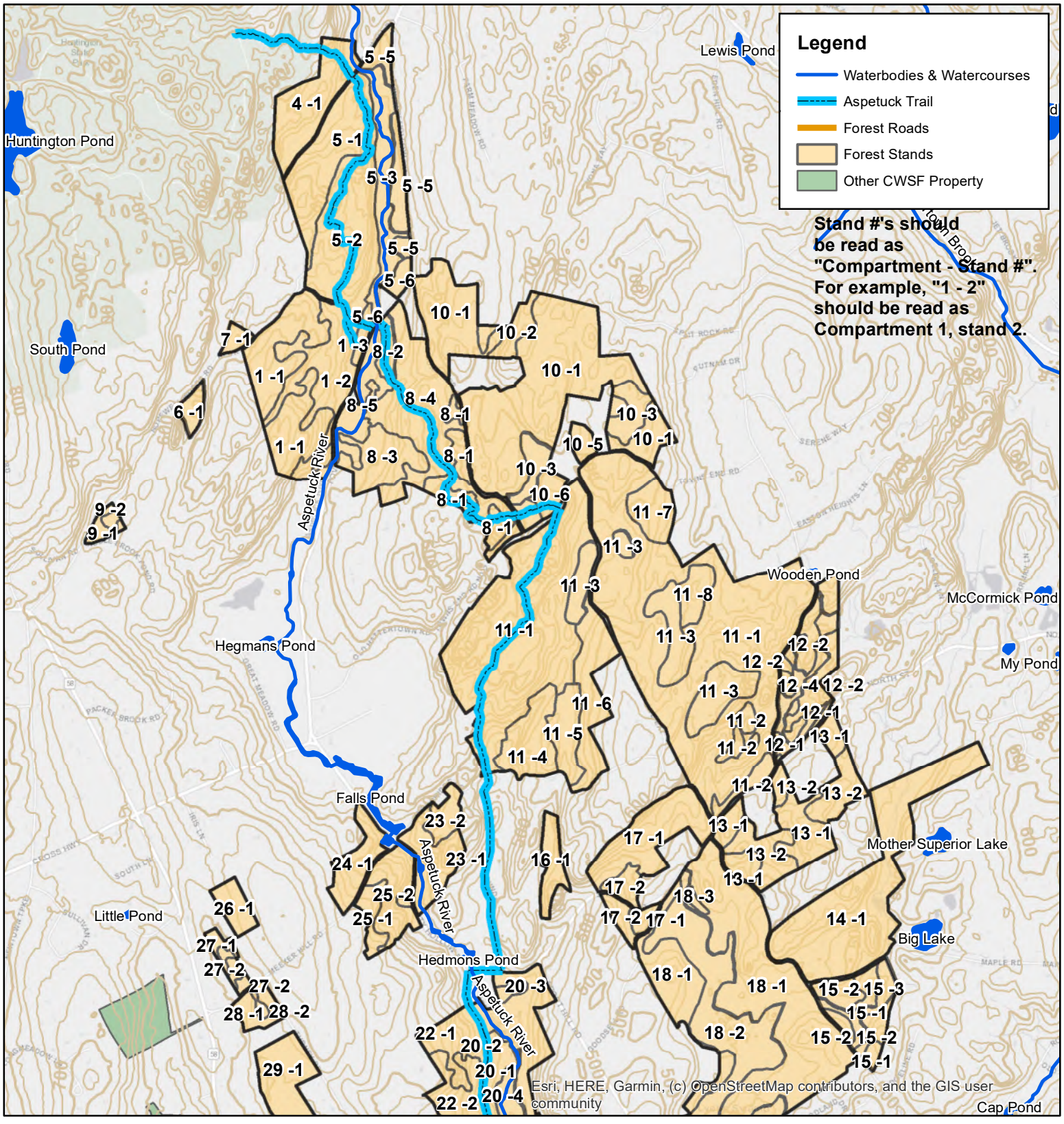
Base Map (1/4)

Newtown, Redding, and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
0 0.1 0.2 0.4 0.6 0.8



Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Base Map (2/4)

Redding and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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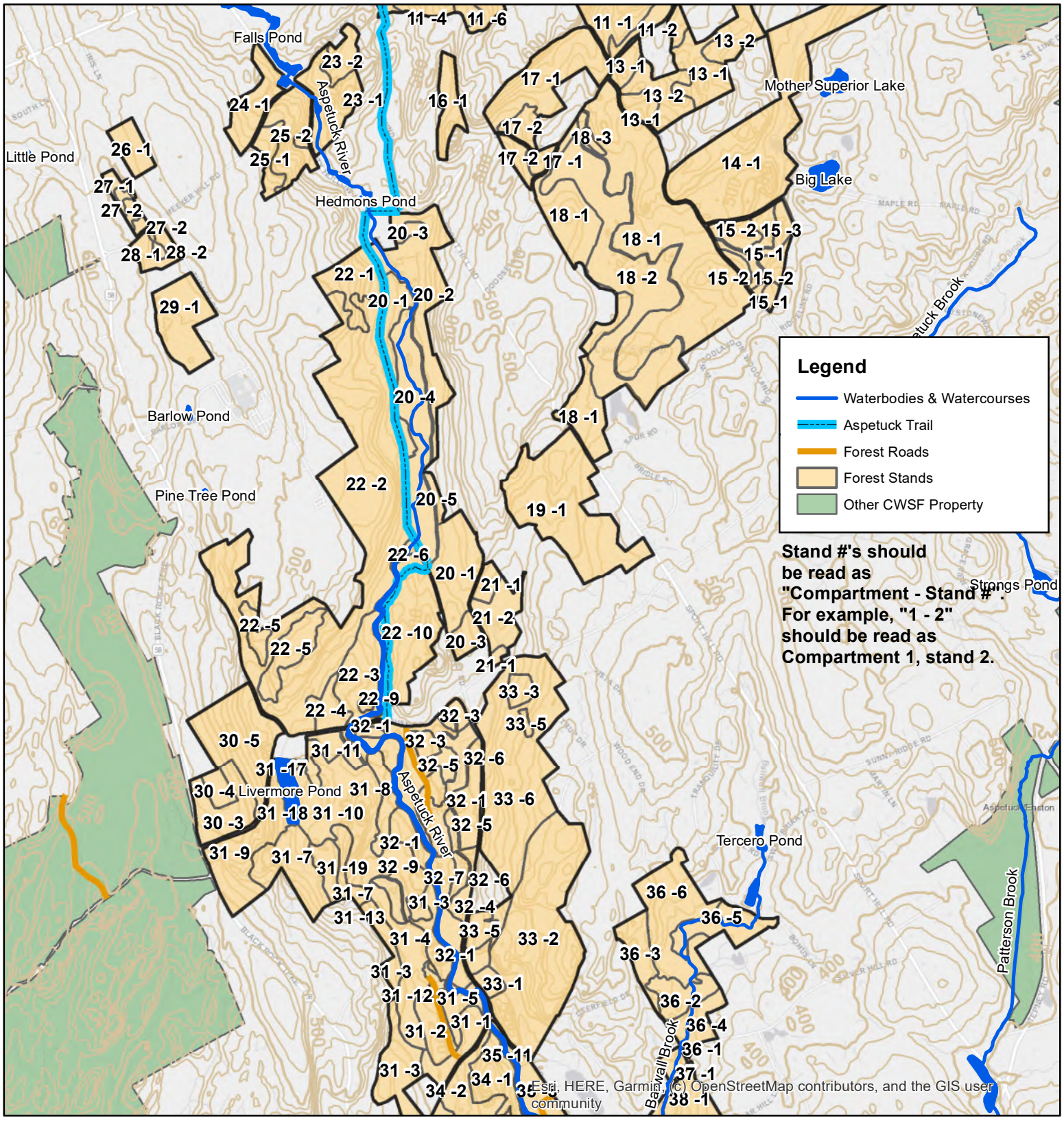

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Base Map (3/4)

Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
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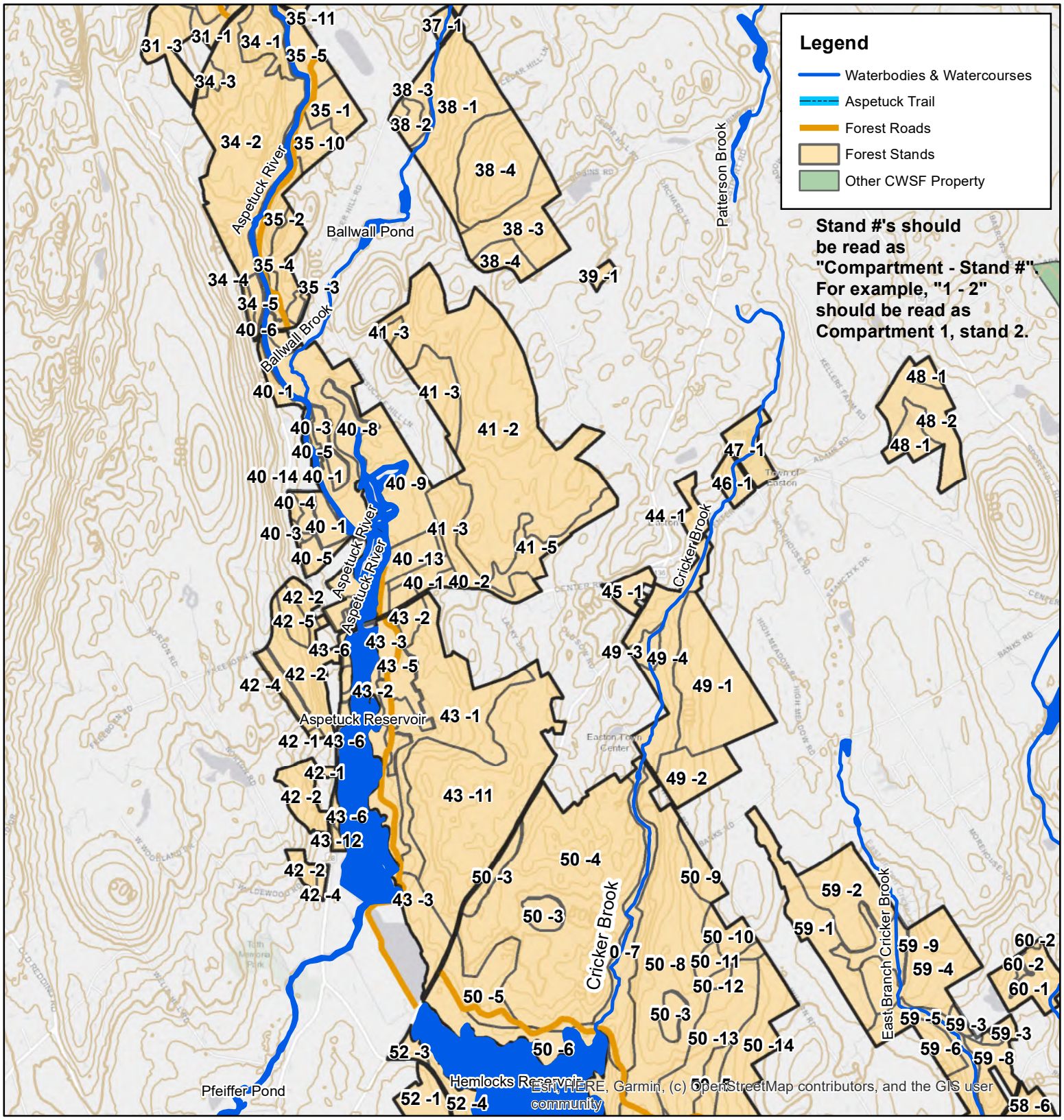

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Base Map (4/4)

