Forest Stewardship Plan

Prepared for

Township of Byram

10 Mansfield Drive
Stanhope, NJ 07874

Property location

Block 226 Lot 25.02; Block 222 Lot 1.00; Block 336 Lot 43; Block 335 Lot2

Byram Township
Sussex County

973-347-2500

Total acreage: ~ 147
Forest acreage: ~147 acres

Planning period: 10 years
Plan prepared for 2009-2018

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Property Location:

The Arnell and Owners Maintenance Properties are located on Andover Lake Mohawk Road. They can be reached from Sparta-Stanhope Road by turning right onto Amity Road (if you are heading south). Proceed for 0.3 miles on Amity Road and make a right onto Lee Hill Road. Follow Lee Hill Road for 1.5 miles and make a left onto Andover-Mohawk Road. Proceed 0.6 miles. The Arnell tract is on the left side of the road (there is a small pull out there) and Owners Maintenance is directly across the street.

The Beckmann/Kostrey parcel can be accessed from Route 206 South by turning left onto Tamarack Road. Go 500 feet and make a right onto Little Paint Way. Proceed 0.25 miles and turn left onto Rodger Drive for 700 feet (you will bear right) and take the first left. Proceed 300 feet to the small parking area on the right, prior to the private home on the dead end.

Property Description:

These three properties combined consist of approximately 147 acres. Owners Maintenance covers approximately 46 acres. The Arnell tract covers approximately 40 acres. The Beckmann/Kostrey tract covers approximately 61 acres. All three of these properties are completely forested at this time. Each has variable terrain and two contain small pockets of wetlands. No wetlands were noted on the Owners Maintenance tract.

Forest History:

These properties have not been under extensive management in recent years. Some stumps were noted but most were cut some time ago. Historically most of these forests were likely cleared for fuel for the iron industry or charcoal production.

Boundary Delineation:

The property boundaries are not clearly marked currently but will be marked with paint and signage early in the planning period. These properties were recently surveyed and should be posted before the survey flagging disappears.

Clearly delineated boundaries are a critical requirement to actively manage the land. Marked boundaries will prevent trespass and the possibility of encroachment and illegal dumping given the proximity of residential properties. In some cases adjacent privately owned land is clearly delineated.

Landowner Profile:

The land is owned by a small Township. Forest management activities will be completed by the Township, in cooperation with the forester and potentially carried out by volunteers or contractors. The Township is enthusiastic about owning and managing their woodlot and being active stewards of the land.

Landowner Objectives:

The management objectives for the Byram Township properties are:

1. Maintain forest health and vitality through forest Stand improvement activities.
2. Manage these lands for multiple wildlife species.
3. Incorporate hiking trails and passive recreation on these properties.
4. Incorporate a deer reduction program to improve forest health conditions.
5. Control invasive species prior to further proliferation on these properties.
6. Clean up litter on the Arnell tract.
7. Monitor ATV trespass and enforce existing regulations.
8. Conserve soil and water resources by incorporating Forest Management Best Management Practices.

Soil Descriptions:

Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils – This soil is nearly flat. Ponding is frequent up to 1 foot in depth outside of the growing season. Depth to the water table is 0-6 inches. This soil has a very slow infiltration rate and a high potential for runoff.

Catden mucky peat, 0 to 2 percent slopes (CatbA) soils – This soil is flat. Ponding is frequent through the entire year with the exception of July through September. Depth to the water table is 0-6 inches. This soil has a very slow infiltration rate and a high potential for runoff.

Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes (ChkC) soils - This soil series is moderately sloped and rocky. Depth to the water table is greater than 80 inches. This soil has a very slow infiltration rate. Surface water runoff is high. Available water capacity is low.

Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils - This soil series is very steep. Depth to water table is greater than 80 inches. Available water capacity is low to very low. Potential of damage to soil by fire is moderate. This soil is poorly suited for log landings and roads.

Hibernia loam, 0 to 8 percent slopes, extremely stony (HhmBc) soils - This soil is level to slightly sloped. Depth to water table is 6-18 inches. This soil is somewhat poorly drained. This soil has a slow infiltration rate when soils are wet. Runoff potential is very high. Available water capacity is very low.

Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils - This soil is moderately sloped. This soil is well drained. Depth to water table is about 18 to 40 inches. Available water capacity is low. This soil has a slow infiltration rate when soils are wet. Runoff rates are very high.

Table 1. Soil Information

Soil Symbol	Erosion Hazard	Equipment Limitation	Seedling Mortality	Windthrow Hazard	Site Index *	Species to Favor
AhcBc	Slight	Moderate	High	Moderate	Red Maple 50	Arborvitae, White Spruce
CatbA	Slight	Severe	High	Severe	Red Maple 56 SilverMaple 82	Arborvitae, White Spruce
ChkC	Moderate	Moderate	Low	Low	Red Oak 70 Sugar Maple 65 White Ash 75	White Pine, Norway Spruce, Red Pine

ChkE	Moderate	Severe	Low	Low	Red Oak 70 Sugar Maple 65 White Ash 75	White Pine, Norway Spruce, Red Pine
HhmBc	Slight	Severe	High	Moderate	White Pine 55 Red Oak 47 Sugar Maple 56	White Pine
RokD	Severe	Moderate	Low	Low	Upland Oaks 70 Tulip Poplar 75 White Ash 65	Austrian Pine, White Pine, Norway Spruce

*** Site Index (SI)**

The collective influence of soil factors will determine the site index for a particular tree species on a given soil area. Site index is the total height to which dominant trees of a given species will grow on a given site at some index age, usually 50 years in the Northeast. Dominant trees are the tallest trees in the Stand. If it is stated that an area has a site index for Sugar Maple of 70 feet at 50 years, then we expect Sugar Maple seedlings planted on that area today to be 70 feet tall in 50 years. Index age and tree species must be stated when referring to site index because the site index of one species will be different from the site index of another species growing on the same area.

The following factors have a major impact on forest soil productivity and site index:

Topsoil Depth. The depth of the uppermost soil layer is a critical factor affecting tree growth. Topsoil is highest in organic matter and nutrients, is usually well aerated and drained, and allows maximum root growth and root penetration.

Soil Texture. The proportion of sand, silt and clay in the topsoil and subsoil layers is called texture. Sandy soils are normally very well drained and often lack nutrients due to constant leaching loss. At the other end of the spectrum are the pure clay soils comprised of very small, fine soil particles.

Subsoil Consistence Class. Consistency of the subsoil layer is another important factor in forest soil productivity. The combination of soil-sized particles and the physical and chemical properties of each individual particle type in a given soil determine the soil's consistence class.

Limiting Layers. A layer which restricts the downward penetration of a tree's root system will reduce tree growth in direct relation to the depth of layer. In rare instances, a limiting layer may

increase site productivity, such as below sandy soils where the layer may retard leaching of nutrients and increase available moisture.

Fertility. Fertilization is normally not recommended early in the rotation except in the case of a critical deficiency of a major nutrient such as phosphorus. A soil test prior to site preparation will alert a landowner to critical deficiencies.

Research has shown conflicting results in forest tree response to nitrogen fertilization, particularly early on. Growth may be suppressed if the fertilizer increases the growth of competing weeds. Best planting success results from early fertilizer use arise in combination with herbicide or mechanical control of competing vegetation. Fertilization will not be required for reforestation efforts on these properties.

Internal Drainage. Few tree species can grow in soils which are constantly wet. Drainage can be improved in some cases by tilling, ditching, or adding bedding as a site preparation method. Measuring Site Index can be determined by two methods: One method is to locate on the area in question several dominant trees of the species of interest or a species with a known conversion factor to the species of interest. Using accurate age and height measurements, read the site index from a graph showing height over age curves for that species.

Site quality index listed in Table 1 above can be represented as Poor, Fair, Good, Very Good and Excellent as follows:

< 50	Poor
51-60	Fair
61-70	Good
71-80	Very Good
>81	Excellent

Stand Descriptions:

Stand 1 (Owners Maintenance)

Stand 1 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. This Stand is located on the southeastern portion of the Owners Maintenance tract and has a southern aspect.

Stand 1 is a timber-sized Upland Oak Stand covering approximately 10.88 acres. Dominant tree species in this Stand are Black, Chestnut and Red Oak. White Oak, Sugar Maple and Pignut Hickory are minor understory components. The sub-canopy includes Red Maple, Sugar Maple, Beech, Amelanchier, Grape and Hophornbeam. The overstory covers about 45% of this Stand while the sub-canopy covers about 40% of this Stand.

The shrub layer covers <5% of this Stand. Shrub species found here include Japanese Barberry and Huckleberry on the ridges. Floor species include Christmas Fern, Pennsylvania Sedge, Partridgeberry, White Snakeroot, Wintergreen, White Ash, White Wood Aster and Garlic Mustard. Floor species cover about 50% of this Stand.

Tree quality is good in this Stand with potential sawtimber found in the Black, Red and Chestnut Oak at this time. Forest Stand improvement activities will focus on removing some of the unacceptable growing stock. This can be done through girdling to create wildlife habitat or removal of poorly formed trees for firewood. Removing poorly formed trees will increase the vigor and growth rates of the remaining trees in this Stand.

Trees removed during forest Stand improvement may also be felled and left on the forest floor to provide downed woody debris for wildlife habitat and foraging areas and soil protection. Others may be girdled and left to provide Standing dead trees for foraging and nesting habitat for numerous birds. All forest management activities will be completed while maintaining species diversity in this Stand. While there is good subcanopy, there are very few tree seedlings noted on the forest floor. It is important to improve growth in the shrub layer in this Stand.

Lack of cover in the shrub layer may be due to excessive deer populations or due to the density of the canopy and subcanopy and the lack of light reaching the forest floor. Gypsy Moth populations should be monitored, particularly early in this planning period and deer populations should be monitored long term, as high populations will impede tree growth and facilitate invasive species spread.

The average basal area of this Stand is 90 square feet per acre with about 71 trees per acre. Stand 1 has an average diameter at breast height (dbh) of about 15 inches. Current acceptable growing stock in this Stand is about 7,440 board feet/acre while unacceptable growing stock is about 5.08 cords/acre. This Stand is currently fully stocked. Trees in this Stand are 60-80 years in age.

Site quality is good in this Stand. The presence of disease or insect infestation was not noted in this Stand during the forest inventory. Deer browse appears to be moderate to heavy in this Stand. Tree tops may be piled in brush piles to provide wildlife habitat and to protect seedlings from deer browse allowing them to grow into the sapling stage while not being browsed by deer. Deer populations must be closely monitored, as they can alter the forest ecosystem and affect habitat for other wildlife species. The possibility of hunting may be limited to bow hunting due to the size of the property and the residential development bordering the property.

Without active management, this Stand will convert to a Northern Hardwood Stand over time and lose the Oak dominated canopy.

Stand 1 Forest Management Recommendations

The primary goals for this Stand are to remove the Japanese Barberry, increase native shrub growth and improve growth rates of the remaining trees, while protecting the soil resource on steep slopes. Gypsy Moth populations and deer browse pressure should be monitored.

Once the Japanese Barberry has been removed, the canopy may be opened by removing poorly formed trees for firewood. If removal of firewood by residents is not possible the canopy shall be opened by girdling or felling and leaving on site, poorly formed and hazard trees of all species to maintain species diversity in this Stand. The soil should be protected during any activity on this

property. Aesthetics near home sites will be maintained. By opening the canopy, forest regeneration and native shrub growth will be improved.

Removal of competition will improve the growth rates of remaining trees as well as the vigor of the entire Stand. Tops of trees removed should be left on site in brush piles. Brush piles will be created so as to not affect aesthetics of this Stand, particularly in areas visible from neighboring homes.

This Stand would be the start of any hiking trails through this property and the adjacent Arnell tract due to access to the road and to the pull off site. Trail development will be completed in conjunction with the NY-NJ Trail Conference.

Recommendations for Stand 1

1. **Remove Japanese Barberry.**
2. **Maintain and improve forest regeneration while maintaining aesthetics as viewed from neighboring homes.**
3. **Trees removed may be used as firewood, girdled or felled and left on site as wildlife habitat.**
4. **Protect soil quality in this Stand.**
5. **Monitor deer browse pressure and Gypsy Moth populations.**
6. **Work with the NY-NJ Trail Conference on trail development.**
7. **The Forester will mark all trees to be removed from this site.**

Stand 2 Owners Maintenance Tract

Stand 2 is a Northern Hardwood Stand located on 4.56 acres. This Stand is located on the western edge of Owners Mainetenance tract, south of the powerline cut. Stand 2 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 2 has a slight northwestern aspect.

Stand 2 is a pole-sized Stand. The overstory of this Stand is dominated by Sugar Maple, Chestnut Oak and White Ash. Minor overstory components include White Oak, Black Birch, Pignut Hickory, Cherry and Poison Ivy. The understory includes Amelanchier, Sugar Maple, White Ash and Black

Cherry. The overstory covers about 45% of this Stand while the understory covers about 55% of this Stand.