Fairfield and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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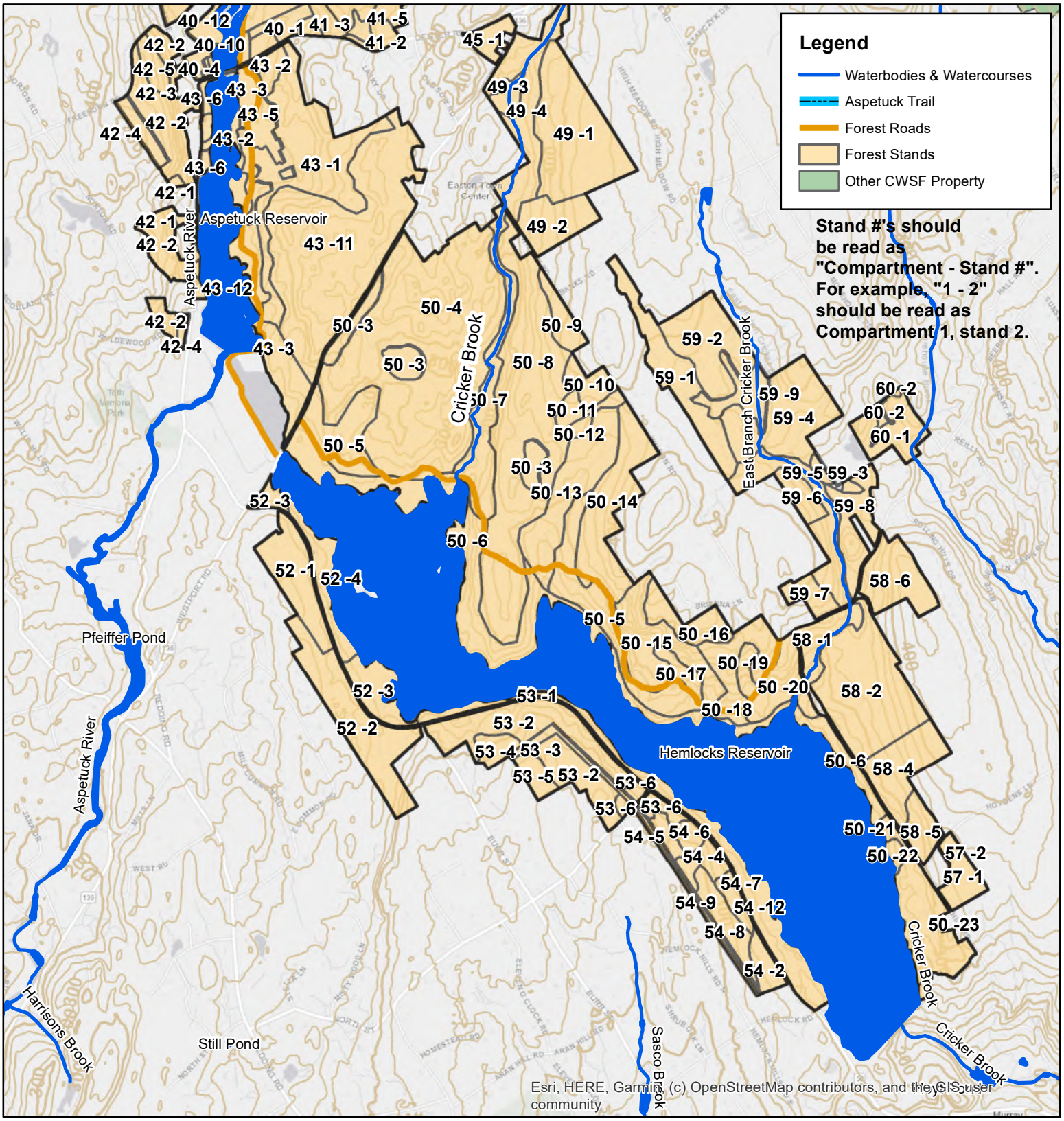
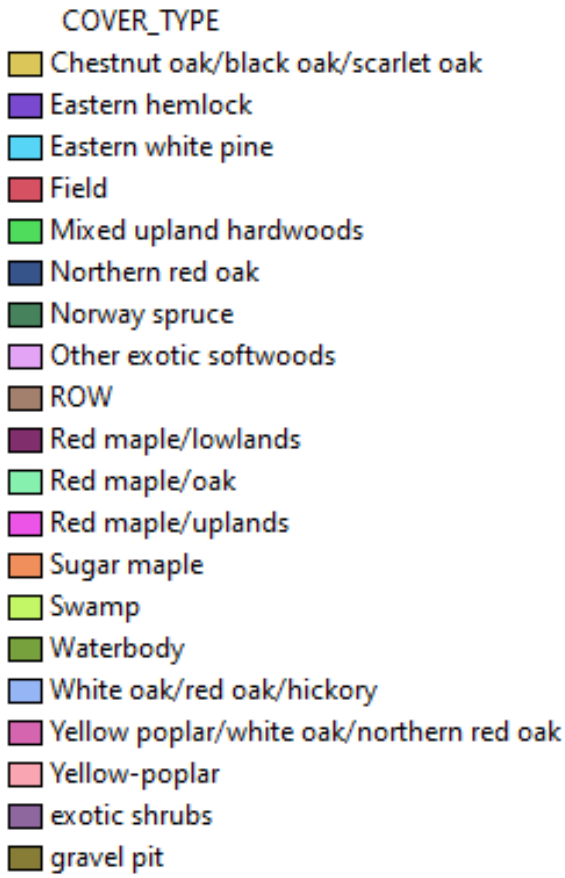


Forest Type Map Key



Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Forest Type Map (1/4)

Newtown, Redding, and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
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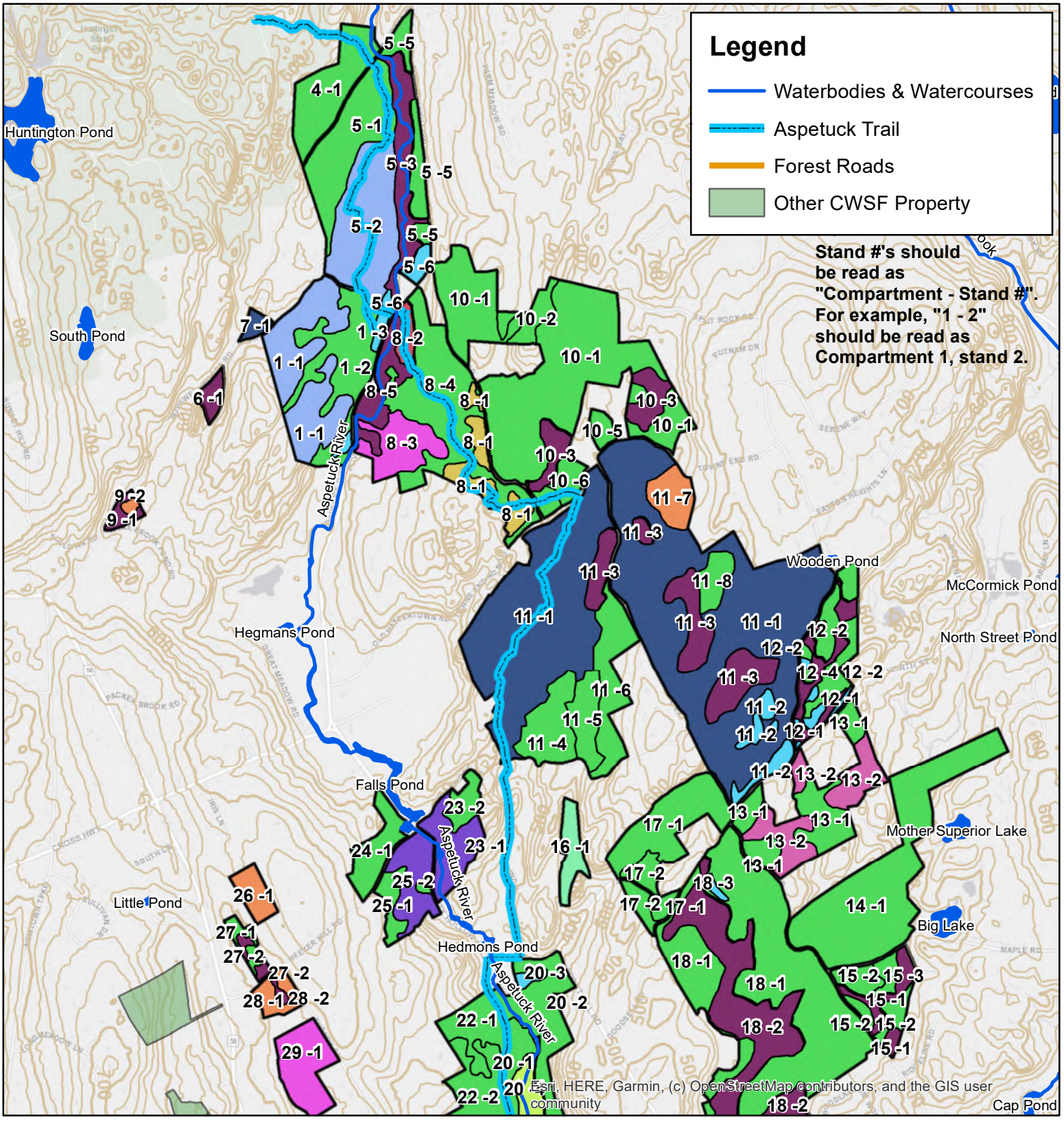

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Forest Type Map (2/4)

Redding, and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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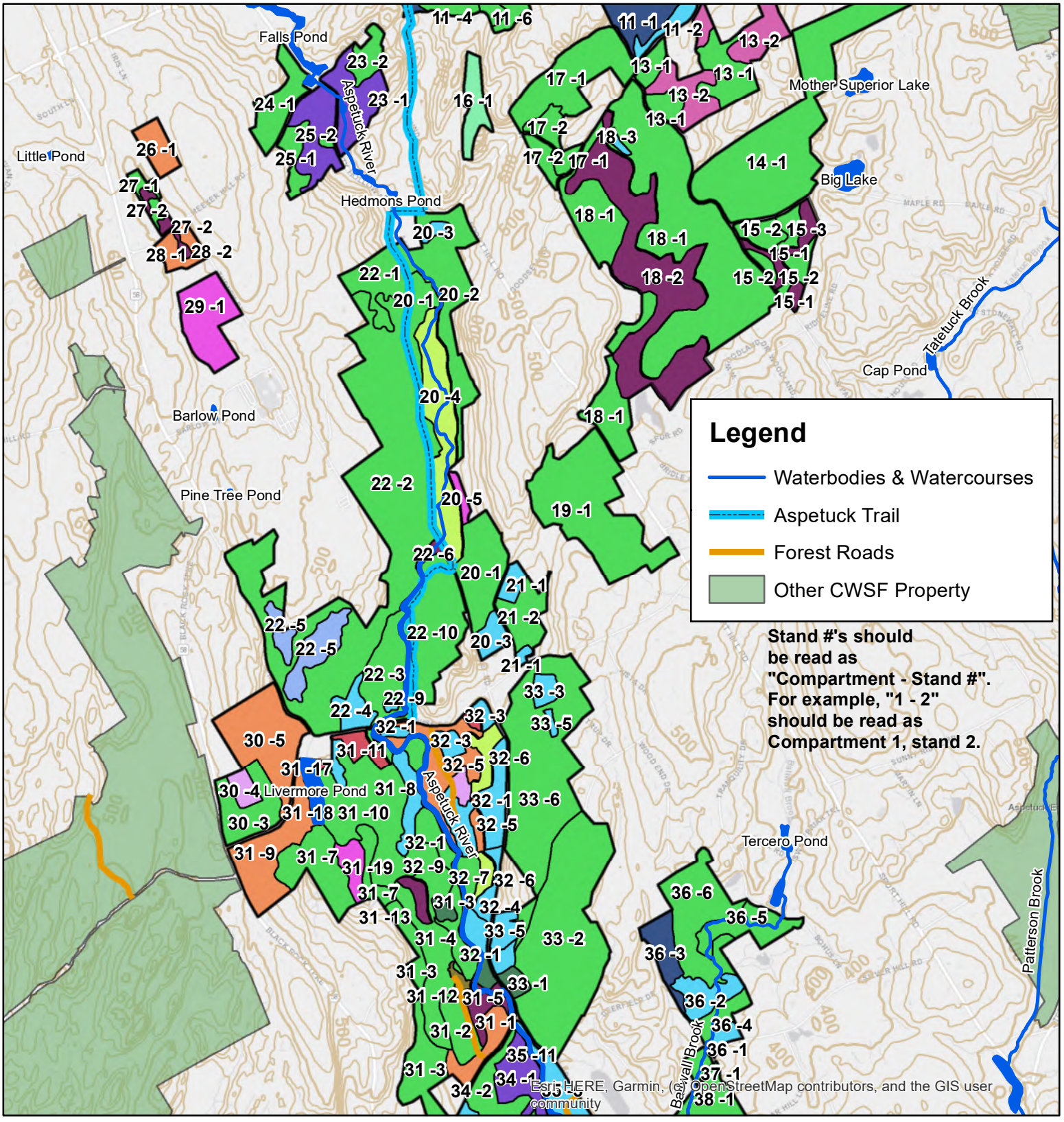

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Forest Type Map (3/4)

Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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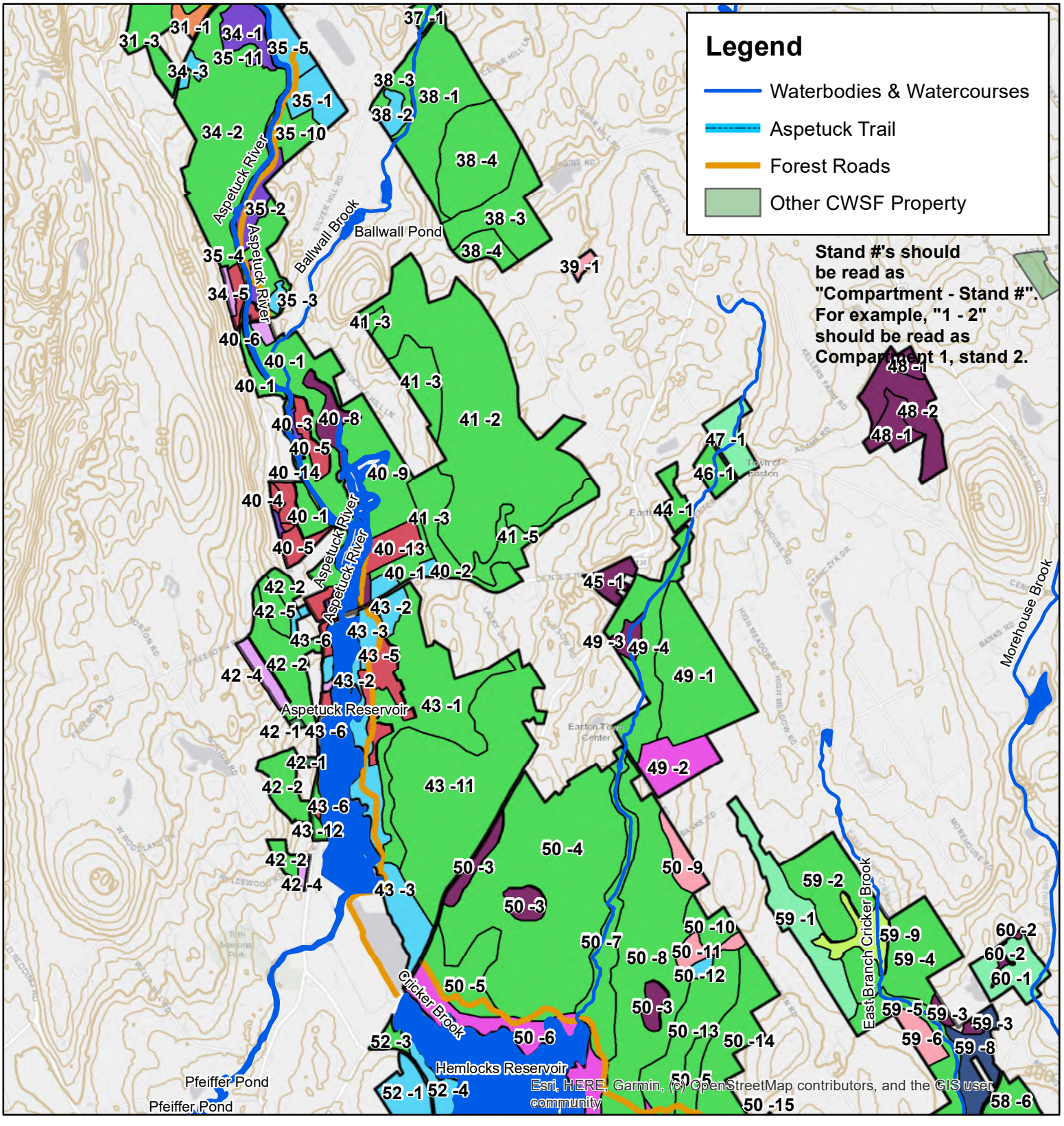

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Forest Type Map (4/4)

Easton and Fairfield, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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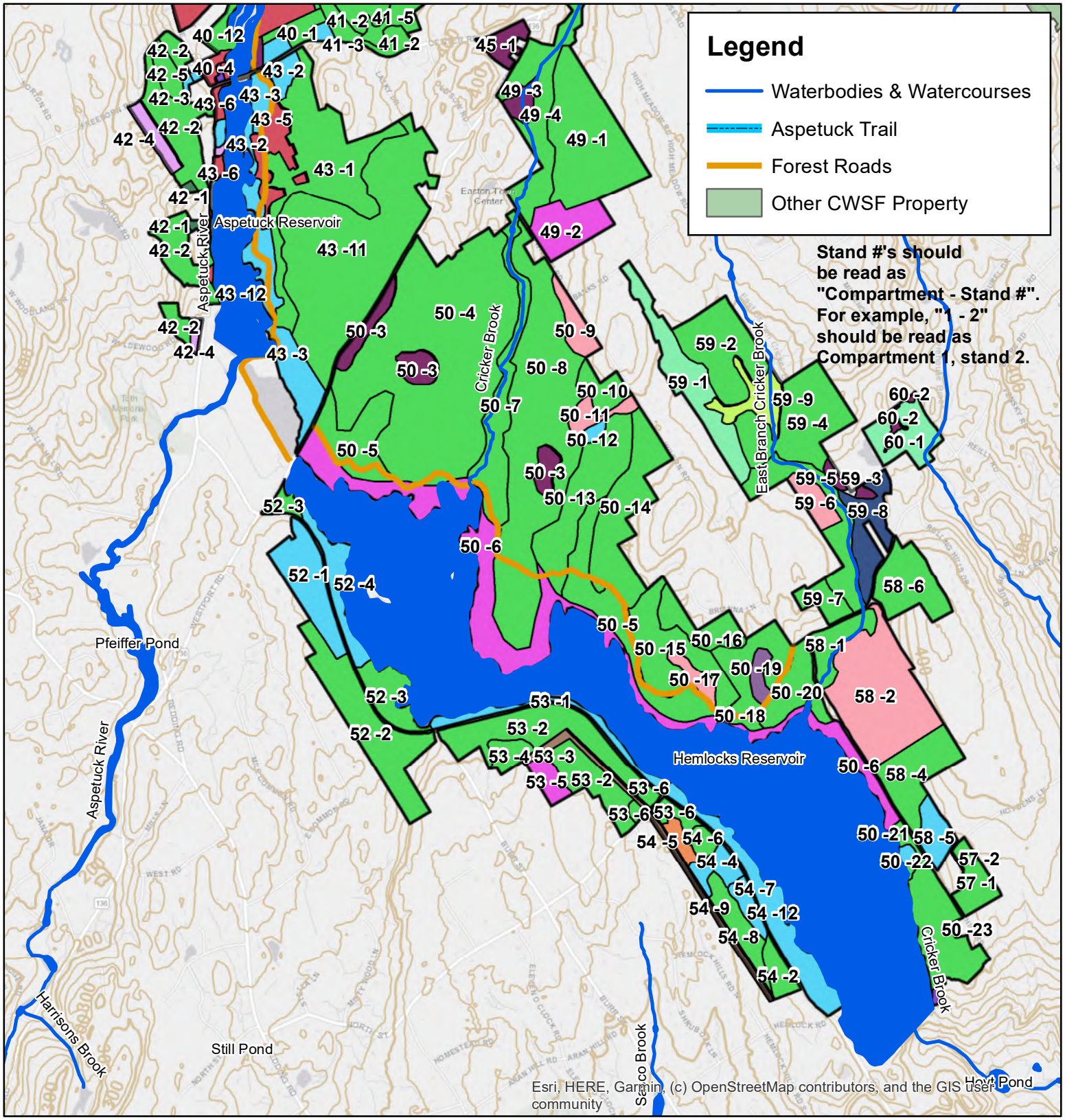

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Site Index Map (1/4)

Newtown, Easton, and Redding, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
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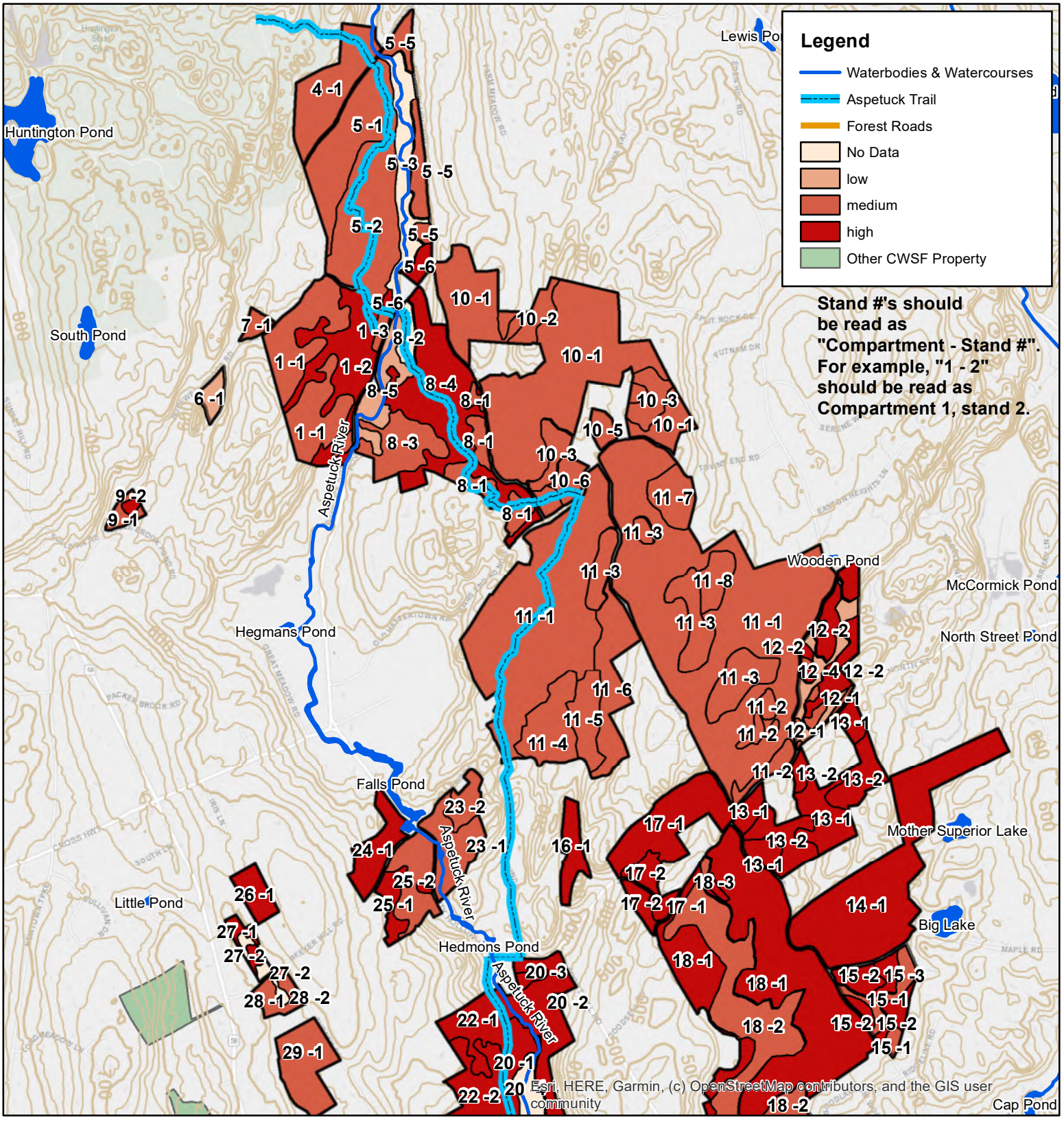

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Site Index Map (2/4)

Redding and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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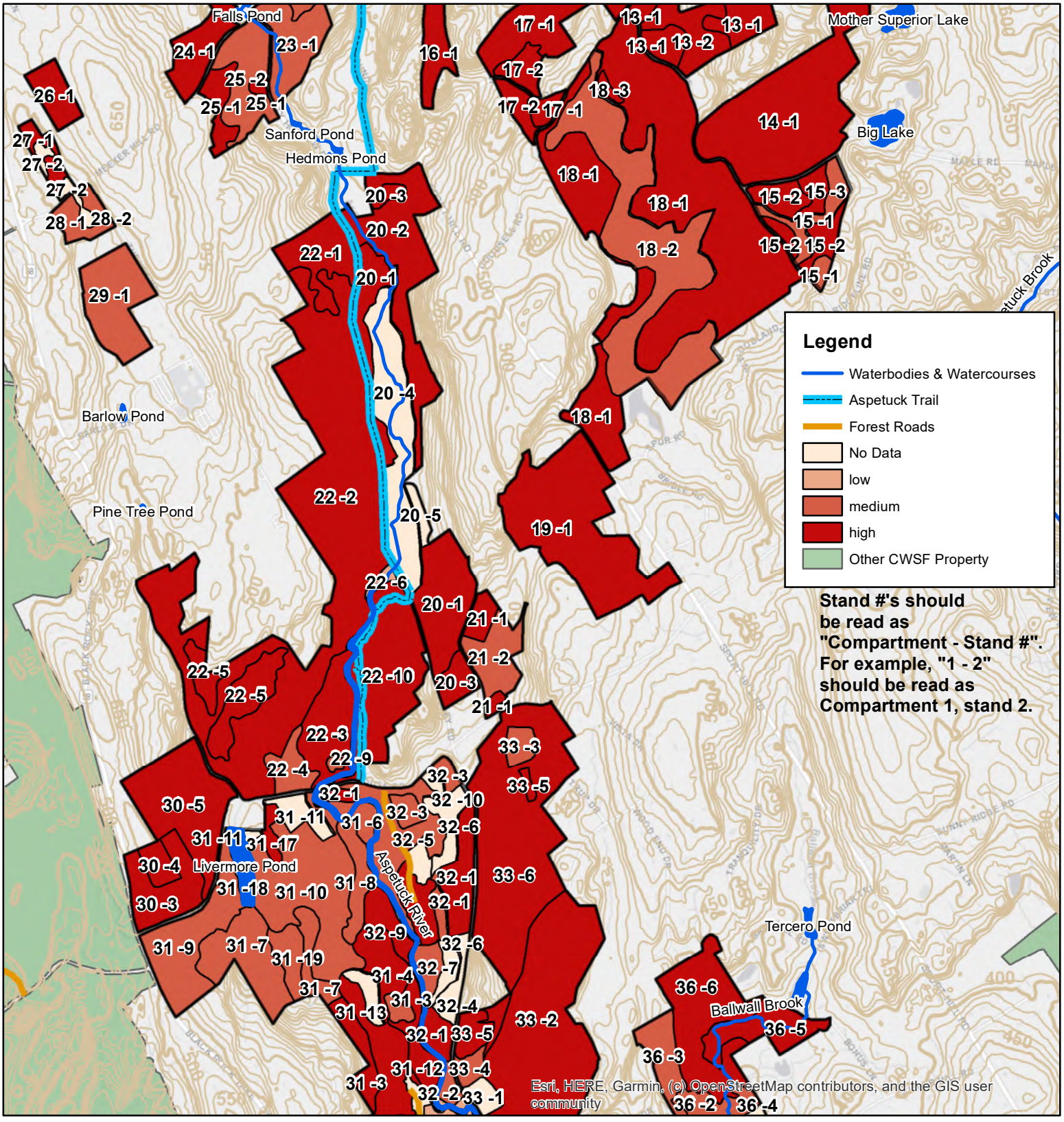

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Site Index Map (3/4)

Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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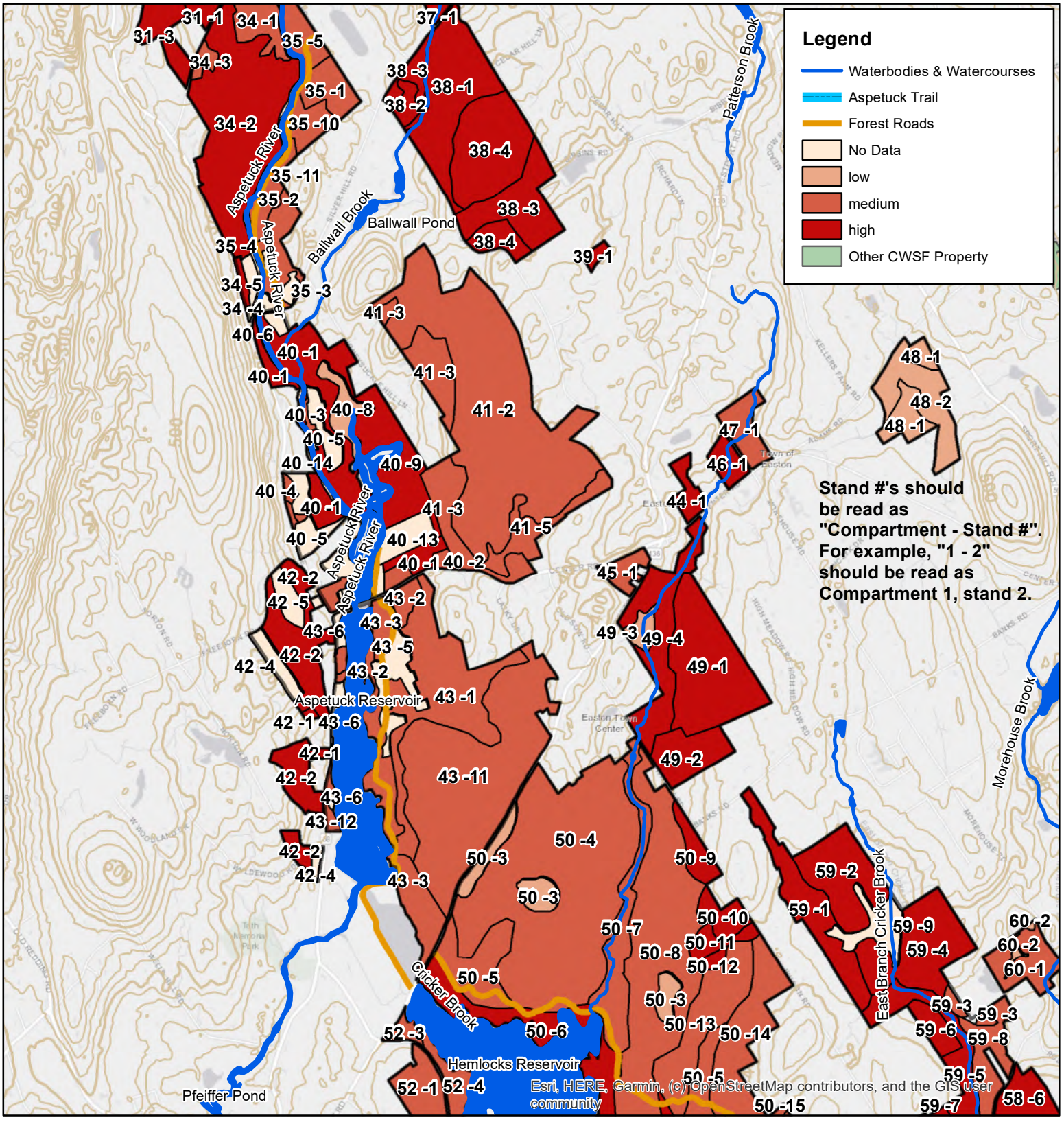

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Site Index Map (4/4)

Easton and Fairfield, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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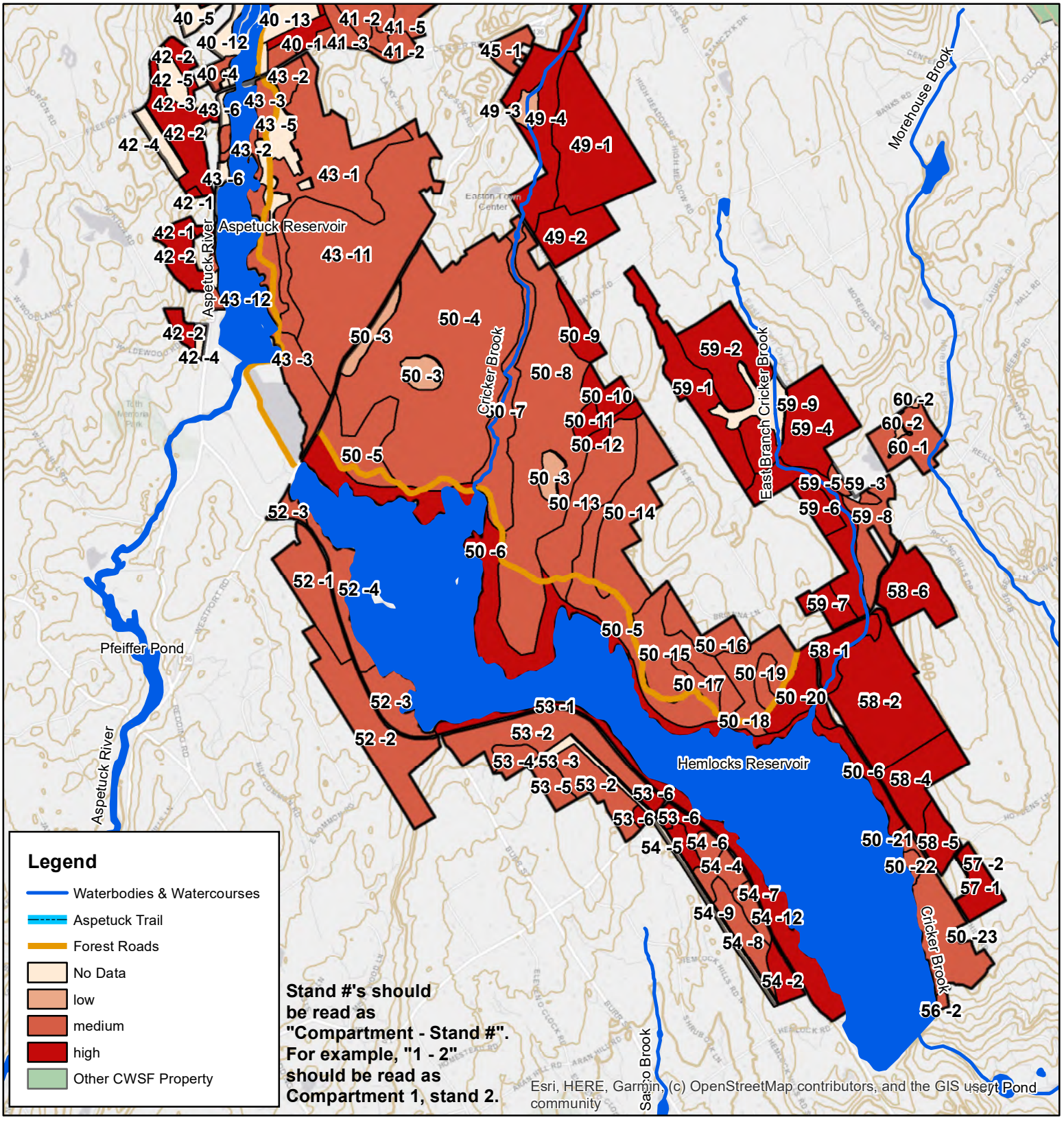

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Tree Size Class Map (1/4)

Newtown, Redding, and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
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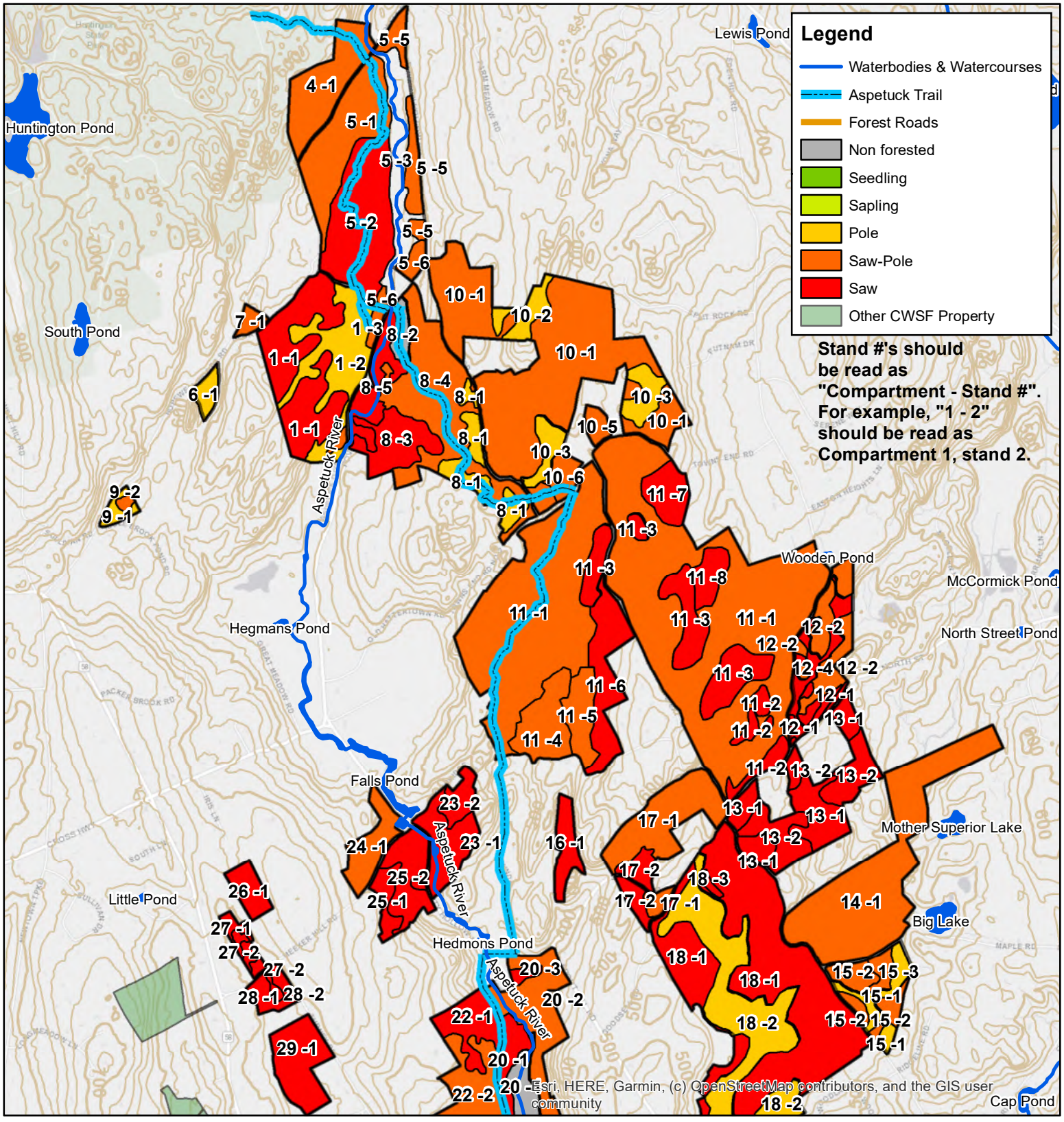

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Tree Size Class Map (2/4)

Redding and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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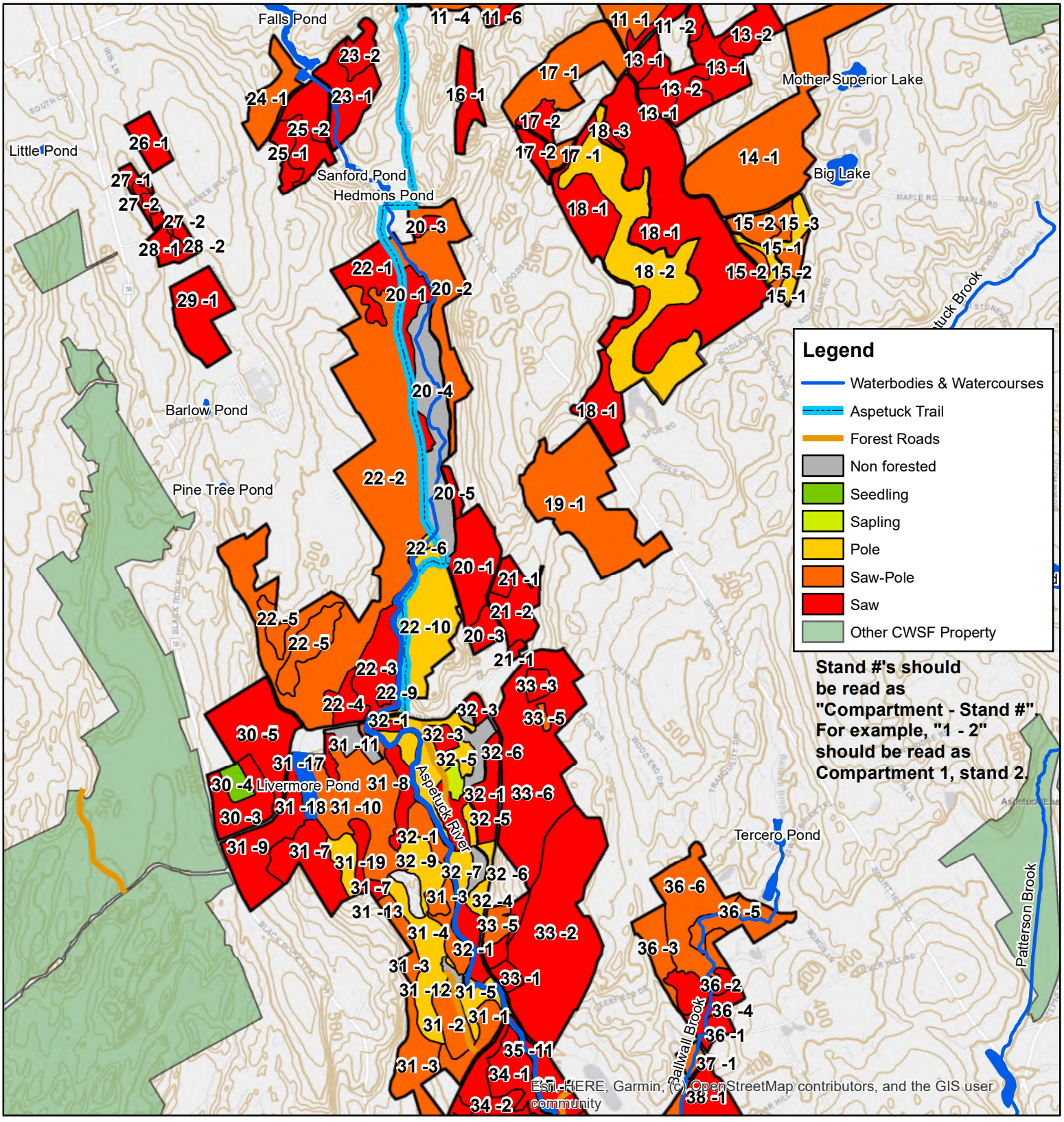