The shrub layer is virtually absent from this Stand, although there is some Huckleberry noted. Floor species include White Snakeroot, Pennsylvania Sedge, Sassafras, Partridgeberry and Wintergreen. Shrub species cover 0% of this Stand while floor species cover 40% of this Stand.

Tree quality is good in this Stand with potential future timber found in Sugar Maple, Hickory and Oak. Forest Stand improvement activities will focus on removing unacceptable growing stock, mainly poorly formed Sugar Maples and Black Birch, while allowing the remaining trees to mature further. The large amount of dead Red Cedar on the forest floor and stone walls provides signs that this Stand was cleared at one time and is proceeding through forest succession.

The average basal area of Stand 2 is 110 square feet per acre, with 215 trees per acre. Stand 2 has an average diameter at breast height (dbh) of 9.5 inches. This Stand is currently fully stocked. Acceptable growing stock is 4,590 board feet per acre while unacceptable growing stock is about 8.41 cords per acre. Trees in this Stand are about 50-70 years of age. Potential growth rates in this Stand are 57 cubic feet per acre for Red Oak and 43 cubic feet per acre for Sugar Maple and White Ash.

Site quality is good to very good in this Stand. Deer browse appears to be heavy. Vertical diversity and species diversity in this Stand are good with the exception of the shrub layer, which is absent. No forest insect or disease infestations were noted in this Stand during the forest inventory.

The boundary in this Stand is currently clearly marked with flagging but should be marked with paint and posters before the flagging is lost.

Stand 2 Forest Management Recommendations

This Stand is moving through forest succession into a Northern Hardwood Stand, which would be expected in a Stand with a northwestern aspect. Poorly formed trees in this Stand can be girdled and left Standing. Access would be an obstacle to removing any biomass from this Stand.

The boundary of this Stand and of this entire property should be clearly delineated during the early planning period. No invasive species were noted in this Stand. This Stand should be monitored for deer browse pressure and invasive species.

Activity in this Stand can occur late in the planning period, with the exception of the boundary delineation.

Recommendations for Stand 2

1. **Remove poorly formed trees from this Stand to improve vertical structure.**
2. **Monitor this Stand for invasive species and deer browse pressure.**
3. **All trees will be marked by the Forester for removal.**

Stand 3 Owners Maintenance Tract

Stand 3 is located on the Owners Maintenance tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. This Stand is located in the center of the property.

This Stand is the powerline cut and has no canopy or subcanopy. It covers 2.09 acres. The shrub layer consists of Japanese Barberry, Red Cedar and Wineberry. One shrub was not identified. Floor species include Hayscented Fern, Little Bluestem, White Snakeroot, Tulip Poplar seedlings and Goldenrod.

There is an ATV trail located through this Stand that will provide ATV access to the remainder of the property and that will lead to soil erosion and possibly the dispersion of invasive species.

The Japanese Barberry should be removed from this Stand early in the planning period to reduce the chances of it moving into the adjacent forest. Current Township regulations prohibit ATV use. ATV access should be monitored and Township rules concerning use on public land should be enforced. Portions of this Stand are extremely steep.

An agreement should be worked out with the power utility to assure that the clearing of this line will be maintained exclusively through mechanical removal, rather than herbicide application, and that this Stand will be allowed to grow into early successional forest habitat and cut only every 5 years or so. By doing this important wildlife habitat will be created and soils, particularly on the steepest slopes, will be protected as the roots from shrubs and trees will remain in place long term.

This area can also provide a vista for a stop along a hiking trail.

Stand 3 Forest Management Recommendations

ATV activity should be monitored and Township prohibitions on ATV use on public land enforced. Invasive species should be removed early in the planning period. This will prevent their further spread through this Stand and the adjacent forest.

An agreement with the power utility should be formalized to assure that vegetation is removed mechanically from this Stand, which will provide valuable early successional wildlife habitat, reduce the use of herbicides and protect soil in this Stand.

Recommendations for Stand 3

1. **Work out an agreement with the power utility to mechanically remove vegetation from this Stand every five years or so under its line maintenance program.**
2. **Remove the invasive species (Japanese Barberry and Wineberry) from this Stand.**
3. **Monitor the ATV activity in this Stand and enforce the Township prohibition against ATV use on Township owned lands.**
4. **Monitor soil erosion in this Stand.**

Stand 4 Owners Maintenance Tract

Stand 4 is an Oak Hickory/Northern Hardwood Stand located on 2.36 acres. This Stand is located on the western edge of the Owners Maintenance Tract, just north of the powerline cut. Stand 4 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE

soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 4 has a slight southeastern aspect.

Stand 4 is a pole-size Stand covering 11.86 acres. This Stand is dominated by Mockernut Hickory and White Ash. Red Oak and Chestnut Oak are minor overstory components. The sub-canopy includes Maple, Amelanchier, Hickory, Flowering Dogwood and Crab Apple. The overstory covers about 40% of this Stand while the sub-canopy covers about 60% of this Stand.

The shrub layer covers <5% of this Stand. The only shrub species noted here was Japanese Barberry (invasive species), which should be removed promptly prior to any other forest management activities being conducted. Floor species include White Snakeroot, Pennsylvania Sedge, Garlic Mustard and Bedstraw species. Floor species cover about 10% of this Stand. The Garlic Mustard is found along the stone wall and is in a small enough population to be hand pulled by volunteers.

Tree quality is good at this time. Active management is not advised at this time until the Japanese Barberry and Garlic Mustard have been removed. Once these populations are controlled, poorly formed trees should be removed from this Stand or girdled in an effort to improve native plant growth in the shrub layer and on the forest floor.

The average basal area of Stand 4 is 100 square feet per acre, with 163 trees per acre. Stand 4 has an average diameter at breast height (dbh) of 8.5 inches. This Stand is currently fully stocked. Acceptable growing stock is 4,890 board feet per acre while unacceptable growing stock is about 1.32 cords per acre. Trees in this Stand are about 70 years of age. Potential growth rates in this Stand are 57 cubic feet per acre for Red Oak and 43 cubic feet per acre for Sugar Maple and White Ash.

Trees may also be cut and left on the forest floor to provide downed woody debris for wildlife habitat and foraging areas and soil protection. Others may be girdled and left, to provide Standing dead trees for foraging and nesting habitat for numerous birds. All forest management activities will be completed while maintaining species diversity in this Stand and protecting the wet soils and stream. Site quality is good to very good in this Stand.

Two deer were noted in this Stand. Deer populations and browse pressure should be monitored, as active forest management and invasive species control is difficult to impossible without a reduction program.

Stand 4 Forest Management Recommendations

The primary goal for this Stand is to improve vertical structure, promote native plant regeneration and remove invasive species. Japanese Barberry and Garlic Mustard should be removed from this Stand early in the planning period prior to these species going to seed. Neither species is found in overbearing populations at this time, and thus control is possible.

Control can be coordinated with volunteers and or the County SLAP program early in this planning period. Deer populations should be monitored and controlled, as there is very little shrub layer and floor species are sparse.

Forest Stand improvement activities will also include removing poorly formed trees at the end of this planning period and only after the invasive species have been removed.

Recommendations for Stand 4

1. **Remove Garlic Mustard and Japanese Barberry from this Stand early in the planning period.**
2. **Monitor or reduce deer population to improve native species regeneration and improve vertical structure.**
3. **Once invasive species are under control, the canopy may be opened in an effort to improve vertical structure of the forest.**
4. **The Forester will mark all trees to be removed from this site.**

Stand 5 Owners Maintenance Tract

Stand 5 is an Oak-Hickory Stand located on 12.70 acres. Stand 5 is located on the Owners Maintenance tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes

(ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 5 has a slight to very steep southern aspect.

Stand 5 is a small pole-sized Oak-Hickory Stand. The overstory of this Stand is dominated by Pignut Hickory, Red Oak, Black Oak and Chestnut Oak. Sugar Maple is a minor overstory component. The understory includes Sugar Maple, Amelanchier and Sumac in canopy openings. The overstory covers about 50% of this Stand while the understory covers about 40% of this Stand. Over time, without active management, this Stand will likely convert to a more shade tolerant northern hardwood dominated Stand.

The shrub layer is virtually absent from this Stand. Floor species include Pennsylvania Sedge, Wintergreen and Partridgeberry. Shrub species covered 0% of this Stand while floor species covered 45% of this Stand.

Tree quality is good in this Stand, with potential future timber found in Hickory and Oak species. Forest Stand improvement activities in this Stand will focus on removing poorly formed or dying trees from this Stand. Trees with good form will be left to serve as the seed source for the future forest and to improve growth rates of the remaining crop trees.

The average basal area of Stand 5 is 110 square feet per acre, with 259 trees per acre. Stand 5 has an average diameter at breast height (dbh) of 8.5 inches. This Stand is currently fully stocked. Acceptable growing stock is about 6,120 board feet per acre while unacceptable growing stock is about 4.33 cords per acre. This Stand is approximately 70-90 years of age. Potential growth rates in this Stand are 57 cubic feet per acre for Red Oak and 65 cubic feet per acre for Sugar Maple and White Ash.

Site quality is good to very good in this Stand. Deer browse appears to be heavy in this Stand. Gypsy Moth populations were moderate to heavy in this Stand and should be closely monitored. An ATV tail was noted in this Stand and should be monitored and possibly mapped, should enforcement become necessary.

Stand 5 Forest Management Recommendations

Gypsy Moth populations must be closely monitored in this Stand. Populations were currently moderate to high during the forest inventory. While Gypsy Moth impact on this forest area may improve vertical structure and native regeneration, they may also provide a source of defoliation downwind in residential areas of Byram Township. If population densities are high enough the Township should consider participating in the State spray program, which is generally initiated in May while planning should occur much earlier.

If Gypsy Moth populations are controlled, native regeneration should be improved with the canopy openings being created through girdling as long as deer populations and invasive species are kept in check.

The ATV trail through this Stand should be monitored and possibly mapped to aid enforcement. Posting the property would make the riders aware that they are trespassing and that ATV use is prohibited on Township-owned parcels.

Recommendations for Stand 5

1. **Closely monitor Gypsy Moth populations in this Stand and spray if necessary.**
2. **Monitor and possibly GPS the ATV trail through this Stand.**
3. **Control deer in this Stand.**
4. **Once Gypsy Moth populations are reduced, work should commence to improve native plant regeneration and improve vertical structure.**
5. **All trees will be marked by the Forester for girdling/removal.**

Stand 6 Owners Maintenance Tract

Stand 6 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. This Stand is located on the southern portion of the Owners Maintenance tract just south of the powerline cut and has an extremely steep southern aspect.

Stand 6 is a small pole-sized Red Cedar Stand covering approximately 2.55 acres. Dominant tree species in this Stand are Red Cedar and Pignut Hickory. Chestnut Oak is a minor understory component. The sub-canopy includes Pignut Hickory and Red Oak. The overstory covers about 35% of this Stand while the sub-canopy covers about 20% of this Stand.

The shrub layer covers <5% of this Stand. Shrub species found here include Huckleberry and Red Cedar. Floor species include Pennsylvania Sedge, Cinquefoil, Cedar seedlings and some Garlic Mustard. There was an unusual fern on this site that was not identified. Floor species cover about 65% of this Stand.

The average basal area of this Stand is 70 square feet per acre with about 257 trees per acre. Stand 6 has an average diameter at breast height (dbh) of about 7 inches. Acceptable growing stock is about 140 board feet/acre while unacceptable growing stock is about 5.77 cords/acre. This Stand is currently fully stocked.

A Ribbon Snake was noted sunning in this Stand and numerous birds were noted in the cedar trees.

Stand 6 Forest Management Recommendations

No forest management activities are recommended in this Stand. The Garlic Mustard should be removed if possible, without disrupting the very thin soil here. Given the extreme slope and limited soils of this site, any hiking trails should be kept away from this Stand.

This Stand may contain some unique plants, which could be surveyed at a later date. A possible experiment could be to fence a small portion of this Stand to gauge the affect of deer browse on wildlflowers.

Recommendations for Stand 6

1. **Remove Garlic Mustard without disturbing the thin and limited soils on this site.**
2. **Keep hiking trails away from this Stand due to the extreme slope and limited soils.**
3. **Possibly fence a small portion of this site to measure the affect of deer browse on wildflowers.**

4. **Survey the wildflowers that may be found on this site.**

Stand 7 Arnell Tract

Stand 7 is found on Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils. The AhcBc soils have site index of 50 for Red Maple. This Stand is located along the roadway on the northern portion of the Arnell tract. This Stand is very wet and has no aspect.

Stand 7 is a small pole-sized Maple Ash swamp covering approximately 4.03 acres. Dominant tree species in this Stand are Red Maple and White Ash. Basswood, Swamp White Oak, Yellow Birch, Hemlock and Red Oak are minor overstory components. The sub-canopy includes Musclewood, Witch Hazel, Beech and Hophornbeam. The overstory covers about 40% of this Stand while the sub-canopy covers about 35% of this Stand.

The shrub layer covers 10% of this Stand. Shrub species found here include Japanese Barberry, Asiatic Bittersweet and Japanese Knotweed (along the road). Floor species include Japanese Stilt Grass, Skunk Cabbage, Virginia Smartweed, Spotted Touch Me Not, False Nettle, Poison Ivy, Spicebush, Halbert-leaf Tearthumb, Partridgberry, Virginia Creeper, Jack in the Pulpit, Christmas Fern, White Snakeroot and Tussock Sedge. Floor species cover about 85% of this Stand.

Tree quality is moderate in this Stand, with potential sawtimber found in the White Ash at this time. However, a timber sale is not an option in this Stand due to the very wet soil. Forest Stand improvement activities will focus on removing invasive species and cleaning up the large amount of roadside litter.

During forest Stand improvement, trees may be girdled and left to provide Standing dead trees for foraging and nesting habitat for numerous birds. In time they will drop woody debris and provide wildlife habitat and foraging areas and soil protection. Creating canopy openings in concert with invasive species removal and deer reduction, native shrub species will be encouraged. Currently there are no native species noted in the shrub layer.

The average basal area of this Stand is 90 square feet per acre with about 351 trees per acre. Stand 7 has an average diameter at breast height (dbh) of about 7 inches. Acceptable growing stock is about 1,430 board feet/acre while unacceptable growing stock is about 1.11 cords/acre. This Stand is currently fully stocked. Trees in this Stand are 60-80 years in age.

Site quality is poor in this Stand. The presence of disease or insect infestation was not noted in this Stand during the forest inventory. Deer browse appears to be moderate to heavy in this Stand. Tree tops may be left in brush piles to provide wildlife habitat and to protect native seedlings from deer browse, allowing them to grow into the sapling stage. Deer populations must be reduced and closely monitored, as they can alter the forest ecosystem and affect habitat for other wildlife species. The possibility of hunting maybe limited to bow hunting due to the location of this Stand near homes bordering the property.

Without active management, this Stand will become dominated by Asiatic Bittersweet and Japanese Knotweed and provide limited habitat for wildlife and native plant species.

Stand 7 Forest Management Recommendations

The primary goals for this Stand are to remove the Japanese Knotweed, Japanese Barberry and Asiatic Bittersweet and increase native shrub growth while maintaining the excellent floor species diversity noted here. Deer browse pressure should be closely monitored and a control program implemented.

Litter from neighboring homes needs to be cleaned up. The soil should be protected during any activity on this property. In time, native shrub growth will be improved. Spicebush is currently found on site but is being heavily browsed.

This Stand would be the start of any hiking trails through this property and the adjacent Owners Maintenance, tract due to access to the road and to the pull off site. Trail development will be completed in conjunction with the NY-NJ Trail Conference, while taking care not to disturb these very wet soils.

Recommendations for Stand 7

1. **Remove Japanese Knotweed, Japanese Barberry and Asiatic Bittersweet.**
2. **Maintain and improve native shrub regeneration by reducing deer browse pressure.**
3. **Clean up the litter near the road and from neighboring homes.**
4. **Protect soil quality in this Stand.**
5. **Work with the NY-NJ Trail Conference on trail development.**
6. **The Forester should coordinate invasive species removal from this site.**

Stand 8 Arnell Tract

Stand 8 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils and Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils. The RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. The AhcBc soils have site index of 50 for Red Maple. This Stand is located on the northeastern corner of the Arnell tract and has a northwestern aspect.

Stand 8 is a large pole-sized Northern Hardwood Stand covering approximately 6.19 acres. Dominant tree species in this Stand are Yellow Birch, Beech and Red Maple. White Oak, Chestnut Oak and Hickory are minor understory components. The sub-canopy includes Witch Hazel, Highbush Blueberry, Yellow Birch, Musclewood, Beech and Black Birch. The overstory covers about 55% of this Stand while the sub-canopy covers about 35% of this Stand.

The shrub layer covers 0% of this Stand. Floor species include Partridgeberry, Christmas Fern, Wintergreen, Red Maple and Beech seedlings. Floor species cover about 15% of this Stand.

Tree quality is good in this Stand, with potential sawtimber found in the Yellow Birch, White and Chestnut Oak at this time. Forest Stand improvement activities will focus on removing increasing vertical structure and encouraging growth in the shrub layer. This can be done through girdling to create wildlife habitat or removal of poorly formed trees for firewood, if access across Stand 7 can be created without damaging the soils there. Removing poorly formed trees will increase the vigor and growth rates of the remaining trees in this Stand.

Trees removed during forest Stand improvement may also be felled and left on the forest floor to provide downed woody debris for wildlife habitat and foraging areas and soil protection. Others may be girdled and left to provide Standing dead trees for foraging and nesting habitat for numerous birds. All forest management activities will be completed while maintaining canopy and subcanopy species diversity in this Stand and while improving growth in the shrub layer with native species.

Lack of cover in the shrub layer may be due to excessive deer populations or due to the density of the canopy and subcanopy and the lack of light reaching the forest floor. Gypsy Moth populations should be monitored, particularly early in this planning period as they were moderate to heavy during the inventory. Deer populations should be monitored and reduced long term, as high populations will impede tree growth and potentially facilitate invasive species spread from Stand 7.

The average basal area of this Stand is 110 square feet per acre with about 187 trees per acre. Stand 8 has an average diameter at breast height (dbh) of about 10.5 inches. Acceptable growing stock is about 3,330 board feet/acre while unacceptable growing stock is about 9.27 cords/acre. This Stand is currently fully stocked.

Site quality is poor to very good in this Stand, depending on the soil. Flat areas are likely poor, while sloped portions of this Stand on the slope will be very good. Tree tops may be piled in brush piles to provide wildlife habitat and to protect seedlings from deer browse, allowing them to grow into the sapling stage.

Stand 8 Forest Management Recommendations

The primary goals for this Stand are to increase native shrub growth and improve growth rates of the remaining trees, while protecting the soil resource on steep slopes. Gypsy Moth populations and deer browse pressure should be closely monitored.

Once the invasive species have been controlled in Stand 8, the canopy may be opened by removing poorly formed trees for firewood. If removal of firewood by residents is not possible, the canopy shall be opened by girdling or felling and leaving on site poorly formed and hazard trees of all

species to maintain species diversity in this Stand. By opening the canopy, forest regeneration and native shrub growth will be improved.

Recommendations for Stand 8

1. **Monitor deer browse pressure and Gypsy Moth populations.**
2. **Improve forest regeneration and native species growth in the shrub layer.**
3. **Trees removed may be used as firewood, if access is possible; if not, trees will be girdled or felled and left on site as wildlife habitat.**
4. **Protect soil quality in this Stand.**
5. **No activity shall commence until invasive species from Stand 7 have been removed and controlled.**
6. **The Forester will mark all trees to be removed from this site.**

Stand 9 Arnell Tract

Stand 9 is a Northern Hardwood Stand located on 6.08 acres. This Stand is located in the center of the Arnell property. Stand 9 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils and Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils. The RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. The AhcBc soils have site index of 50 for Red Maple. Stand 9 has a northwestern aspect.

Stand 9 is a pole-sized Stand. The overstory of this Stand is dominated by Sugar Maple, Black Birch, Yellow Birch and White Ash. Minor overstory components include Red Oak, Bigtooth Aspen and White Oak. The understory includes Witch Hazel, Yellow Birch, Hornbeam and Musclewood. The overstory covers about 40% of this Stand while the understory covers about 65% of this Stand.

The shrub layer is virtually absent from this Stand, although there is some Japanese Barberry, which should be removed. Floor species include Partridgeberry, White Snakeroot, Pennsylvania Sedge, Christmas Fern, Wintergreen, Hay-scented Fern, Violet, Indian Pipe and another fern species. Shrub species cover <5% of this Stand while floor species cover 35% of this Stand.

Tree quality is good in this Stand, with potential future timber found in Red Oak, Sugar Maple and White Ash. Forest Stand improvement activities in this Stand will focus on removing unacceptable growing stock, mainly poorly formed Sugar Maples and Black Birch, while allowing the remaining tree to mature further. This Stand should be managed for its old growth character.

The average basal area of Stand 9 is 100 square feet per acre, with 576 trees per acre. Stand 9 has an average diameter at breast height (dbh) of 5.5 inches. This Stand is currently fully stocked. Acceptable growing stock is 7,240 board feet per acre while unacceptable growing stock is about 7.16 cords per acre. This Stand was harvested in the past, and some extremely large trees were removed.

Site quality is good to very good in this Stand. Deer browse appears to be heavy. Two deer were noted during the forest inventory. Vertical diversity and species diversity in this Stand is good, with the exception of the shrub layer, which is absent. There was a light infestation of Gypsy Moth in this Stand.

The boundary in this Stand is currently clearly marked by the adjacent property owner, but the Township should mark the boundary with paint and posters as well.

Stand 9 Forest Management Recommendations

This Stand has been harvested in the past. This Stand should be managed for its potential for old growth character. There are large trees in this Stand, a good understory, and good species diversity. Old growth character can be enhanced by creating canopy openings by cutting or girdling trees in groups to maximize the amount of light reaching the forest floor. Native regeneration and the shrub layer are noticeably absent from this Stand.

Deer browse appears to be heavy in this Stand and control measures should be investigated. Japanese Barberry should be removed from this Stand prior to any work being completed. There is an old logging road through this Stand from a previous harvest.

Recommendations for Stand 9

1. **Remove the Japanese Barberry from this Stand.**
2. **Manage this Stand toward old growth character by removing trees in groups and encouraging the development of native tree saplings.**
3. **Implement a deer management program to reduce the population.**
4. **Properly maintain the old logging road to prevent serious erosion.**
5. **All trees will be marked by the Forester for removal.**

Stand 10 Arnell Tract

Stand 10 is an Oak-Hickory Stand located on 16.38 acres. Stand 10 is located on the Arnell tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils and on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple, while the RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. Stand 10 has a variable but mainly northeastern aspect.

Stand 10 is a timber-sized Oak-Hickory Stand. The overstory of this Stand is dominated by Red Oak, Chestnut Oak and Sugar Maple. White Oak, Mockernut and Pignut Hickory and Black Birch were minor overstory components. The understory includes Black Birch, Sugar Maple, Amelanchier, Shagbark Hickory, Red Oak and Hemlock. The overstory covers about 50% of this Stand while the understory covers about 35% of this Stand. Without active management, over time this Stand will likely convert to a more shade tolerant northern hardwood dominated Stand.

The shrub layer is virtually absent and covers <5% of this Stand. The only species noted was Japanese Barberry. Floor species include Partridgeberry, Pennsylvania Sedge, Wintergreen and Rattlesnake Plantain. Floor species covered 55% of this Stand.

Tree quality is good in this Stand, with potential future timber found in Hickory and Oak species. Forest Stand improvement activities will focus on removing poorly formed trees from this Stand.

Trees with good form will be left to serve as the seed source for the future forest, thus improving growth rates of the remaining crop trees.

The average basal area of Stand 10 is 100 square feet per acre, with 111 trees per acre. Stand 10 has an average diameter at breast height (dbh) of 13 inches. This Stand is currently fully stocked. Acceptable growing stock is about 9,670 board feet per acre while unacceptable growing stock is about 3.12 cords per acre. This Stand is approximately 70-90 years of age. Potential growth rates in this Stand are 57 cubic feet per acre for Red, Black, White and Scarlet Oak and Tulip Poplar.

Site quality is good to very good in this Stand. Deer browse appears to be heavy. Gypsy Moth populations were moderate in this Stand and should be closely monitored. There is an old logging road which should be GPS'd and mapped for future forest management activities. One deer was noted in this Stand during the forest inventory

Stand 10 Forest Management Recommendations

Remove Japanese Barberry from this Stand prior to opening the canopy, as its population is limited at this time. Gypsy Moth populations must be closely monitored in this Stand. Populations were moderate during the forest inventory. If population densities are high enough, the Township should consider participating in the State spray program.

Native regeneration should be improved by creating canopy openings being created through girdling, if Gypsy Moth populations are controlled and deer populations and invasive species are kept in check.

The old logging road through this Stand should be mapped to aid enforcement and future forest management activities. If biomass is to be removed from this Stand, the road would have to be mapped and maintained.

Recommendations for Stand 10

1. **Remove the Japanese Barberry from this Stand.**
2. **Closely monitor Gypsy Moth populations and spray if necessary.**

3. **Monitor and GPS the old logging road through this Stand.**
4. **Assess the impact of deer in this Stand on native regeneration.**
5. **All trees will be marked by the Forester for girdling/removal.**

Stand 11 Arnell Tract

Stand 11 is found on Catden mucky peat, 0-2% slopes (CatbA) soils. The CatbA soils have site index of 56 for Red Maple and 83 for Silver Maple. This Stand is located along the southernmost portion of the Arnell tract. This Stand is very wet and has no aspect. Access into this Stand is virtually impossible, due to the Standing water and mucky soils.