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Tree Size Class Map (3/4)

Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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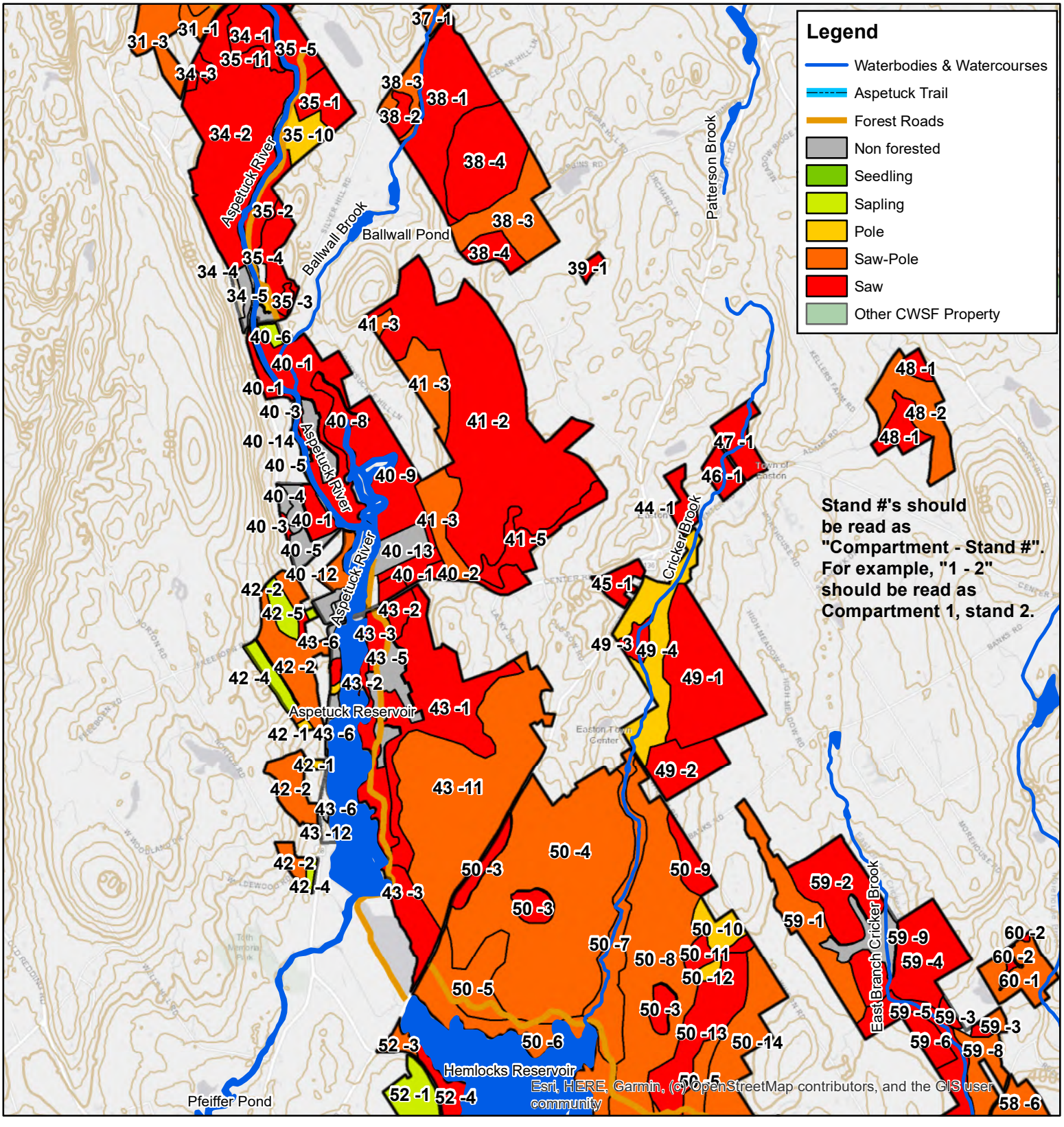

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Tree Size Class Map (4/4)

Fairfield and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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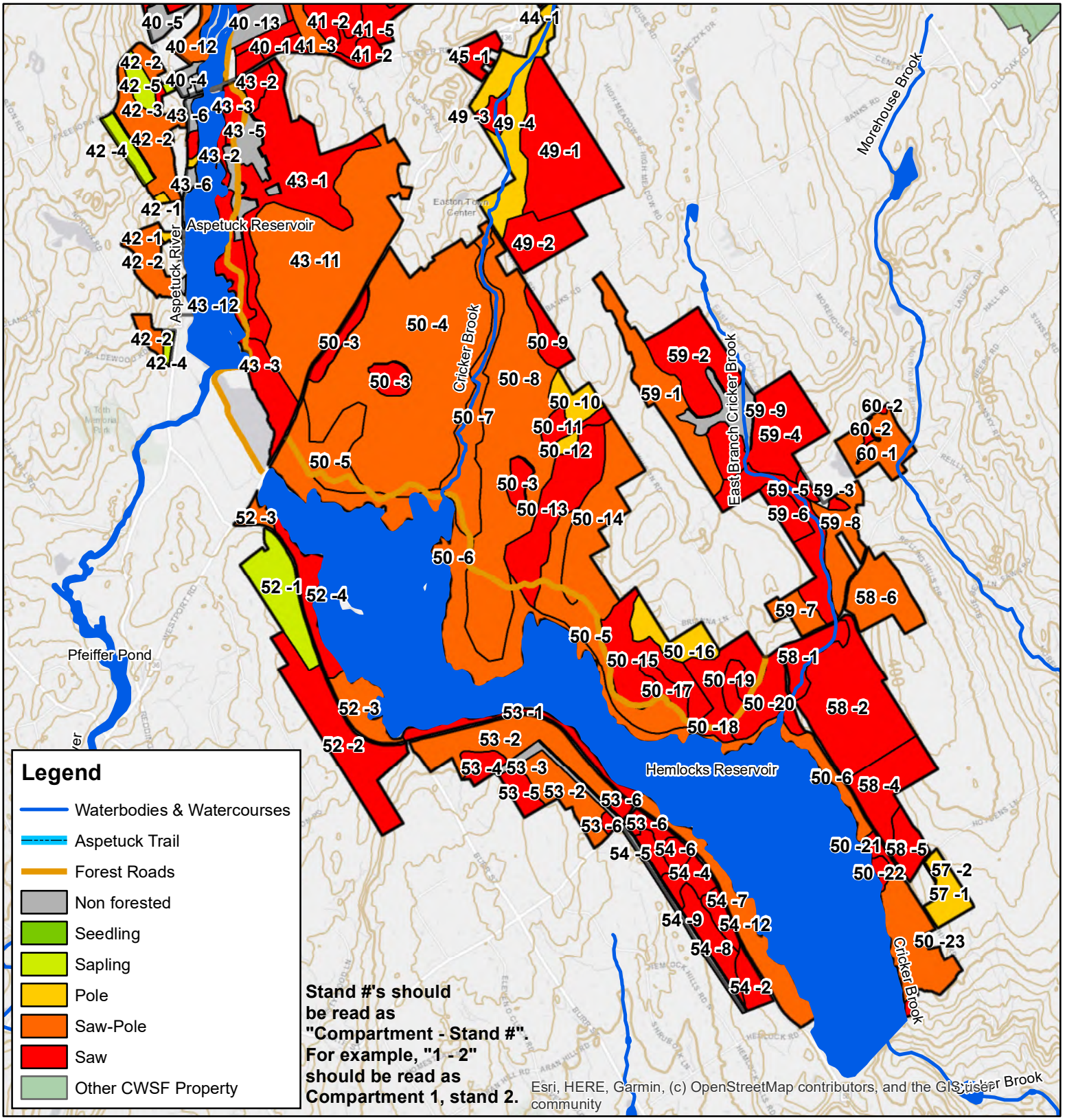

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Work Plan Map

Newtown, Easton, and Redding, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
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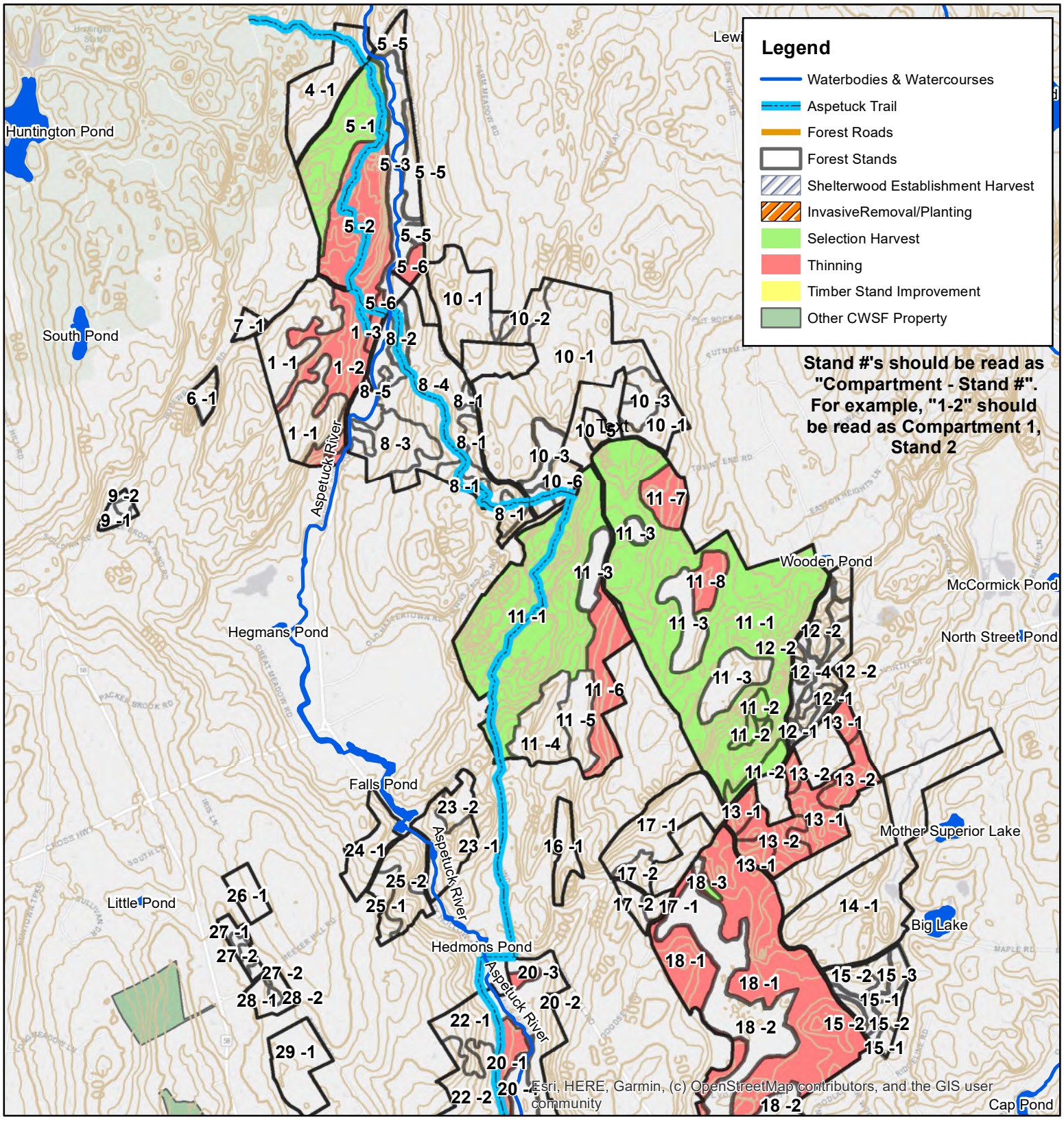

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Work Plan Map (2/4)