Stand 11 is a Maple Ash swamp covering approximately 1.65 acres. Canopy tree species in this Stand are Red Maple, Swamp White Oak, Blackgum and Black Birch, with Tulip Poplar along the edges of the wetland. The sub-canopy is absent in this Stand. The overstory covers about 20% of this Stand.

The shrub layer covers 75% of this Stand. Shrub species found here include Spicebush, Highbush Blueberry, Sweet Pepperbush and Greenbriar. Floor species include Tussock Sedge, Sensitive Fern, Iris, Violet, Tickseed and False Nettle. Floor species cover about 30% of this Stand.

Stand 11 had a basal area of 20. There were about 26 trees per acre. This Stand is severely understocked (which would be expected in soils this wet). The average dbh was 12 inches in this Stand. There were 4.26 cords per acre of unacceptable growing stock. There is no potential sawtimber noted in this Stand.

Forest management activities are extremely limited in this Stand. This Stand should be monitored for rare plants, invasive plants and potential as a vernal pool breeding area for reptiles and amphibians.

Site quality is poor in this Stand. The presence of disease or insect infestation was not noted during the forest inventory. Deer browse appears to be heavy.

Stand 11 Forest Management Recommendations

The primary goals for this Stand are to monitor for rare plants and invasive species. If invasive species are noted, they should be removed promptly. This Stand should also be monitored for its potential to serve as a large vernal pool. A pool this size could provide critical habitat for reptiles and amphibians.

Recommendations for Stand 11

1. **Monitor this Stand for invasive species and remove them promptly.**
2. **Given the possibility for rare plants to be found, this Stand, should be evaluated during the growing season.**
3. **There may be a very large vernal pool, in this Stand which should be evaluated for breeding habitat for reptiles and amphibians.**

Stand 12 Arnell Tract

Stand 12 is a Hemlock Stand located on 0.86 acres. This Stand is located on the northwestern edge of the Arnell property. Stand 12 is found on Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils. The AhcBc soils have site index of 50 for Red Maple. Stand 12 has an eastern aspect.

Stand 12 is a pole-sized Stand. The overstory of this Stand is dominated by Hemlock and Black Birch. Minor overstory components include Black Oak, Sugar Maple, Red Maple, Tulip Poplar and Hickory. The understory includes Witch Hazel, Yellow Birch and Musclewood. The overstory covers about 40% of this Stand while the understory covers about 55% of this Stand.

The shrub layer is virtually absent from this Stand, although there is some Japanese Barberry, which should be removed. Floor species include Christmas Fern, Wintergreen, White Pine seedlings, Violet, Partridgeberry, a Fern species and Canada Mayflower. Shrub species covered <5% of this Stand while floor species covered 25% of this Stand.

Tree quality is fair to good with potential future timber found in Black Oak and Sugar Maple. Other than removing the Japanese Barberry and monitoring Hemlock Woolley Adelgid there is no management activity required at this time.

The average basal area of Stand 12 is 120 square feet per acre, with 707 trees per acre. Stand 12 has an average diameter at breast height (dbh) of 5.5 inches. This Stand is currently over stocked. Acceptable growing stock is 6,790 board feet per acre while unacceptable growing stock is about 15.88 cords per acre.

Site quality is good in this Stand. Deer browse appears to be heavy. There was a large number of squirrels noted and a light infestation of Gypsy Moth in this Stand. Vertical diversity and species diversity in this Stand is good, with the exception of the shrub layer, which is absent. This is to be expected from a Hemlock Stand which is only lightly infested with the Woolley Adelgid.

Stand 12 Forest Management Recommendations

This Stand should be managed to maintain the Hemlock cover. This may be difficult if the Hemlock Woolley Adelgid population increases significantly. Areas as remote as this are impossible to treat. If the Hemlocks begin to die off, actions should be taken to protect the soils on the slopes.

The Japanese Barberry should be removed as it makes up only a small portion of this Stand at this time. Gypsy Moth populations were low and would never cause dramatic defoliation here due to the species make up of this Stand.

Recommendations for Stand 12

1. **Remove the Japanese Barberry from this Stand.**
2. **Monitor the Hemlock Woolley Adelgid populations in this Stand.**
3. **Fell trees parallel to the slope should the Hemlocks begin to die in large numbers.**

Stand 13 Beckmannn/Kostrey Tract

Stand 13 is an Oak-Hickory Stand located on 19.38 acres. Stand 13 is located on the Beckmann/Kostrey tract on the northernmost portion of the property. It is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils, Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils and on Hibernia loam, 0 to 8% slopes, extremely stony (HhmBc) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple, while the RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. HhmBc soils have a site index of 55 for White Pine, 56 for Sugar Maple and 47 for Red Oak. Stand 13 has a very steep northwestern aspect.

Stand 13 is a sapling-sized Oak-Hickory Stand. In the recent past, this Stand was a Hemlock dominated Stand which succumbed to Hemlock Wolley Adelgid. The overstory of this Stand is made up of Chestnut Oak and Red Oak. Scarlet Oak, Black Birch, Beech and Hickory were minor overstory components. The understory includes Black Birch, Red Maple, Hemlock, Red Oak, Chestnut sprouts and Hophornbeam. The overstory covers about 20% of this Stand while the understory covers about 80% of this Stand. Over time this Stand will likely convert to a more shade tolerant northern hardwood dominated Stand, unless the Eastern Hemlock recovers, which is unlikely at this time.

The shrub layer covers 10% of this Stand. Species noted in this layer included Multiflora Rose, Huckleberry and Beech. Floor species include Hemlock seedlings, White Oak seedlings, Sugar Maple seedlings, White Snakeroot, Goldenrod and Partridgeberry. Floor species covered 35% of this Stand.

Tree quality is moderate in this Stand with potential future timber found in Chestnut and Red Oak species. Forest Stand improvement activities in this Stand will focus on maintaining forest cover and protecting soils on these steep slopes. This can be completed by removing poorly formed trees, which should be felled parallel to the slope and left on site. Trees with good form will be left to

serve as the seed source for the future forest. The felling of poorly formed trees will result in improve growth rates of the remaining crop trees.

The average basal area of Stand 13 is 70 square feet per acre, with 1413 trees per acre. Stand 10 has an average diameter at breast height (dbh) of 3 inches. This Stand is currently fully stocked. Acceptable growing stock is about 1,830 board feet per acre while unacceptable growing stock is about 17.08 cords per acre.

Site quality is good in this Stand. Deer browse appears to be light in this Stand. Gypsy Moth populations were light to moderate in this Stand and should be closely monitored. Much of this Stand is good early successional habitat, due to the death of the Hemlock canopy and dense growth of saplings.

Stand 13 Forest Management Recommendations

Multiflora Rose should be removed from this Stand although the density of the subcanopy may shade it out in a relatively short period. Gypsy Moth populations must be closely monitored in this Stand. Populations were light to moderate during the inventory. If population densities are high enough, the Township should consider participating in the State spray program. Loss of the already thin canopy could lead to soil loss and erosion from this site.

There is a moderately sized American Chestnut near the parking area which should be monitored for its potential use as a breeding tree for the American Chestnut Foundation.

Recommendations for Stand 13

1. **Remove the Multiflora Rose.**
2. **Closely monitor Gypsy Moth populations in this Stand and spray if necessary.**
3. **Monitor tree growth and soil erosion.**
4. **All trees will be marked by the Forester for girdling/removal.**

Stand 14 Beckmann/Kostrey Tract

Stand 14 is an Oak-Hickory-Hemlock Stand located on 10.52 acres. Stand 14 is located on the Beckmann/Kostrey tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils and Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple, while the RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. Stand 14 has a moderate to very steep northwestern aspect.

Stand 14 is a large pole-sized Stand. In the recent past, this was a Hemlock dominated Stand which is quickly succumbing to the Hemlock Woolley Adelgid. The overstory of this Stand is dominated by Chestnut Oak and Hemlock. Red Oak and Pignut Hickory were minor overstory components. The understory includes Black Birch, Amelanchier and Red Oak. The overstory covers about 50% of this Stand while the understory covers about 40% of this Stand.

The shrub layer covers 30% of this Stand. Species noted in this layer included Black Birch and Huckleberry. Floor species include Pennsylvania Sedge, Chestnut Oak seedlings and an unknown fern species. Floor species covered 20% of this Stand.

Tree quality is moderate in this Stand, with potential future timber found in Chestnut and Red Oak species. Forest Stand improvement activities in this Stand will focus on protecting soils on these steep slopes. Trees with good form will be left to serve as the seed source for the future forest and culling of poorly formed trees will result in improved growth rates of the remaining crop trees. It may be possible to underplant conifers in this Stand, possibly White Pine, to maintain the conifer cover in this area long-term. Portions of this Stand have been decimated by the Hemlock Woolley Adelgid

The average basal area of Stand 14 is 90 square feet per acre, with 125 trees per acre. Stand 14 has an average diameter at breast height (dbh) of 11.5 inches. This stand is currently fully stocked.

Acceptable growing stock is about 1,480 board feet per acre while unacceptable growing stock is about 12 cords per acre.

Site quality is good in this Stand. Deer browse appears to be moderate. Gypsy Moth populations were moderate to heavy and should be closely monitored. The double infestation of Woolley Adelgid and Gypsy Moth could have a devastating long-term effect on this Stand. The tick population in this Stand is extremely high.

Stand 14 Forest Management Recommendations

This Stand should be monitored for the Woolley Adelgid populations, which are already devastating the canopy. Treatment in an area with such steep slopes would be difficult to impossible. Gypsy Moth populations must also be closely monitored. Populations were moderate to heavy during the forest inventory. If population densities are high enough, the Township should consider participating in the State spray program. These two insects together can wipe out the canopy of this Stand.

This Stand should be under-planted with a conifer in an attempt to maintain conifer cover in this Stand, as it provides habitat for different species of wildlife than the deciduous forest which dominates the landscape in this area. White Pine may not duplicate the exact habitat but would provide winter cover.

In portions of this Stand there may be a significant fire risk, due to the tremendous amount of downed woody debris. If possible this material should be cut to lay on the ground so that if a fire occurs the threat of crowning is drastically reduced.

Recommendations for Stand 14

1. **Closely monitor Gypsy Moth populations in this Stand and spray if necessary.**
2. **Under plant this Stand with a conifer, likely White Pine.**
3. **Cut downed woody debris so it is in contact with the soil to reduce the fire risk.**

4. **Monitor tree survival and soil erosion in this Stand.**
5. **Possibly girdle poorly formed trees, as long as the canopy is not further devastated by the Gypsy Moth.**
6. **All trees will be marked by the Forester for girdling/removal.**

Stand 15 Beckmann/Kostrey

Stand 15 is an Oak-Hickory savannah type Stand located on 11.71 acres. Stand 15 is located on the Beckmann/Kostrey tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils, Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes (ChkC) soils and Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple, while the RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. ChkC soils have a site index of 75 for White Ash, 70 for Red Oak and 65 for Sugar Maple. Stand 15 has a slight western aspect.

Stand 15 is a large sapling Stand. Most trees in this Stand are stunted, due to the shallow soils on this ridge top. The overstory of this Stand is dominated by Red Oak. Chestnut Oak, Pignut Hickory, Hophornbeam and Pitch Pine were minor overstory components. The understory does not exist in this Stand. The overstory covers about 25% of this Stand.

The shrub layer covers 5% of this Stand. Species noted in this layer included Red Cedar, Huckleberry, Black Birch and Wineberry. Floor species include Pennsylvania Sedge, Wintergreen, Cinquefoil, Little Bluestem, Aster species and an unknown fern species. Floor species covered 65% of this Stand.

Tree quality is poor in this Stand with no future timber. The soils are very thin and the large majority of the trees are stunted, being mostly 25-30 feet in height. This savannah-type ecosystem is

likely very fire prone. It may be possible to plant Pitch Pine to increase its prevalence here. This Stand is drought prone and would be affected early on during dry spells.

The average basal area of Stand 15 is 60 square feet per acre, with 398 trees per acre. Stand 15 has an average diameter at breast height (dbh) of 5.5 inches. This Stand is currently fully stocked. There is no acceptable growing stock, while unacceptable growing stock is about 3.45 cords per acre.

Site quality is good in this Stand (according to soil maps). Deer browse appears to be moderate to heavy. Gypsy Moth populations were moderate during the forest inventory and should be closely monitored.

This Stand would make an excellent vista for a hiking trail. This activity could increase the risk of fire, depending upon the frequency and type of use.

Stand 15 Forest Management Recommendations

Gypsy Moth populations must be closely monitored in this Stand. Populations were moderate during the inventory. If population densities are high enough, the Township should consider participating in the State spray program.

This Stand's savannah-type habitat should be maintained. Controlled fire may be a possible if limited management tool to maintain the character in this Stand. It could also be under-planted with Pitch Pine. There are a few Pitch Pine growing in this Stand already.

This Stand also provides an excellent vista for a hiking trail. This will likely be a destination for any trails created on this property. Deer browse pressure should also be monitored in this Stand. A small area could be fenced to study the affect of deer on wildflowers.

Recommendations for Stand 15

1. **Closely monitor Gypsy Moth populations in this Stand and spray if necessary.**
2. **Under-plant this Stand with a Pitch Pine.**
3. **Maintain the savannah-type character of this Stand.**
4. **All trees will be marked by the Forester for girdling/removal.**

Stand 16 Beckmann/Kostrey Tract

Stand 16 is an Upland Oak-Hickory Stand located on 8.40 acres. Stand 16 is located on the easternmost portion of the Beckmann/Kostrey tract. It is found on Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes (ChkC) soils and Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. ChkC soils have a site index of 75 for White Ash, 70 for Red Oak and 65 for Sugar Maple. Stand 16 is mainly flat but has variable aspects.

Stand 16 is a large-sapling Stand. The overstory of this Stand is dominated by Chestnut and Black Oak and Black Birch. Red Oak, White Oak, Swamp White Oak, Hemlock, Pin Oak and Silver Maple are minor overstory components. The understory included Amelanchier, Black Birch, Highbush Blueberry and Sugar Maple. The overstory covers about 45% of this Stand while the understory covered about 25% of this Stand.

The shrub layer covers 10% of this Stand. Species noted in this layer included Huckleberry, Highbush Blueberry and Greenbriar. Floor species include Chestnut Oak, Huckleberry, Black Oak seedlings, Pennsylvania Sedge and an unidentified Moss species. Floor species covered 45% of this Stand.

Tree quality is good in this Stand, with future timber found in Chestnut and Red Oak at this time. The average basal area of Stand 16 is 80 square feet per acre, with 400 trees per acre. Stand 16 has an average diameter at breast height (dbh) of 6 inches. This Stand is currently fully stocked. Acceptable growing stock is

Stand 16 Forest Management Recommendations

Gypsy Moth populations must be closely monitored in this stand. Populations were currently high. If population densities are high enough the Township should consider participating in the State spray program which is generally initiated in May while planning should occur much earlier.

The vernal pools in this stand should be monitored for amphibian and reptile species which may breed in them as well as unusual wildflowers and the New England Bluet. There is potential future timber in this stand but access would be difficult unless access was gained from the east.

Deer browse pressure should also be monitored in this stand. A small area may be fenced to study the affect of deer on wildflowers.

Recommendations for Stand 16

1. **Closely monitor Gypsy Moth populations in this stand and spray if necessary.**
2. **Monitor the vernal pools for threatened and endangered species which may reside in this stand. A herptile survey should be coordinated.**
3. **Any forest management conducted here would protect these vernal pools.**
4. **Try to keep hiking trails away from the vernal pools in this stand.**
5. **All trees will be marked by the Forester for girdling/removal.**

Stand 17

Stand 17 is an Upland Oak stand located on 10.50 acres. This stand is located in the southwest corner of the Beckman/Kostrey property. Stand 17 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 17 has a steep western aspect.

Stand 17 is a small timber sized stand. The overstory of this stand is dominated by Chestnut Oak and Red Oak. Minor overstory components include White Oak, Black Birch, Red Maple and Sugar Maple. The understory includes Red Maple, Black Birch, Sugar Maple, Sassafras and Hophornbeam. The overstory covers about 45% of this stand while the understory covers about 25% of this stand.

The shrub layer is covers about 10% this stand. Shrub species noted include Witch Hazel, Black birch, Blackberry, Poison Ivy, Sugar Maple and Amelanchier. Floor species include Huckleberry, Chestnut Oak, Ferns, Red Maple and Christmas Fern. Floor species covered 20% of this stand.

Tree quality is good with potential future timber found in Chestnut and Red Oak. This stand will move toward a more shade tolerant Northern Hardwood forest over time. If the Oak dominance to be maintained the canopy should be opened to promote regeneration of oak species. This would require a shelterwood type cut.

Forest stand improvement activities at this time should focus on removing unacceptable growing stock, mainly poorly formed Sugar Maples and Black Birch, while allowing the remaining trees to mature further. Access to this stand will be difficult due to the steep slopes to the west. If access can be worked out from the neighboring property to the east materials could be extracted from this stand.

The average basal area of stand 17 is 100 square feet per acre, with 86 trees per acre. Stand 17 has an average diameter at breast height (dbh) of 14 inches. This stand is currently fully stocked. Acceptable growing stock is 5,460 board feet per acre while unacceptable growing stock is about 11.83 cords per acre.

Site quality is good to very good in this stand. Deer browse appears to be moderate. There was a moderate to heavy infestation of Gypsy Moth in this stand. This should be closely monitored as this may speed up succession toward a northern hardwood stand if the oak species are killed by a repeated heavy defoliation.

The boundary in this stand is should be clearly marked as it is adjacent to numerous homes to the southwest. The Township should mark the boundary of this property with paint and posters. This area should also be monitored for encroachment from neighboring properties.

Stand 17 Forest Management Recommendations

This stand due to the steep slopes should be managed to protect the soils resources. There is also a stream at the bottom of the hill. This stand should be monitored for Gypsy Moth whose infestation will be moderate to heavy.

If it is decided that oak dominance will be maintained in this stand active management must be undertaken as this stand will slowly convert to a northern hardwood stand given the species found in the understory. A shelterwood type situation should be created to promote oak species growth. There is some potential timber noted in this stand but access would be the main issue towards conducting a harvest here.

Deer browse appears to be moderate in this stand and control measures should be investigated. No invasive species were noted but if they are found they should be removed promptly.

Recommendations for Stand 17

1. **Monitor this stand for Gypsy Moth populations.**
2. **Protect the soils in this stand and the stream at the base of the hill.**
3. **Clearly delineate the property boundary in this stand**
4. **If oak dominance is preferred by the Township active management must be implemented.**
5. **All trees will be marked by the Forester for removal.**

Forest Health

Several forest health issues were noted during the forest inventory. Insect infestations included Gypsy Moth and Hemlock Woolley Adelgid. The Adelgid was noted and has had a significant impact in stands 12, 13 and 14. The Gypsy Moth was noted in stands 1, 5, 8, 9, 10, 13, 14, 15, 16 and 17. Stands 5, 8, 10, 14, 15, 16 and 17 had moderate or heavy infestations.

Non-native invasive species control should be conducted in stands 1, 3, 4, 6, 7, 9, 10, 12 and 13. Stands with light infestations can be attacked first and most effective as well as stand 7 which is heavily infested with invasive species.

Given the make up of the stands on this property there are potential forest health problems for this property including but not limited to the species discussed below. These insect or disease outbreaks may be hastened by trees under stress due to competition, age and drought. The property should be inspected yearly to gauge forest health. Any decline in forest health noted by the landowner should be immediately brought to the attention of the Forester.

Gypsy Moth

The gypsy moth is native to Europe and Asia and is the major introduced pest of eastern United States hardwood forests. The gypsy moth is found mainly in the temperate regions of the world, including central and southern Europe, northern Africa, central and southern Asia, and Japan. The gypsy moth was originally introduced into Medford, Massachusetts in 1869 by Leopold Trouvelot, a French astronomer with an interest in insects. Trouvelot wanted to develop a strain of silk moth that was resistant to disease as a part of an effort to begin a commercial silk industry. However, several gypsy moth caterpillars escaped from Trouvelot's home and established themselves in the surrounding areas. Surprisingly, it wasn't until 20 years later that the first outbreak occurred. Despite all control efforts since its introduction, the gypsy moth has persisted and extended its range.

Gypsy moth caterpillars hatch from eggs during bud-breaking which occurs in mid-spring. Although the caterpillars are capable of feeding on over 300 species of trees and shrubs they prefer oaks. The male and female caterpillars typically pass through five and six instars (stages), respectively, before they enter the pupal (resting) stage in early to mid-summer (June-July). They remain in the pupal

stage for approximately 2 weeks and the male moths emerge one or two days before the females. The adult male and female gypsy moths are easily distinguished from one another; the males are brownish-gray, whereas the females are white with black markings and slightly larger. Unlike the males, the females are incapable of flight.

After emerging from the pupal stage, female moths emit a pheromone (chemical) which attracts males from moderate distances and mating then occurs. The females then lay oval shaped egg masses which are covered with hairs from her body. The buff-colored egg masses contain 100 to 1,500 eggs and are laid on the underside of tree limbs, bark, rocks, and structures including buildings, campers, mobile homes, etc. Long distance spread of the gypsy moth occurs when egg masses are unknowingly transported from infested areas on vehicles. Short distance spread (up to a couple of miles) results when small caterpillars are blown by the wind, a process known as ballooning.

Repeated defoliation stresses trees and can lead to death. During outbreaks in residential areas gypsy moth caterpillars are an extreme nuisance. Trees lose their foliage, caterpillars crawl everywhere, and their droppings rain from the trees.

Various control measures are available for use against the gypsy moth; however New Jersey's efforts are mainly aerial applications of Bt (*Bacillus thuringiensis*) by the NJ Department of Agriculture in cooperation with the New Jersey Forest Service. Bt is a naturally occurring disease that only kills caterpillars. Bt is applied only in areas of heavy infestation which is detected by field surveys conducted in fall and winter.

In 2008, approximately 137,171 acres where defoliated by Gypsy Moths in Sussex County, including 1,614 acres which were moderately defoliated in Byram Township. In 2007, 96,655 acres were defoliated in Sussex County and 0 acres in Byram Township. In 2009, it is hoped that these numbers begin to decrease. The State of New Jersey has proposed spraying 172 acres in Byram Township in 2009. These properties should be inspected regularly to detect and manage infestations early.

Hemlock Woolly Adelgid

The Hemlock Woolly Adelgid, *Adelgid tsugae* has been in the United States since 1924. It is a native of Asia and is a serious pest of Eastern Hemlock. A fully grown adult is about the size of a period on this page. The best sign of an infestation is white cottony sacs at the base of needles. They are present throughout the year but are most prominent in the spring. They are dispersed by wind, birds, mammals and humans moving infested plants.

The adelgid feeds during all seasons of the year. The insect prevents tree growth by sucking sap from young growth. This feeding causes discoloration of the needles from deep green to grayish green and eventually drop of the needles. The loss of new growth significantly weakens the tree and death can result in a few years.

An integrated pest management approach is best in reducing infestation. Practices to enhance tree vigor, frequent visual inspections of Hemlock trees and using chemical and biological controls have shown the best results. Infestations often begin on large Hemlocks which intercept prevailing winds or are particularly attractive to birds and other wildlife. Health can be improved via forest stand improvement activities, reducing water stress and pruning. Fertilization, particularly with nitrogen, has been shown to enhance the adelgid's survival and reproduction.

Psuedoscymnus beetles have been released as natural predators of the adelgid and have shown good results in test studies. Applications of dormant oils or insecticidal soaps in late April or early May, late summer and again in June have also proven effective but are not feasible in a forested situation. Soil injections of Merit in Spring and Fall have also showed positive results.

Forest Tent Caterpillar

The forest tent caterpillar is a native insect that occurs throughout most of the United States and Canada. This caterpillar feeds on a wide variety of hardwoods. In the North and West, trembling aspen is preferred. Forest, orchard, and ornamental trees are also acceptable, and several extensive outbreaks of the insect have occurred in the past.

Eggs are laid in masses containing 100 to 350 eggs. The mass is a cylindrical band, ringlike in shape and 25 to 37 mm (1 to 1.5 in.) wide, that encircle the twig (fig. 20). The ends of the mass are square, and the whole mass is coated with a dark-whole mass is coated with a dark colored, glue-like substance. Winter is spent in the egg stage, and hatching occurs in the spring about the time the tree buds begin to swell.

Young larvae feed on the expanding buds; the older ones eat the foliage. Young larvae from one egg mass feed together as a group on a leaf or leaf cluster. As the larvae grow and mature, the group breaks up and each larva feeds alone on the foliage. Full-grown larvae are about 50mm (2 in.) long with a light bluish-black head and a few scattered white hairs. The back of the body is marked lengthwise with a row of whitish-yellow, keyhole-shaped spots. The remainder of the body is various shades of gray (fig. 21).

Larvae lay down strands of silk as they move about. They also form silk mats on the trunks and branches on which they collect in-groups to rest between feedings. Contrary to the common name, a tent is not constructed by the larvae. As they approach maturity, they wander about individually in search of food or places to pupate.

Pupation occurs in pale-yellow cocoons about 25 mm (1 in.) long that are spun in folded leaves, bark crevices, and other protected sites (fig. 22). Depending on the geographic location, the appearance of adults occurs from late May in the South to early July in the North. The stout-bodied, light buff-brown adults have a wingspread of 25 to 37 mm (1 to 1.5 in.).