Newtown, Easton, and Redding, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
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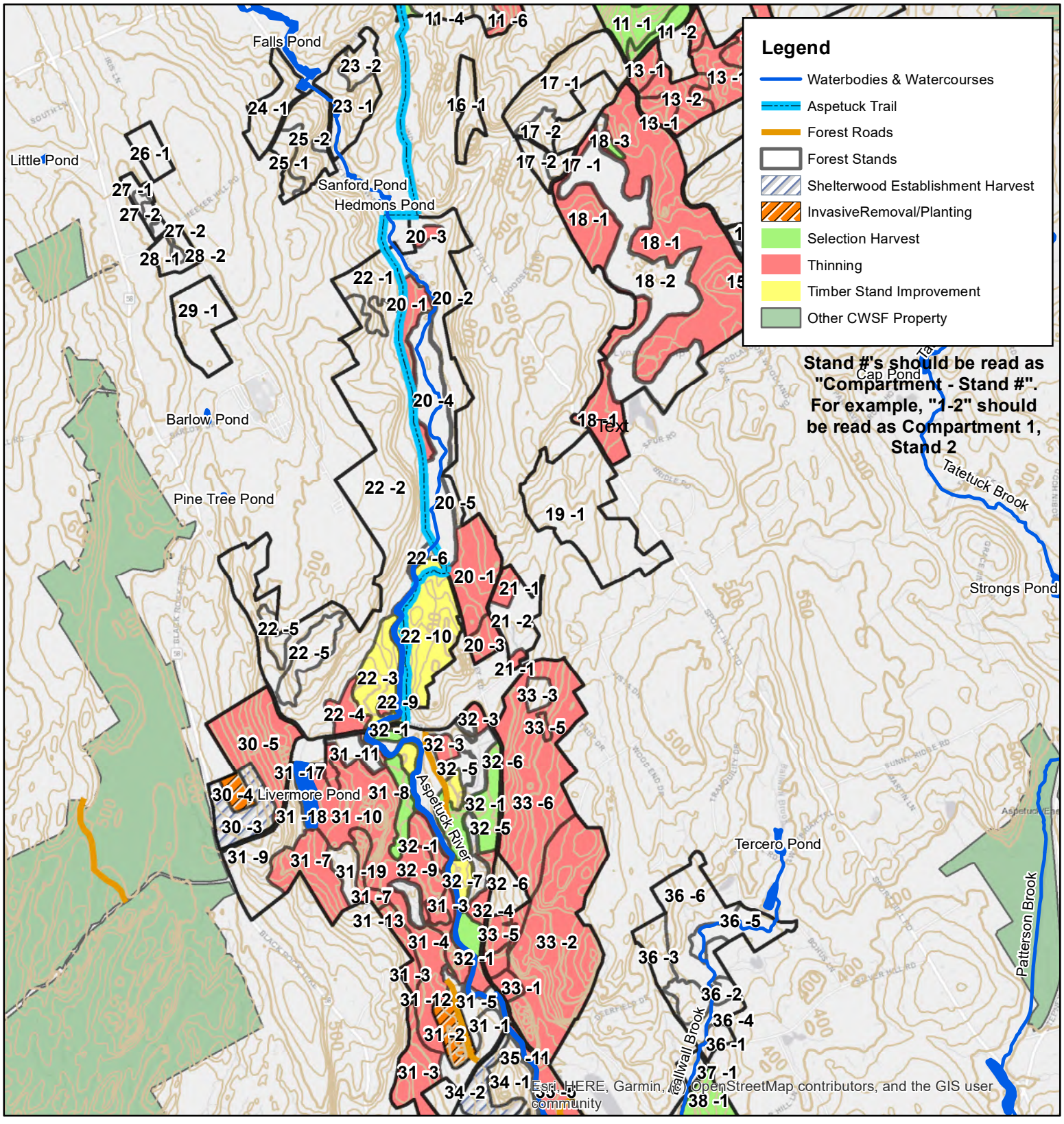

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Work Plan Map (3/4)

Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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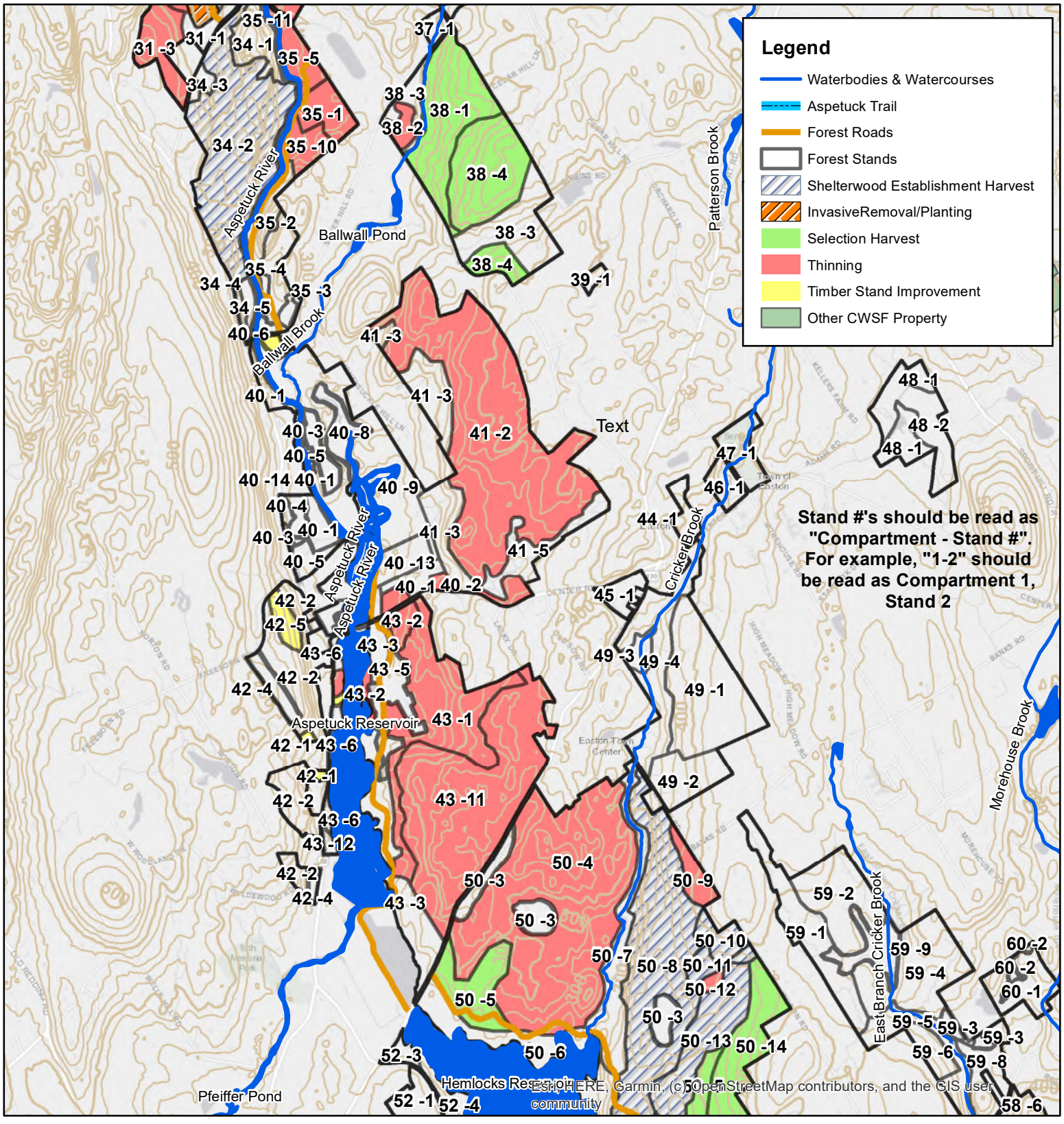

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Work Plan Map (4/4)

Fairfield and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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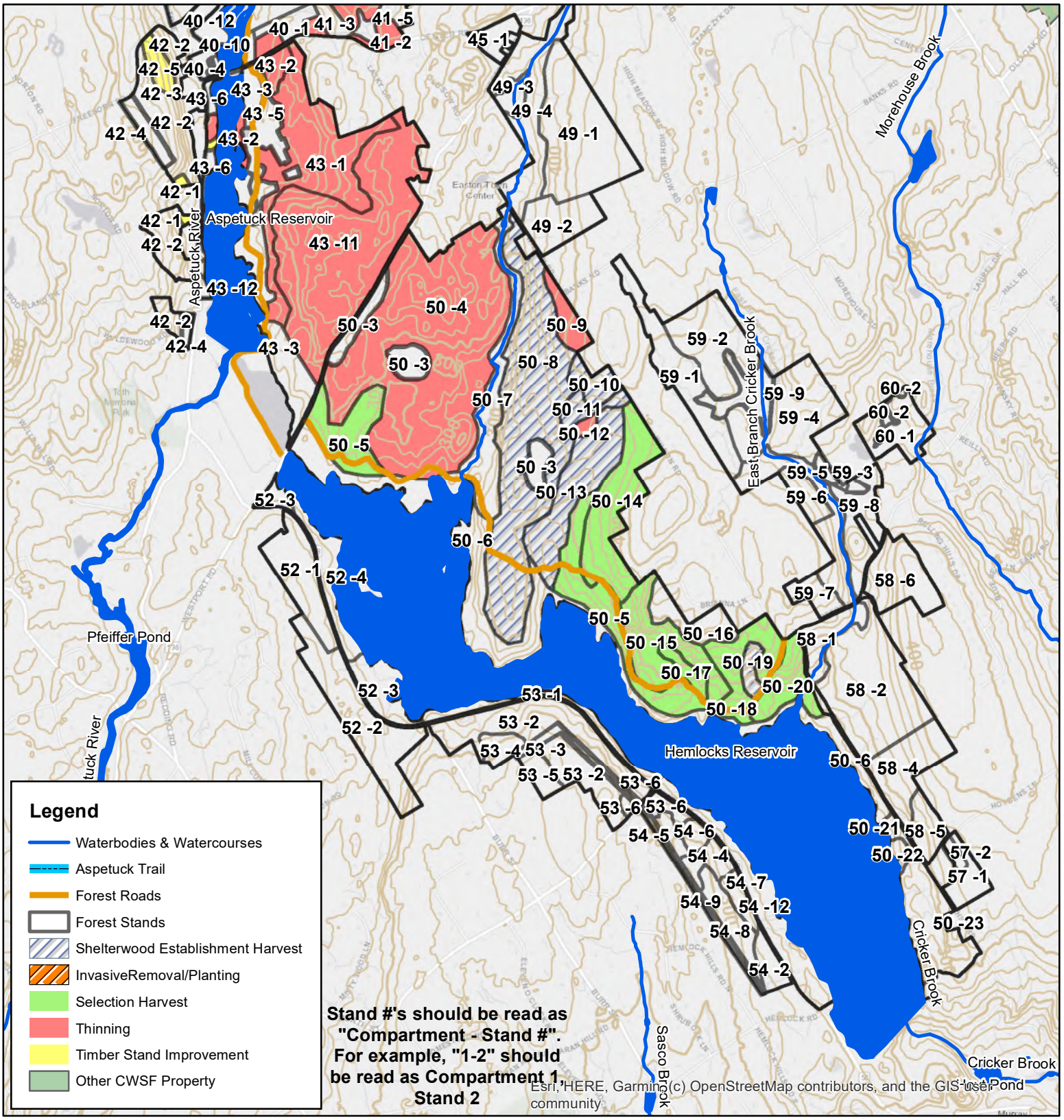

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Invasive Plant Focus Areas (1/4)

Newtown, Redding and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
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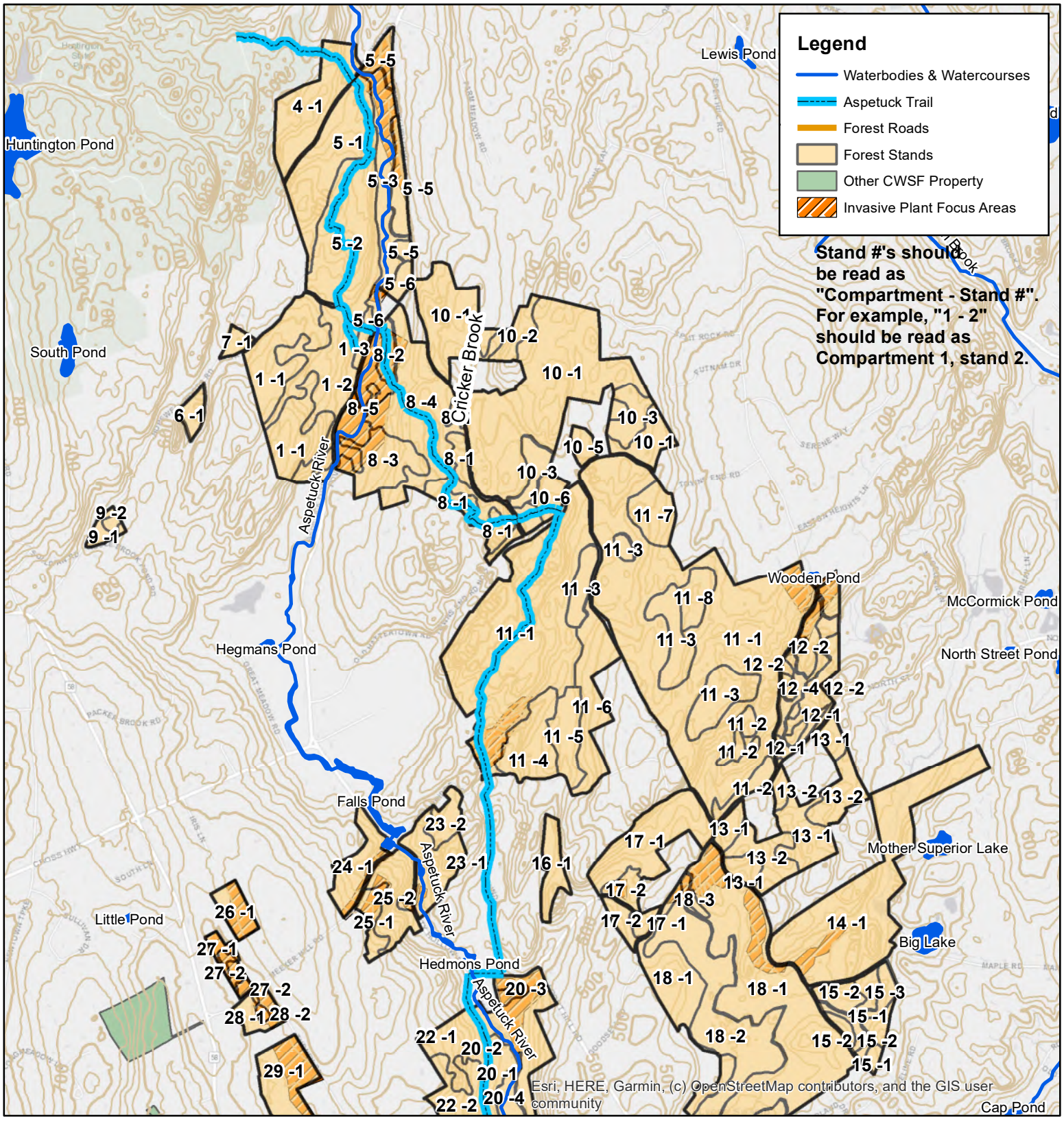