There was no sign of tent caterpillars found during the inventory of this property.

Bacterial Leaf Scorch

Bacterial Leaf Scorch (BLS) is an incurable disease that affects mainly Red Oak as well as other oak species, American Elm, Sycamore and Red Maple. BLS is caused by a bacterium *Xylella fastidiosa*, which disrupts water flow causing leaves to brown. It is believed to be spread by xylem feeding insects such as leaf hoppers, tree hoppers and spittle bugs. These bugs feed on an infected plant, picking up the bacteria and then injecting the bacterium into a healthy plant leaves. It can also spread from other plants such as Goldenrod, Blackberry and Alfalfa.

Symptoms are most visible in the fall. The pattern of leaf scorch is irregular, beginning at the outer edges of the leaf and moving inward, with a characteristic red or yellow band between the brown and green portions of the leaf. Reduction of environmental and water stress, insects and other diseases may enhance the development of Bacterial Leaf Scorch. Improved growth rates, removal of stressed branches and watering are the recommended responses. Again this problem affects mainly urban trees although a study is underway to gauge its affect on forested ecosystems.

There were no signs of Bacterial Leaf Scorch noted on this property.

Asian Long-horned Beetle

The Asian Longhorned Beetle, *Anoplophora galbripennis* is native to portions of eastern Asia and was first discovered in New York City in 1996. They arrived in the United States via wood packing materials used cargo shipments from China. Trees favored by the Asian Longhorned Beetle are mainly Maple but infestations have also been found on Horsechestnuts, Poplars, Willows, Elms, Mulberry and Black Locust. Currently there is no known chemical or biological defense against this species. Out breaks in New Jersey have been limited to urban areas including Carteret, Woodbridge, Rahway, Jersey City and Linden have all had infestation. In case of infestation the affected trees are cut down and destroyed as are a buffer of healthy unaffected trees. A quarantine area is also established from which no wood products are permitted to leave. No infestations have been found in forested environments although the effect would be no less devastating.

Mature Asian Longhorned Beetles are very large insects with bodies ranging from 1-1½ inches in length and antennae which can be up to 4 inches long. They are shiny black with white spots and antennae are black and white banded. These beetles can fly but only over short distances. The major mode of transport is via transport of infested materials.

Signs of an infested tree include exit holes which are 3/8 to ¾ inches in diameter. Mature beetles emerge from trees in late May through October, with a peak in July. Sap may be noted oozing from infested trees and coarse sawdust or frass may be found on the ground or lower branches.

The majority of damage is inflicted by the beetle larvae which burrow deep with a tree to feed on the trees food and water conducting vessels. This eventually girdles the cambium layer and causes structural defects.

There were no signs of this insect noted on this property.

Wildlife

Although few species were noted during the inventory with the exception of White-tailed Deer, Pileated Woodpeckers, a Ribbon Snake and Black-capped Chickadees, these properties hold the potential to provide suitable habitat for many wildlife species with proper management, including neo-tropical birds and amphibian species.

This mosaic of land use provides ideal habitat for the White-tailed Deer, while its proximity to residential developments may limit hunting opportunities. For forest management and habitat diversity, White tailed Deer are the biggest concern. White-tailed Deer have become once of the greatest threats to forest restoration, growth, species and vertical diversity. Extremely high deer populations in the area are altering the vitality and composition of the future forest in many areas of New Jersey.

An indicator of a high deer population includes lack of forest regeneration, forest stratification, loss of shrub species and visible browse lines in extreme cases. In many areas of New Jersey forest composition is being altered. This loss of stratification and vertical diversity is a major threat to biodiversity particularly herbaceous plants and ground or shrub nesting neotropical migrants.

Deer need to be taken into account in every facet of this forest management plan to assure future forest regeneration, restoration of native shrub species. The most effective deer control programs focus on doe harvesting as they have a smaller home range and one buck can fertilize many does in a season. The landowners understand the importance of keeping the deer population in check and may permit hunting on the property. Deer will have a negative impact on landscaping as well as any agricultural products which may be raised on the property.

Based upon the vertical structure and the lack of a shrub layer in many of the stands on these properties deer populations should be reduced on these properties for the health of the forest ecosystem as a whole. Browse levels should be closely monitored as time goes on.

Snags

Snags provide essential habitat for at least 35 species in the Northeast which use cavities for nesting, shelter, roosting perching and foraging sites. A snag is a standing dead or dying tree. A downed log is a log lying on or near the forest floor. Trees can be killed by a variety of factors including lightning, storms, fire, disease or insect outbreaks.

Large snags (>12" dbh) tend to be more valuable than small snags as they can be used by a wider variety of species. Small clumps of snags scattered throughout the forest are best as they provide nesting and foraging sites in one location. Large groups of snags are not usually used by more than one pair of the same species due to territorial behavior.

Active forest management can have a positive impact on snags and downed woody debris in the following ways. During regeneration cuts cull trees and snags can be left to provide for wildlife habitat. Trees can be girdled rather than removed from site. The tops can be removed from large trees to create a snag. Snags created should include trees of multiple sizes to provide shelter and food for a variety of species. A combination of species should also be left as snags. Oaks, Hickories and Ash tend to be harder woods than Maples, Poplars and Pines and would provide habitat for a longer period of time.

Vernal Pools

A vernal pool is a contained basin depression lacking a permanent above ground outlet for water. They fill with water with the rising water tables of fall and winter with melt water and runoff from winter and spring snow and rain. A vernal pool is a wetland that holds water for 2-3 months a year in spring and early summer. Vernal pools are critical breeding habitat for numerous species of frogs and salamanders. The drying of these pools is critically important to these species because they cannot support fish which would feed upon frog and salamander eggs and young stages of these

species. By late summer vernal pools are generally (but not always) dry. Breeding of these species typically occurs immediately after snow melt.

Several vernal pools were noted on these properties, particularly the Beckman/Kostrey property. The vernal pools should be surveyed, monitored and protected during any forest management activities.

Threatened and Endangered Species

As part of the Forest Stewardship Program a search of the Natural Heritage Database was conducted. Eleven Endangered, Threatened or Species of Concern were found to potentially reside on or near the Byram Township owned property. This search includes documented sightings and potential habitat as described by the Landscape Project.

Cave aquatic and Cave terrestrial communities were listed for the Owners Maintenance site. No information could be located concerning these habitats and they will not be discussed further in this plan. It should be noted that no caves were noted during the forest inventory.

Bald Eagle Foraging Area

The Bald Eagle, *Haliaeetus leucocephalus*, is a State endangered species (listed in 1974) and a federally threatened species (proposed for delisting). Bald Eagles are large birds (7-8' wing span) with a fully white head and tail. Adult plumage does not appear until the fifth year. Prior to this they are generally mottled brown and white. By the fourth year, they develop a white head and tail but retain some brown flecking and appear dirty.

Bald Eagle habitat consists of areas of forest that are associated with bodies of water. Their diet is primarily fish. Bald Eagles have historically been associated with the forests near the Delaware Bay and rivers emptying into the Atlantic Ocean and Delaware Bay. They require a location that is safe from human disturbance. Nests are typically in super-canopy trees that are taller than surrounding trees. This is done to allow them to land and depart from the nest with ease.

Foraging habitat consists of large perch trees near water. Winter habitat consists of the same with the added condition of open ice-free waters.

As recently as 1982, there was only 1 Bald Eagle nest in New Jersey. The State launched a hacking program which brought 60 eaglets to New Jersey between 1983 and 1989. Combined with the ban of DDT in 1972 a second nest appeared in 1988. Currently, there are 59 pairs with 55 active nests in New Jersey with the majority concentrated in the Delaware Bay Region. This is a remarkable comeback for a species that maintained only one nest in 1982.

The management recommendations in this plan will not affect the local eagle nest or its foraging habits. Given the distance to a viable feeding area from these properties it is unlikely that a Bald Eagle would be noted on any of these properties other than soaring overhead.

Barred Owl

The Barred Owl, *Strix varia*, is a State Threatened Species in New Jersey. Barred Owls nest in dense coniferous and mixed forests, wooded swamps and river valleys. Nests are 20-50 feet from the ground, typically in cavities but abandoned hawk and squirrel nests may be used. Nest sites in northern New Jersey were over 1600 feet from the nearest residence and had little or no forest clearings or trails. Typical home ranges are from 213-914 acres. These owls feed on mice and other rodents.

The Barred Owl is 21 inches tall with brown upper parts with buffy white barring. The tail has alternating bands of brown and gray. The throat is white and the head has no ear tufts. The facial disk is grayish white with a brown outline. Feet and toes are feathered. Eyes are dark brown and the hooked bill is buff yellow. The song “who cooks for you, who cooks for you all” is most likely heard February to April. Barred Owls prefer flat lowland terrain and avoid rocky slopes and hillsides.

Forest Management practices in this plan will have no effect on the Barred Owl. There are numerous large diameter trees on this property. Snags may be created to improve habitat and large dead and dying trees may provide suitable habitat for this species. It is possible that these properties may serve as nesting or forage site.

Bobcat

The Bobcat, *Felis refus,* was once thought to be extirpated from the State of New Jersey due partially to hunting but mainly due to habitat destruction and fragmentation. It was listed in 1973 as a game species with a closed season. Between 1978 and 1982, 24 Bobcats were captured in Maine and released in Northern New Jersey. In 1991 the Bobcat was reclassified as Endangered under NJ's Endangered and Non-game Species Conservation Act.

Bobcats have been confirmed in Sussex, Warren, Morris and Passaic Counties by a scent post survey in 1995. Reliable sightings have been reported in Mercer, Somerset, Bergen, Burlington, Ocean, Atlantic, Cape May, Cumberland and Salem Counties.

Bobcats generally have tawny to grayish-brown fur with spots and streaks of whitish colored underside that is also spotted and streaked. The fur around their lips chin and underside of the neck are also lightly colored. They have ruffs of fur on both sides of their face and small tufts on the ears. The tip of the short tail is black.

The Bobcat has relatively long legs in relation to their bodies with hind legs longer than their front legs. This accentuates the 5-7 inch bobbed tail. A mature Bobcat is approximately 35" in length and 20" at the shoulder. Weights range from 15-25 pounds for adult females and 20-40 pounds for adult males.

Bobcats use habitat containing a mix of early and late successional stages and do not prosper in areas of intense agriculture or suburbanization. They prefer habitats that provide dense understory cover (such as Mountain Laurel and Rhododendron) for resting and protection from weather. Bobcats in northern New Jersey often use rock outcrops, caves and ledges for hunting, resting and rearing

young. Bobcats feed on a variety of prey on small mammals including rabbits, squirrels, chipmunks other rodents and birds. Males will hunt deer during winter months if other prey is scarce.

Bobcats may inhabit or pass through the Byram owned properties but they lack of dense understory growth except in stand 1 limits the potential cover for this species. Forest management activity will improve habitat by improving understory cover.

Bog turtle

The bog turtle, *Clemmys muhlenbergii*, is a state endangered and federally threatened species. The bog turtle is 3-4 ½" in length. The identifying mark is a large yellow or orange patch on each side of the head. The bog turtle is found in freshwater wetlands of high quality with little to no woody vegetation, fens, wet meadows and marshes.

Given that the wetlands on these properties are forested it is unlikely that it serves as an ideal habitat for the bog turtle which favors agricultural land and an open canopy. It is unlikely that the bog turtle would be found on the Byram owned properties although potential sites on the Beckman/Kostrey and Arnell properties can be investigated further. If a survey of the wetlands were completed. The best time to see the bog turtle is from mid-April thorough June basking in the sun. If it is found to be suitable habitat for the bog turtle appropriate management recommendation can be added to this plan. This may require removal of woody vegetation and maintenance of the herbaceous vegetation which can be accomplished via mechanical means of livestock grazing.

Cerulean Warbler

The Cerulean Warbler, *Dendroica cerulean*, is a Species of Special Concern in New Jersey. This bird nests in mature deciduous forest usually with oaks on high horizontal limbs far from the trunk 30-60 feet from the ground. The Cerulean Warbler is an insect feeder which forages high in trees with great agility. This species is very sensitive to forest fragmentation.

The Cerulean Warbler is 4 ¾ inches in length. The male is light blue above and white underparts with indistinct black streaks on the back and upper tail coverts. A narrow black necklace on the upper breast with some black streaking on the flanks as well as white wing bars. The female has bluish green to olive upperparts and white to yellow white underparts with faint streaking on the flanks, two white wing bars and a yellowish eyebrow stripe. This bird's song has 3 parts. Two-three slow buzzy notes then several rapid buzzy notes followed by a longer buzzy note on a higher pitch, "zray zray zray ze-ze-zezreeeee".

This species may forage and nest on this property and the surrounding area, which provides extensive contiguous forest. Forest management activities in this plan will have little effect on this species which will maintain high canopy habitat.

Cooper's Hawk

The Cooper's Hawk, *Accipiter cooperii*, is a State Threatened Species. Copper's Hawks typically nest in deciduous, coniferous and mixed riparian or wetland forests. Nests are 35-45 feet off the ground in the crotch of coniferous trees or near the trunk of deciduous trees. Occasionally, they will use old crow nests. Nest sites are in sub-climax forests with moderate to heavy shrub cover, 1/3 a mile from the nearest home. They are monogamous, solitary nesters. Home ranges vary from 260 to over 1000 acres and contain forest edges and small opening near streams. Copper's Hawks feed mainly on birds.

The Cooper's Hawk is crow sized, with a short rounded wings and a long narrow tail. In flight this bird is cross shaped and distinguished from the Sharp shinned Hawk which appears T shaped with a small head. Cooper's Hawk has a dark cap, blue-gray back and rusty, barred under parts. The tail is usually rounded and white edged. The call given during the breeding season is a loud nasal "cak cak cak".

Forest management activities in this plan will maintain or improve the habitat for this species by increasing vertical

structure of the forest and habitat for its prey species. These birds often forage near homes and bird feeders. These properties provide potential habitat for the Cooper's Hawk.

Great Blue Heron

The Great Blue Heron, *Ardea herodias*, is the largest of North American herons and is a stable species in New Jersey whose breeding colonies are protected. The Great Blue Heron stand 4 feet tall and has a wingspan of 6 feet; despite this the bird only weights 6.5 pounds. Their bodies are dark blue-gray, which contrasts with a white streaked black breast and abdomen. It has a long gray neck with a white crown, cheek and throat. Two long black occipital crests rise from the crown stripe in adults. The Great Blue Heron has very long legs, a long neck and a sharp bill.

The Great Blue Herons diet consists mainly of fish which it swallows head first as well as frogs, snakes, salamanders, rodents and sometimes insects. The Heron will wade through water and freeze briefly before striking at its prey with its bill. The heron breeds in localized colonies called rookeries and may fly 15-20 mile to feeding locations. Mating occurs in March or April with the male heron building the nest usually high in living trees but occasionally in dead trees. Herons lay 3-7 eggs and have a 28 day gestation period and both parents care for the eggs and young. Usually one or two survive. Chicks fledge in about 60 days.

In the late 19th and 20th centuries Great Blue Herons were shot in large numbers for there plumage for the millinery industry. Although they have adapted well to presence of humans and shoreline development their nesting colonies remain vulnerable.

No rookeries were noted on this property. This species is a very unlikely but possible visitor to these properties due to the small stream located on the two sides and vernal pools of the Beckman/Kostrey tract and the small stream on the Arnell tract. Forest management activities will have no effect on this species as there are no rookeries noted on this property and potential foraging areas will not be impacted.

New England Bluet Damselfly

The New England Bluet Damselfly, *Enallagma laterale*, is a State Species of Concern. It flight season ranges from May 12th to June 28th. This species is found in Sussex, Morris Passaic and Bergen Counties. This species is very rare and local throughout its range. They are just over one inch in size.

This species is a small semi aquatic insect. It has large eyes on the sides of its head, short antennae and four heavily veined wings. The males thorax is mostly blue with black stripes on the shoulder and top. It has a long and slender abdomen composed of ten segments. Abdomen segments are blue with black markings on segments 1-7. Segments 6 and 7 are almost entirely black on top. Segments 8and 9 are entirely blue.

They are found in swampy open water. Nymphs are aquatic while adults inhabit emergent vegetation in wetlands and also fields and forests near wetlands. Adults feed on a wide variety of smaller insects typically caught in flight. They are believed to have a one year life cycle.

This species may be found near the vernal pools on the Beckman/Kostrey property and the wetlands located on the Arnell tract. It may be possible to survey this property for this species in late spring or early summer. Forest management activities will not affect this species.

Wood Turtle

The wood turtle, *Clemmys insculpta*, is a state threatened species. The wood turtle is 5-9" in length, with a brown carapace with irregular pyramids rising from concentric ridges. The wood turtle breeds in vernal ponds or along clean streams and moves some distance from these breeding areas especially after spring and summer rains.

The Arnell, Beckman/Kostrey properties and to a lesser extent the Owner's Maintenance tract seem to provide suitable habitat for this

species. Owner's Maintenance lacks the wetland portion of the habitat required for this species but wetlands on the Arnell tract are directly across the road from the Owner's Maintenance property. The Beckman/Kostrey property provides the best potential habitat for this species.

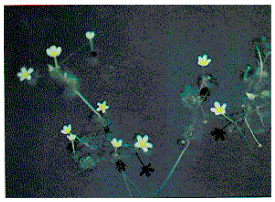
The fragmentation of the forest by development may have impaired the long term viability of this species. During any time on the property special attention will be paid to looking out for the species. Any forest management activities involving motorized equipment will be competed during the winter months while this species is dormant. Large woody debris should be left on the ground for shelter for this species. Creation of snags will provide beneficial habitat for this species when woody debris is added to the forest floor. Downed woody debris is limited at this time but with the reduced health of this forest large limbs are beginning to fall to the forest floor.

Early Coral-root

Early Coral-root, *Corallorhiza trifida,* is a 4-12 inch tall plant. The flower is yellowish-green, sometimes tinged with purple and ¾ inch long. It flowers from May to June and is found in swamps and damp woods. This plant is found from Maryland west to California and north to Alaska and Newfoundland, Canada. Early Coral-roots' leaves are bladeless bracts sheathing the stem. This plant may be sought by collectors and its location should not be disclosed. This plant is listed as imperiled in New Jersey.

White Water Crowfoot (Longbeak Buttercup)

White Water Crowfoot, *Ranunculus longirostris*, is a state threatened species in New Jersey. It is found in slow moving streams, ponds and marshes. It is found from New Hampshire to Virginia, southwest through Texas to California and North to Washington State. Most of this plant is submersed. Leaves are cauline (found near the top of the stem) globular in outline, flattened and .4 to .8 inches long and .8 to 1.2 inches in length. Flowers are five petaled, white and suffused with yellow at the base. Flowers are ¼ to ½ inch in width.



Invasive Species

Invasive plant and animal species are one of the biggest threats to biodiversity. Invasive plants and animals out compete and eventually replace native species. During the inventory the list of non-native plant species distributed to Consulting Foresters were also surveyed. Japanese Barberry, Asiatic Bittersweet, Garlic Mustard, Wineberry, Japanese Knotweed, Japanese Stilt Grass and Multiflora Rose were the non-native and invasive species were noted on these properties during the forest inventory.

Japanese Barberry

Japanese Barberry, *Berberis thunbergii*, was located in stands 1, 3, 4, 7, 9 10 and 12. Japanese Barberry is a spiny deciduous shrub growing up to 8 feet in height and width. Leaves are alternate, simple and entire. Stems are numerous, reddish-brown and angled or grooved with stiff, short, single spines. The native species usually has 3 prolonged spines and toothed leaves. Fruit appears in late summer is bright red, dry and oblong and may remain on the shrubs through winter. This plant was introduced between 1864 and 1879 from Japan. It is found in full sun to full shade in most soil types. Growth is minimal in low light and seedling survival drops from 90% in moderate to high light to 40% in low light. Plants will persist in low light conditions. They leaf out prior to canopy trees and leaves remain after leaf fall. Deer herbivory is minimal. There are at least 47 cultivars.

Threats

Barberry can grow in sun or shade and in many soil types (Johnson 1996). Branches touching the ground can root, and new shoots can develop from underground roots (Wisconsin Dept. Natural Resources 1998). Barberry can grow so thick in the understory of open forests that it shades out indigenous understory plants and decreases biological diversity. This could adversely affect birds and other animals dependent on the native plants (Johnson 1996). Barberry also affects soil properties, particularly pH, which can affect plant establishment (Kourtev, et al. 1998). Severe infestations of barberry can form nearly impenetrable thorny thickets that impact the recreational value of natural lands.

Control

Mechanical removal by hoe or weed wrench is effective if most of the root system can be removed (Vermont IEPFSS1998). Regular mowing can prevent reinfestation in successional fields. Herbicide treatment can be used to treat shoots that resprout (Johnson 1996). Small patches can be pulled or dug out early in the season, before seed set (Johnson 1996).

Multiflora Rose

Multiflora Rose, *Rosa multiflora*, was located in stand 13. Multiflora Rose is a perennial deciduous shrub up to 16 feet and as wide with long arching branches. It reproduces by seeds, sprouts and layering, when long branches touch the ground and root. Leaved are alternate, pinnately compound with 5-11 elliptical leaflets. Stems are flexible, green-red with rigid curved thorns with a wide base. Multiflora Rose was introduced in 1886 from Asia and promoted in the 1930's and 40's as a living fence, soils stabilizer and wildlife food and cover. It can be found in forest canopy gaps, roadsides, streambanks, pastures and mature forests. It may serve as nest sites for birds and rabbits. Repeated herbivory is lethal. There are at least 3 cultivars.

Threats

Multiflora rose can produce dense, impenetrable monocultures that exclude indigenous plants and restrict the movement of some animals (Eckardt 1987). It is a strong competitor for below-ground resources, inhibiting the growth of indigenous plant species and also commercial crops in adjacent agricultural fields (Eckardt 1987). It is tolerant of some shade, and of a range of moisture conditions, enabling it to invade a variety of natural plant communities. It significantly alters natural plant community structures and reduces overall biological diversity.

Control

Repeated mowing or cutting can be used to control the spread of small populations, but will not eradicate them (Eckardt 1987) since multiflora rose can resprout from stumps. Small plants can be dug out, provided the entire root is removed (Virginia NHP 1998). Plant growth regulators have been used effectively to prevent plantings from spreading, and herbicides can be used to kill plants (Eckardt 1987). Herbicides should be used with caution, as they could harm indigenous plants. Several potential biological control agents are under investigation (Eckardt 1987).

Wineberry

Wineberry, *Rubus phoenicolasius,* was noted only in stand 3. Wineberry grows from biennial arching canes, which reach up to 2 m long. The leaves are divided into three leaflets whose undersides are covered in small, dense white hairs. The stems and buds are covered by dense 3-5 mm long purple hairs, which give the stems a shaggy appearance. The five-petaled flowers are white and bloom in late spring to early summer. The fruits mature in mid to late summer. Fruits are red, juicy berries dispersed by birds and other animals.

Habitat

Wineberry is frequent in open or disturbed habitats such as thickets, fields, and forest edges, railroad and utility rights-of-way, and old homesites. It also successfully invades wooded ravines, floodplain forests, calcareous forests, shale bluffs, and traprock and diabase forests.

Distribution

Wineberry was introduced into the eastern United States from Asia. Originally grown in cultivation, wineberry is now widespread throughout the Eastern United States were it occurs from Vermont south to Georgia, and west to Arkansas. It occurs throughout New Jersey's physiographic provinces, but reaches its greatest abundance in the Piedmont, Highlands, and Ridge and Valley provinces.

Threats

Wineberry forms an extensive, nearly impenetrable understory layer in favorable locations such as moist soils in forests over dolomite, marble, shale, diabase, and traprock. These substrates are known to support several rare plant communities and unique plant assemblages. Thickets of wineberry alter the structure of natural plant communities, outcompete rare or declining plant species, and contribute to the loss of biological diversity. In the Piedmont and the Kittatinny limestone valley of the Ridge and Valley Province, wineberry frequently occurs with the invasive nonindigenous species Japanese barberry (*Berberis thunburgii*), Japanese honeysuckle (*Lonicera japonica*), and Japanese stiltgrass (*Microstegium vimineum*) (D. Snyder, personal observation). Such wholly unnatural plant associations can dominate an acre or more of woodland, with an obvious reduction in the diversity of indigenous understory and herbaceous species.

Control

There is currently no control information specific to wineberry, but other *Rubus* species are controlled mechanically and with herbicides. Small plants can be handpulled, and larger plants can be dug out. It is important to remove the root crown, as plants will resprout from the crown. Root crowns and stumps can also be treated with herbicides if left in the ground, but herbicides can harm adjacent indigenous plants.

Japanese knotweed

Japanese knotweed, *Polygonum cuspidatum*, was found in stand 7. Japanese Knotweed is a herbaceous perennial that forms large clumps up to 13 feet tall. The smooth stems are stout and hollow like bamboo, and they show little branching. The leaves are broadly ovate, 2-6 inches long and taper to a point. The plants are dioecious (male and female flowers on separate plants), and bloom in late summer and early fall. The greenish-white flowers are very small, and are arranged in branched sprays from the leaf axils. When in full bloom, the plant has masses of flowers all along the stem. The seeds are held in winged, triangular, shiny black-brown achenes that are generally wind dispersed, but can also be dispersed by water and by transportation of fill dirt. The plant also produces long rhizomes (up to 20 m in length) that allow the plant to spread quickly locally, and when rhizome fragments are transported to new sites they can initiate a new population.