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Invasive Plant Focus Areas (2/4)

Redding and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

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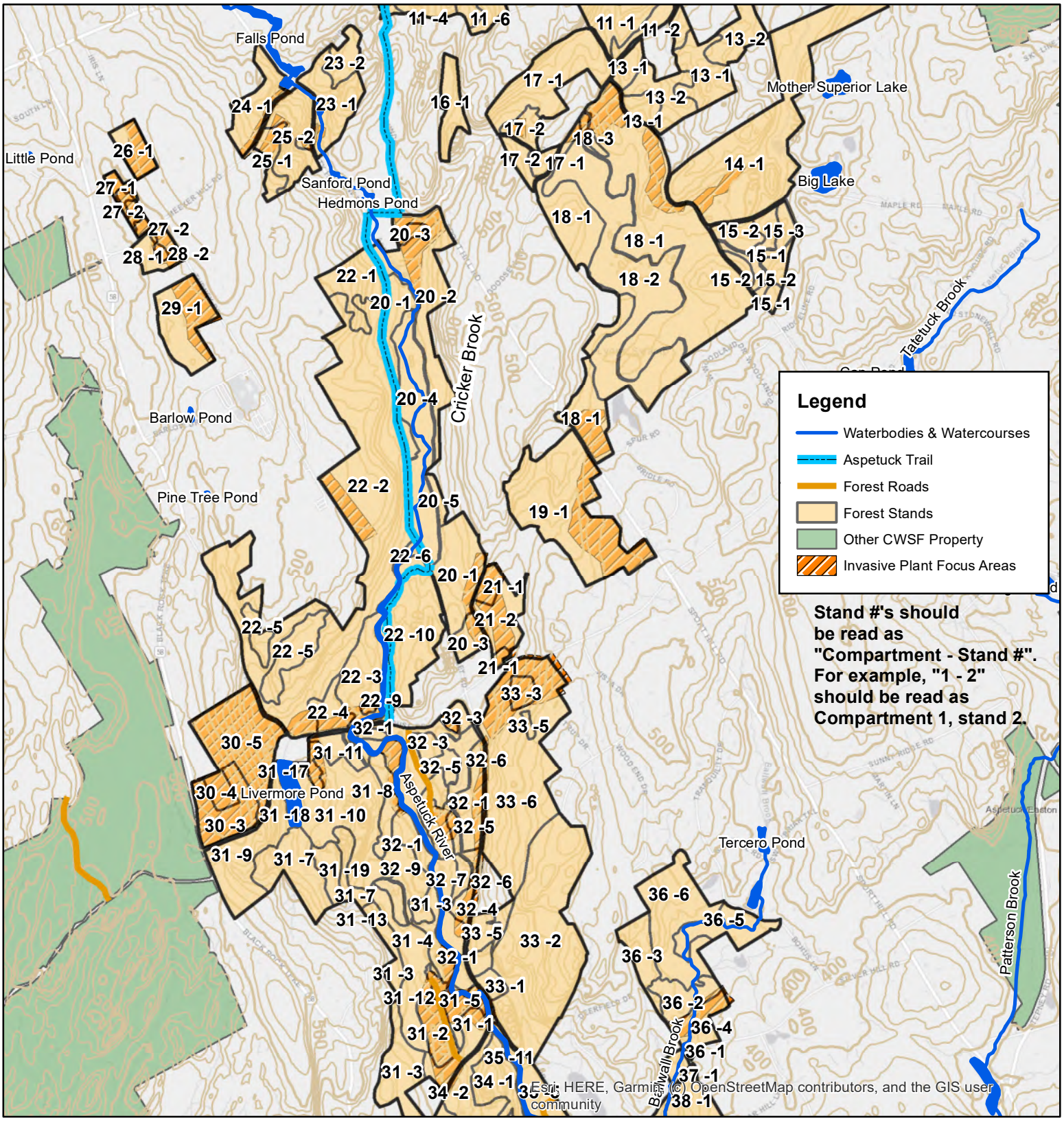

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Invasive Plant Focus Areas (3/4)

Easton, CT
4,785 Acres

Prepared by: R. Turnbull
May 2023

Map Scale 1:24,000

Miles
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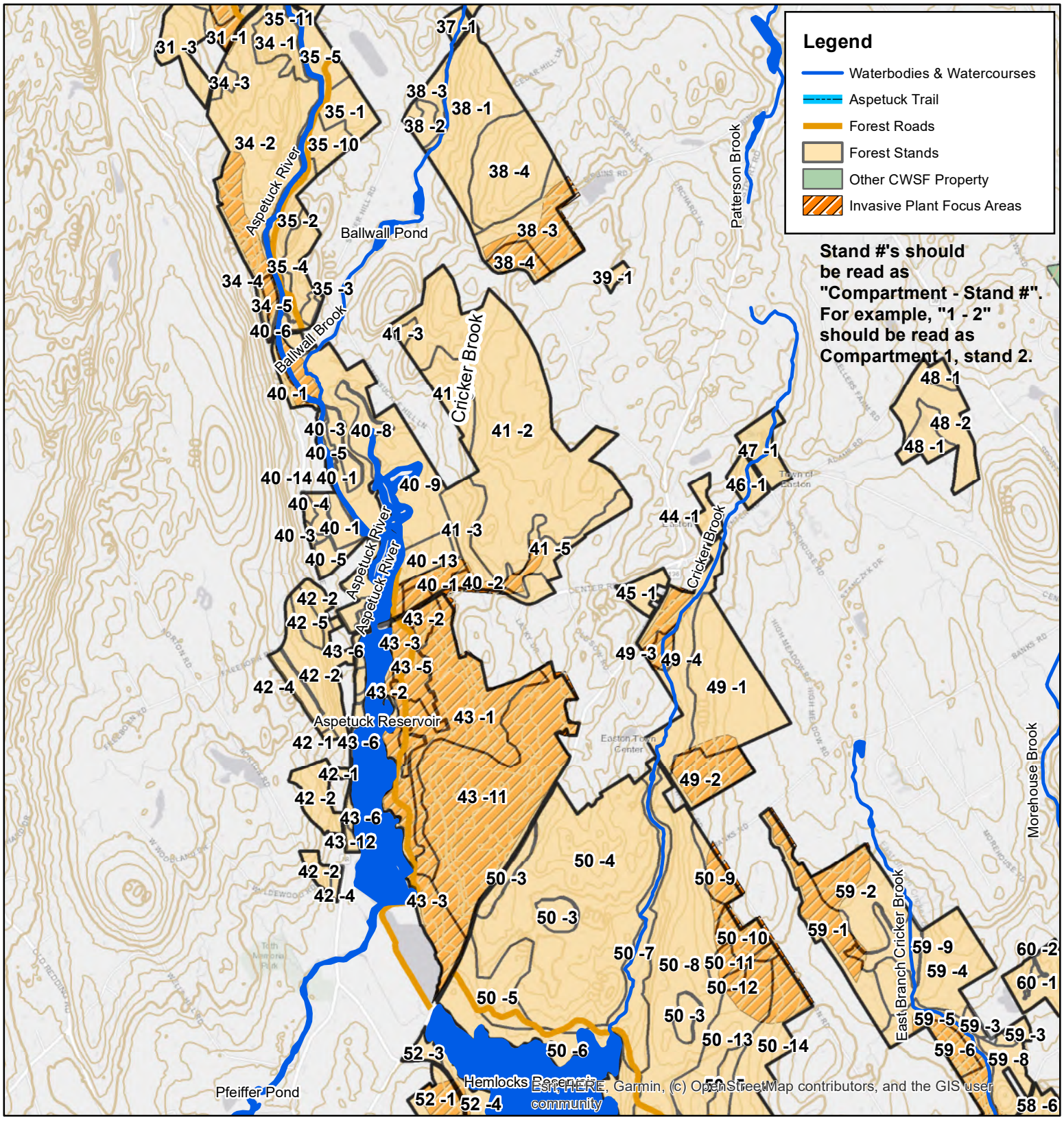

Aspetuck-Hemlock Reservoir Block - Centennial Watershed State Forest

Invasive Plant Focus Areas (4/4)

Fairfield and Easton, CT
4,785 Acres

Prepared by: R. Turnbull
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Map Scale 1:24,000

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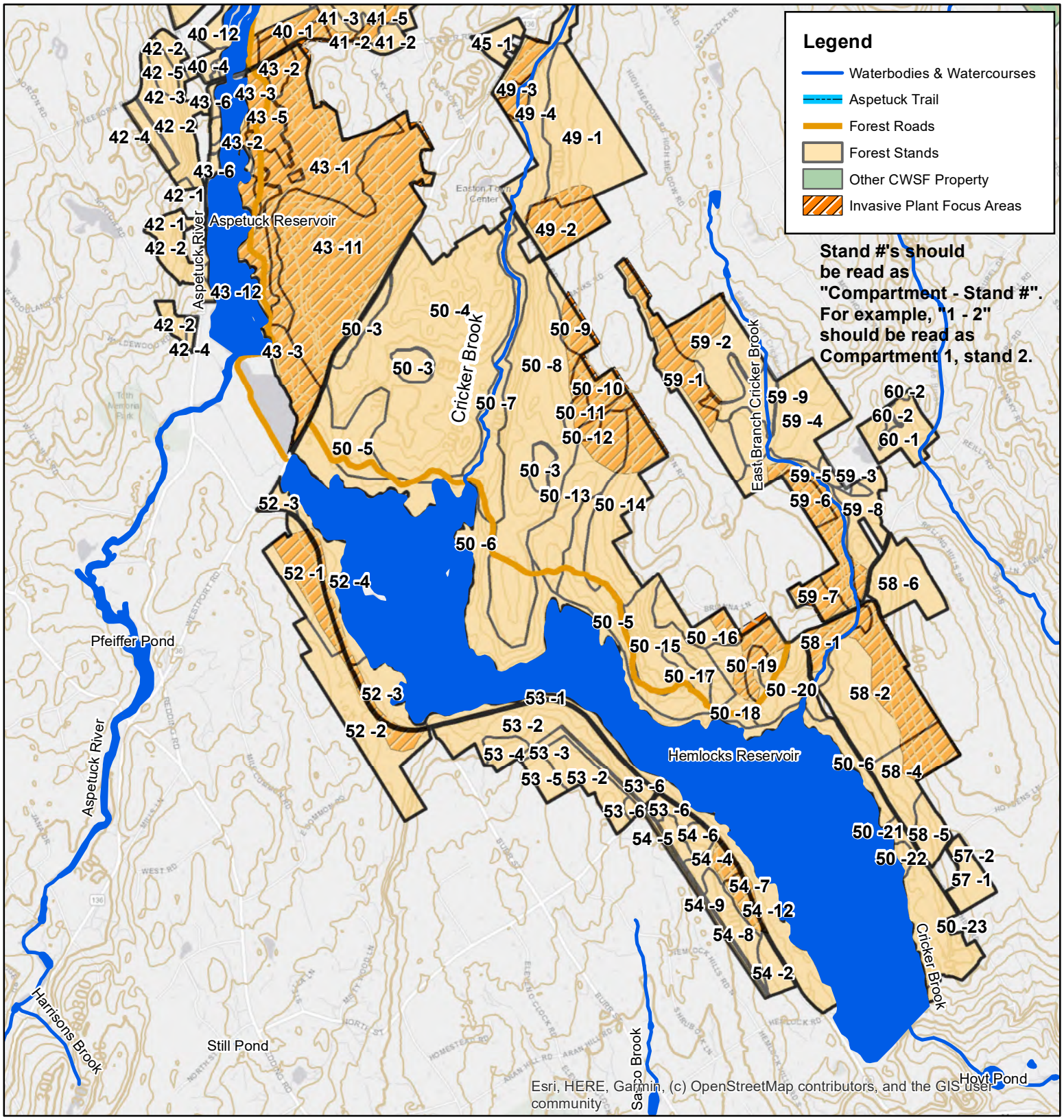

Appendix A Review and Comments

Copies of the plan were sent to the Conservation Commissions of Newtown, Fairfield, Redding, and Easton for review. Presentations were made to the Fairfield, Redding, and Easton Commissions at their request.

Fairfield Conservation Commission voted to approve the plan on 11/15/2023. Newtown Conservation Commission requested that we manage the spread invasive plants related to our forest management activities, and that we do not clearcut adjacent to the Aspetuck Trail in Newtown, which is not in our plans. Easton Conservation commission did not have specific comments, and neither did Redding. We did however, have productive and friendly discussion about our plans at the time of those meetings.

The plan was also sent to the Aspetuck Land Trust, the Redding Land Trust, the Newtown Forest Association, the Connecticut Forest and Park Association, and Highstead Arboretum.

Comments were received from these organizations and the plan was revised accordingly. We revised the names of the trail network based on feedback from CTFPA, while Highstead Arboretum provided literature and scientific feedback that will inform how we manage certain areas for old forest characteristics.

The CLC approved the plan at its meeting on 12/04/2023.

Wildlife Comments/Recommendations for Aspetuck-Hemlock Reservoir Block of Centennial State Forest

By Peter Picone, DEEP Wildlife Biologist
Habitat management and State lands Program
Sessions Woods WMA
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Burlington, CT 06013 tel. 860-424-3032

Landscape context –

Wildlife Habitat Conditions and Improvement Possibilities: The regional context of a forested area is important when considering strategies for enhancing or protecting wildlife resources. The towns of Newtown, Easton, Redding and Fairfield collectively lost 3,204 acres of forestland from 1985 to 2015 (Table 1. UConn Center for Land Use Education data https://clear.uconn.edu/projects/landscape/ct-landcoverviewer/). Habitat loss is the greatest threat to biological diversity in the region. The 4785 acres of Centennial State Forest's Aspetuck/Hemlock Reservoir Block are important in providing a stable and protected forested area within an urbanizing part of Connecticut. By its sheer size and location in Connecticut, this predominately forested block adds to the region's biodiversity and ecological processes and services. Wildlife diversity in Aspetuck/Hemlock Reservoir Block and the immediate region surrounding it will benefit greatly through the intelligent management of the forest resources laid out in this 20 year management plan. Wildlife diversity can be enhanced through forest management. Research has shown that manipulating tree size-classes promotes wildlife diversity and wildlife utilize a variety of forest size-classes (Scanlon 1992). Being in a heavily forested region of the State, Aspetuck/Hemlock Reservoir Block is an important area that provides protected habitat for wildlife and, in particular, interior forest birds. The intelligent and scientific management of the forest resources of Aspetuck/Hemlock Reservoir Block will have a positive effect on the protection of biological diversity of the region. Wildlife requiring larger tracts of unfragmented forest are already benefiting. Less abundant wildlife such as disturbance-dependent species including whippoorwill, American woodcock, brown thrasher, chestnut-sided warblers, and Eastern towhees have less suitable habitat. Habitat for these disturbance-dependent species will receive attention by enhancing their

breeding habitat through patch cuts and even-aged forest management. Habitat management actions that improve conditions for early successional habitat wildlife throughout the Aspetuck/Hemlock Reservoir block are scheduled. Special attention should be taken in Compartments/Stands #, 30, 32, 34, 40, 42, 43, and 58 where brown thrasher was identified. When feasible/practical patch cuts of 5 to 10 acres (25 acres in total) with all stems cut down to a 2-inch diameter should be created in these areas to improve early successional forest habitat. Also, a rotation of small clear cuts (5 to 10 acres) throughout the Aspetuck-Hemlock Forest block would go a long way to help create young forest habitat and help create an uneven-aged forest block. Patch cuts of at least 12 acres minimum are most valuable to early successional/disturbance-dependent species (usually have best conditions by the 3rd year through the 10th year after establishment, but good young forest habitat may persist through 15 years). Whenever feasible, thin the patch's edges/ecotone to create a dense and gradual progression of taller vegetation towards the main forest. It is also beneficial to create soft edges/ecotones adjacent to and adjoining existing fields/grasslands. This can be accomplished through aggressive cordwood cutting and/or creating patch cuts sharing a border/edge with the fields (especially fields behind Aquarion Main Office on Black Rock Turnpike).

To assist and maintain Northern Saw-whet owl wintering habitat (another listed species found in compartment/stand 1): Opportunistically use silvicultural practices in mixed forest stands to promote white pine seedling establishment and development. Given the uncertainty of the continuing loss of eastern hemlock due to invasive non-native insect damage, creating young, dense white pine seedling/sapling stands is recommended to attenuate the loss of evergreen cover due to the eastern hemlock decline and maintain healthy evergreen patches throughout. Creating dense white pine seedling patches provides beneficial evergreen cover component that serves as predator avoidance and thermal cover for wildlife. Maintain and enhance existing white pine stands through thinnings, seed tree cuts, group selection cuts or other forest management strategies to increase quality patches of white pine throughout the forest. Time forest management activities, whenever feasible, to coincide with good white pine seed crop years to improve seedling development and retention.

Improve/Create Meadow and Thicket Habitat in Log Landings: When log landings are planned, create patch cuts of 2 to 3 acres in size. These "larger-than-usual" log landings serve as small herbaceous openings with increases in thicket cover and soft mast species such as Dewberry, Black Raspberry, and Blackberry. Bare soil and/or scarified areas from the logging equipment should be seeded with native grasses and wildflowers (consult with Wildlife biologist Peter Picone for detailed seed recommendations). These areas will help improve wild turkey poult foraging sites for insects, fruits and tender herbaceous plant material.

Daylighting: cutting patches of overstory to release fruit/thicket producing shrubs that provide seasonal food sources can be accomplished with group selection cutting or individual tree harvesting. Fleshy fruit is a key food resource for both game and nongame wildlife (Martin et al. 1951). Fruit resources are important for fall migratory songbirds (Wilson 1986) and for resident birds in winter (McCarty et al. 2002, Whitehead 2003). Greenberg et al. (2007) has reported in a study in the Journal of Wildlife Management that land managers can enhance fruit availability for wildlife species by creating or maintaining young stands within forests. Identify invasive non-native plants in each forest stand and develop management strategies (where practical) to reduce or eliminate their threat to native flora. The identification of invasive non-native species during forest inventories could help in the planning efforts to identify and help curtail the expansion of the detrimental invasive non-natives throughout the forest.

Northern Long-eared Bat Conservation: this listed species will require special attention if any new nesting or roosting trees are located. The management strategies to protect this species is evolving and the DEEP wildlife division web site should be consulted for updates.

Wildlife- based Recreation - Hunting and Harvest: Aspetuck/Hemlock Reservoir Block provides opportunities for licensed hunters to be able to harvest deer which is a renewable natural resource provides supplemental food and outdoor recreation.

Although fall or spring wild turkey hunting is not allowed at this time, it should be considered. Fall turkey hunting could be added to the deer bow-hunting permits (archery fall turkey coincides with fall deer archery).

Canada goose hunting should be considered on the Aspetuck-Hemlock Reservoir Block to help manage the resident goose population that causes local and regional damage to and pollution of greenways, lawns and athletic fields. One Canada goose can excrete about 1 quart of droppings day (personal communication Dr. Michael Conover, CT Agricultural Experiment Station, 1988). Resident goose hunting seasons are split into and early and late season and are restricted to non-toxic ammunition.

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Appendix C Definitions

Size Classes

- **Sawtimber –** Hardwood trees 12-inch dbh (diameter breast height or 4.5 feet off the ground) and larger, and softwood trees 10-inch dbh and larger, that contain at least one 8-foot sawlog.
- **Poletimber –** Hardwood trees between 5 and 11 inches dbh and softwood trees 5 to 9 inches dbh. These trees are too small for sawlogs, but could be sold as pulpwood, fuelwood, or other small products where such markets exist.
- **Saplings –** Trees 1 to 5 inches dbh.
- **Seedlings –** Trees less than 1 inch dbh.
- **Stand –** An area of trees of a certain species composition (cover/IV type), age/size class distribution, and condition (quality, vigor, risk), usually growing on a fairly homogeneous site.

An **even-aged** stand contains trees in the main canopy that are within 20 years of being the same age.

An **uneven-aged** stand contains trees of several 15–20-year age classes.

Types of Silvicultural Treatments

- **Clearcut –** Used in even-aged management to regenerate a new forest using seeds already in the soil, seeds brought in from adjacent areas via wind or animals, and/or sprouts from stumps. All stems are removed to provide maximum sunlight for the new forest. Trees such as black cherry, yellow poplar, aspen, and paper birch often regenerate after clearcuts. Often used to create early successional wildlife habitat.
- **Selection harvest –** Used in uneven-aged management. Trees are removed singly or in small groups up to an acre in size, maintaining a fairly continuous canopy. Selection harvests tend to favor trees that can grow in partial shade such as sugar and red maples, black and yellow birch, beech, and hemlock.
- **Single-tree selection** – An uneven-aged Silvicultural technique involving the removal of trees singly or in groups of 2 or 3, which maintains a continuous canopy and an uneven-aged or uneven-sized misture.
- **Group selection** – An uneven-aged Silvicultural technique involving the removal of trees in groups usually 1/10 to 2/3 acre in size, but sometimes up to 1 or 2 acres on large properties. Group selection can be applied in combination with single-tree selection to create a more varied landscape.
- **Shelterwood** – Used in even-aged management. Understory and lower crown canopy trees are removed to allow the new stand to regenerate in partial sunlight. Trees to be retained are usually of the best quality to serve as a desirable source of seed and improve the genetic stock of the forest. After adequate regeneration is established, the overstory is removed in one or two cuts. Shelterwoods are often used to regenerate species such as oak and white pine that have irregular crops of seed and gain an advantage over other species when regenerating in partial shade.
- **Thinning –** The removal of some trees to enhance the vigor and growth of other trees without intentionally regenerating the stand. Allows for the removal of undesirable trees either due to genetic quality, disease, or potential mortality.
- **Seed Tree –** An even-aged Silvicultural technique similar to a clearcut, but leaves several residual trees per acre to provide a seed source of the species you are trying to regenerate (i.e. oak).

Definitions

- **Age class –** The trees in a stand that became established at, or around, the same time. The range of

tree ages in a single age class is usually less than 20 percent of the expected age of that class.
 Basal area – The cross sectional area of a tree's stem at 4.5 feet above the ground, or breast height. Basal area per acre is often used as a stand metric to determine stand stocking and density.
 Best Management Practices – Procedures and treatments that lessen soil erosion, sedimentation, stream warming, movement of nutrients, and visual quality during or following forest management activities.
 Biological diversity – The variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur. Also, the variety of ecological structures and functions at any one of these levels.
 Board-foot volume – The volume of wood expressed as the number of boards 1x1 foot and 1 inch thick
 Carbon sequestration – The process of removing carbon from the atmosphere for use in photosynthesis, resulting in the maintenance and growth of plants and trees. The rate (or amount and speed) at which a forest sequesters carbon changes over time. In the northeastern United States, carbon sequestration (rates) typically peak when forests are young to intermediate in age (around 30-70 years old), but they continue to sequester carbon through their entire life span.
 Carbon storage – The amount of carbon that is retained in a carbon pool within the forest. Storage levels increase with forest age and typically peak in the northeastern United States when forests are old (>200 years).
 Mature tree – A tree that has reached biological maturity shows declining year-to-year volume growth.
 Native plant – A species that naturally occurs in a given location where its requirements for light, warmth, moisture, shelter, and nutrients are met.
 Non-commercial treatment – Any forest management activity that does not produce enough revenue to pay for the costs associated with the treatment.
 Nutrient – Elements and other chemical substances that support biological activity (i.e. Nitrogen, phosphorus, potassium, sulfur, etc.)
 Old Growth – A forest community that has remained undisturbed by man for a long period of time, the length of which is relative and dependent upon locality.
 Overland flow – The portion of rain or snowmelt that flows over the surface of the soil until it reaches a stream channel. It is not absorbed by the soil. Overland flow in forests is rare unless leaf litter and organic horizons of the soil have been severely disturbed or mineral soils have been compacted.
 Patch – A patch is a relatively homogeneous area that differs in some way from its surroundings (e.g., woodlot in a corn field, conifer plantation in a mixed-deciduous forest).
 Peak water flow – The instantaneous maximum flow of water, often occurring as the result of an intense storm, snowmelt, or a combination of both.
 Plantation – A forest stand in which most trees are planted. Typically, planted trees are in rows with equal spacing between each tree.
 Regeneration cuttings – Silvicultural cuttings designed to naturally regenerate the stand by providing for seedling or stump sprout establishment.
 Relative Density – An index of crowding in forest stands, also called the tree-area ratio; a measure of the absolute stand density expressed as a ratio to the density of some reference level. The reference level is usually the stand density of a fully stocked stand for a particular species composition, site, and method of treatment.
 Sedimentation – The accumulation of organic and mineral soil particles and rocks in streams and water bodies due to erosion. Sedimentation often accompanies flooding. The application of Best Management Practices will help protect against sedimentation during and after treatments.
 Seed tree – A tree that produces seed. Seed trees are usually mature and of acceptable quality.

 Shade intolerance – The relative inability of a plant to become established and grow in shade.
 Shade tolerance – The relative ability of a plant to become established and grow in shade.
 Silviculture – The art, science, and practice of establishing, tending, and reproducing forest stands with desired characteristics.
 Species diversity – The number of different plants, animals, and other life forms coexisting in a community.
 Stand condition – The relative number, size, species, quality, and vigor of trees in a forest stand
 Stand density – A quantitative measure of the proportion of area in a stand occupied by trees such as basal area or trees per acre.
 Stocking – A subjective indication of stand density that helps determine whether the stand needs to grow further, be thinned, or regenerated
 Sustainable – The indefinite and steady supply of something
 Understory – The saplings, shrubs, seedlings, and other vegetation growing beneath the forest canopy and above the herbaceous plants on the forest floor.
 Vertical diversity – The extent to which plants are layered within an area. The degree of layering is determined by two factors: 1.The arrangement of different growth forms (trees, shrubs, vines, herbs, mosses, and lichens); 2. The distribution of different tree and shrub species having different heights and crown characteristics
 Water quality and quantity – A category of factors associated with forests that include intensive protection of water quality, riparian areas, wetlands, and fisheries.
 Water yield – The distribution and total quantity of runoff, usually considered over some specified period of time. Water yield may be characterized by total volume of runoff and flow duration curves.
 Watershed – An area of land through which precipitation is redistributed into components of the hydrologic cycle, including evaporation, groundwater, and streamflow. A watershed is all the land giving rise to streamflow at a selected point in a stream channel; the area drained by a river or stream and its tributaries.
 Wetland – In the absence of a single, universally recognized definition, a wetland is a land/water ecosystem characterized by periodic inundation. The soils are developed under the influence of saturation. It supports plants and animals adapted to these conditions.