Habitat

Japanese knotweed tolerates a wide range of soil types, pH levels, and nutrient levels. It prefers open areas, but can tolerate shade. It has become a characteristic species of floodplain forests throughout northern New Jersey and the Inner Coastal Plain. It typically forms dense monocultures along the banks of rivers and streams. It also grows on the margins of ponds and lakes, open woods and thickets, meadows and successional fields. It invades disturbed areas, such as ditches, roadsides, dredge spoils, and recently cleared or filled areas. Once established, it quickly spreads into moist or damp soils in adjacent undisturbed natural plant communities.

Distribution

Japanese knotweed is indigenous to eastern Asia, and was introduced to the United States

as an ornamental before 1890. It is now widespread across the United States, and is considered invasive in at least nine eastern states. It is also invasive in the United Kingdom, where it is prohibited to introduce the plant into the wild. It occurs throughout New Jersey's physiographic provinces.

Threats

The early spring emergence of Japanese knotweed, and its dense growth, prevents indigenous species from establishing, in turn reducing species diversity and wildlife habitat. Because Japanese knotweed favors damp areas and areas that have been disturbed, riparian corridors are particularly at risk. It can cause flooding by decreasing water flow through stream channels. Once established, it is extremely persistent.

Control

Natural areas should be monitored to prevent establishment of Japanese knotweed. Small stands can be controlled by repeatedly cutting the stems during the growing season, and by revegetating once knotweed growth is reduced. All plant parts should be removed from the site. Digging out rhizomes creates soil disturbance and may spread rhizome fragments. Shading with black plastic or shade cloth may also reduce growth. Large stands can be treated effectively with herbicides, but many of the most effective herbicides are nonselective and may persist in the soil. Biological control agents are being investigated in Europe, but research is still in the early stages.

Asiatic Bittersweet

Asian bittersweet, *Celastrus orbiculatus,* was found in stand 7 and is a deciduous, woody, perennial vine that can also grow into a trailing shrub (Bergmann and Swearingen 1999). It climbs by twining around a support. The leaves are alternate, with a rounded glossy appearance, and finely toothed edges. The stems are brown with noticeable lenticels (Dreyer 1994). Asian bittersweet flowers in spring, producing clusters of small greenish flowers in the leaf axils. Fruits mature in late summer to early fall. The green to yellow mature fruits split open to reveal bright red arils that surround the seeds.

Asian bittersweet is sometimes confused with the similar indigenous American bittersweet (*Celastrus scandens*), especially in the nursery trade (Dreyer, et al. 1987). American bittersweet can be reliably distinguished from Asian bittersweet by having terminal, rather than axillary, clusters of female flowers and fruits, and, less reliably, by its more elliptical shaped leaves and more orange-colored fruits (Dreyer 1994). The fruits are primarily dispersed by birds and small mammals (Bergmann and Swearingen 1999). People are often dispersers as well, harvesting the branches for ornamental use and later discarding them. The vine also reproduces asexually by stolons (above-ground stems), rhizomes, and root suckering (Bergmann and Swearingen 1999).

Habitat

Asian bittersweet occupies a wide range of habitats including forest edges and gaps, floodplains, fields, hedgerows, beaches and salt marsh edges (Bergmann and Swearingen 1999). It is shade tolerant, and can establish under a closed forest canopy (Dreyer, et al. 1987; TN-EPPC 1999).

Distribution

Asian bittersweet is indigenous to eastern Asia, including Japan, Korea, and parts of China. It was introduced to the United States in the late 1800s, and was planted as an ornamental and used for wildlife food and cover and erosion control (Dreyer 1994). In the United States it occurs from Maine to Georgia, and west to Iowa and Arkansas (Kartesz 1999; Virginia NHP1999). It is also present in Quebec and Ontario, Canada (Kartesz 1999). Several states consider it invasive, including Connecticut, Delaware, Maryland, Massachusetts, New York, Pennsylvania, Tennessee, Virginia, and Vermont. Clemants and Glenn (1999) map it as widespread throughout northern New Jersey with records in all counties from Monmouth north to Sussex. It occurs in all physiographic provinces.

Threats

Trees and shrubs can be severely damaged by Asian bittersweet, as its twining branches eventually constrict their trunks and branches, and the vegetative growth can over-top and outshade them. This makes the trees more susceptible to damage by wind, snow and ice storms (Dreyer 1994). It can form pure stands over some areas. It threatens dune areas as well, possibly altering erosion patterns and outcompeting native dune vegetation. The alteration of natural vegetation structure caused by

Asian bittersweet can make recovery of an area very difficult. Preliminary investigations indicate that Asian bittersweet has a much higher percentage of pollen and seed viability than does American bittersweet and may therefore be able to outcompete American bittersweet (Dreyer, et al. 1987). There is also evidence that Asian bittersweet may be hybridizing with American bittersweet, threatening the genetic identity of American bittersweet (Dreyer, et al. 1987; Dreyer 1994).

Control

Control of Asian bittersweet can be difficult, as seed germination rates are high, and seeds are persistent in the soil bank (Dreyer 1994). Small populations can be cut repeatedly until the root stores are exhausted. Juvenile plants can be hand-pulled, but any root portions not removed can resprout (TN-EPPC 1999). All plant parts should be removed from the site to prevent reestablishment. A combination of cutting and herbicide treatment of stumps can be effective (Dreyer 1994), but herbicides could adversely affect surrounding native vegetation.

Japanese Stilt Grass

Japanese Stilt Grass, *Microstegium vimineum,* was found in stand 7. Japanese Stilt Grass grows as an annual grass (Mehrhoff 2000) with a sprawling habit, and can reach heights of up to 3 feet (Swearingen 1998; TN EPPC 1998). It has thin, pale green, lance-shaped leaves, about 3 inches in length, which grow alternately along a branched stalk. The leaves have a silvery stripe of reflective hairs down the center of the upper leaf surface (Swearingen 1998). The stalk is distinctly divided by nodes, with the segments between the nodes flattened and widening toward the upper end (Smith 1998). The flowers bloom along a delicate spike that emerges from the stalk tips in late summer and early fall (Swearingen 1998). The seeds mature in mid to late fall, and can remain viable for more than five years in the soil (TN EPPC 1998). Plants spread locally by rooting at the nodes. Seed dispersal is by animals, water, or deposition with fill dirt (TN EPPC 1998). The report that there is a rhizomatous perennial form occurring in eastern North America (Ehrenfeld 1999), has been challenged by Mehrhoff (2000), who believes the report is based on misidentification of the indigenous grass, *Leersia virginica* L. The two species are vegetatively similar and grow in similar habitats, often growing in mixed populations (Mehrhoff 2000). Vegetative plants can be distinguished by the silvery stripe running along the middle of the leaves of Japanese stiltgrass, a

character lacking in *Leersia virginica.* The two species are easily distinguished when in flower or fruit.

Threats

Japanese stiltgrass alters the structure of natural plant communities and reduces biodiversity by displacing indigenous herbaceous vegetation through its dense growth, which rapidly forms monocultures that are sometimes acres in extent. Because of its rapid and dense growth, it alters light and moisture regimes and likely affects seed germination. Kourtev, et al. (1998) speculated that Japanese stiltgrass in association with Japanese Barberry (*Berberis thunbergii*) raises pH and reduces the organic horizons in soils.

Control

Prevent introduction of Japanese stiltgrass from invaded sites to adjacent natural areas by avoiding disturbance to vegetation and soil in the natural areas (Swearingen 1998). Small infestations can be hand-pulled, but pulling will have to be repeated until the seed bank is exhausted. Plants can be mowed when flowers are blooming, but before seed set. Herbicides can be effective, and should be applied before plants set seed (TN EPPC 1998). Herbicides should be used with caution, as they could harm indigenous co-occurring plants.

Garlic Mustard

Garlic Mustard, *Alliaria petiolata,* was found in stands 1, 4 and 6. Garlic mustard is a herbaceous biennial that ranges in height from 0.05 to 1.5 meters (Nuzzo 2000). Seedlings emerge in spring and form rosettes of kidney-shaped leaves by midsummer.

During the second year of growth, plants form one or more stems with alternate, sharply-toothed, triangular to heart-shaped leaves. The plants smell like garlic when crushed, especially the young leaves. A cluster of white, four-petaled flowers form at the end of the stems and branches in spring. Garlic mustard is pollinated by a number of small bees and flies but can self-pollinate in the absence of insects (Cruden, et al.1996). The small oblong black seeds are held in siliques (long narrow capsules) at the ends of the stems (Nuzzo 2000). The seeds begin to mature in May and can remain viable through the summer (Rowe and Swearingen 1998). Garlic mustard has the ability to form seed

banks but as demonstrated by Baskin and Baskin (1992), these seed reserves are viable for only about four years. People readily disperse the seeds when they get stuck on their boots or clothing and by automobiles and mowers. Seeds may also be dispersed by floodwaters, or indirectly by rodents, birds, and deer (Nuzzo 2000).

Threats

Alliaria petiolata can dominate forested understories, resulting in a decline in indigenous herb diversity (Nuzzo 2000). In turn, the decline of indigenous species alters habitat suitability for birds and other animals. Spring flowering plants and the animals dependent on them are particularly affected (Rowe and Swearingen 1998). Garlic mustard may have allelopathic effects as well, preventing plants from growing near it (Nuzzo 2000).

Control

Alliaria petiolata spreads rapidly once established. Baskin and Baskin (1992) reported that if small populations are not eradicated promptly, within a few generations, a few plants can rapidly spread and form dense populations throughout the forest. It is essential, therefore, to begin removal as soon as plants are first observed. Hand-pulling plants can control small infestations. This is most easily done when plants are small and the soil is moist (Rowe and Swearingen 1998). Plants should be pulled before seeds have matured, to prevent inadvertent dispersal. Hand-pulling should continue for at least five consecutive years in order to exhaust the seed bank. However, as Baskin and Baskin (1992) observe, it is likely that seeds will be brought in from other contaminated sites and control methods may be required indefinitely. Flower stalks can be cut in small populations to prevent seeds from maturing, and fire or herbicides can be used to control larger populations (Nuzzo 2000). Late fall is the preferred season for fire or herbicide control, because most indigenous plant species are dormant. Fire is only effective if there is a critical increase in rootcrown temperature. Rootcrowns covered by 1-2 cm of leaf litter will be protected. Removal of the leaf litter will increase seedling survival after the fire, necessitating a second burn the following year. Regardless of the control method used, sites must be monitored for at least five years to ensure that the seed bank has been exhausted (Rowe and Swearingen 1998).

Habitat

Asian bittersweet occupies a wide range of habitats including forest edges and gaps, floodplains, fields, hedgerows, beaches and salt marsh edges (Bergmann and Swearingen 1999). It is shade tolerant, and can establish under a closed forest canopy (Dreyer, et al. 1987; TN-EPPC 1999).

Distribution

Asian bittersweet is indigenous to eastern Asia, including Japan, Korea, and parts of China. It was introduced to the United States in the late 1800s, and was planted as an ornamental and used for wildlife food and cover and erosion control (Dreyer 1994). In the United States it occurs from Maine to Georgia, and west to Iowa and Arkansas (Kartesz 1999; Virginia NHP1999). It is also present in Quebec and Ontario, Canada (Kartesz 1999). Several states consider it invasive, including Connecticut, Delaware, Maryland, Massachusetts, New York, Pennsylvania, Tennessee, Virginia, and Vermont. Clemants and Glenn (1999) map it as widespread throughout northern New Jersey with records in all counties from Monmouth north to Sussex. It occurs in all physiographic provinces.

Threats

Trees and shrubs can be severely damaged by Asian bittersweet, as its twining branches eventually constrict their trunks and branches, and the vegetative growth can over-top and outshade them. This makes the trees more susceptible to damage by wind, snow and ice storms (Dreyer 1994). It can form pure stands over some areas. It threatens dune areas as well, possibly altering erosion patterns and outcompeting native dune vegetation. The alteration of natural vegetation structure caused by Asian bittersweet can make recovery of an area very difficult. Preliminary investigations indicate that Asian bittersweet has a much higher percentage of pollen and seed viability than does American bittersweet and may therefore be able to outcompete American bittersweet (Dreyer, et al. 1987). There is also evidence that Asian bittersweet may be hybridizing with American bittersweet, threatening the genetic identity of American bittersweet (Dreyer, et al. 1987; Dreyer 1994).

Control

Control of Asian bittersweet can be difficult, as seed germination rates are high, and seeds are persistent in the soil bank (Dreyer 1994). Small populations can be cut repeatedly until the root

stores are exhausted. Juvenile plants can be hand-pulled, but any root portions not removed can resprout (TN-EPPC 1999). All plant parts should be removed from the site to prevent reestablishment. A combination of cutting and herbicide treatment of stumps can be effective (Dreyer 1994), but herbicides could adversely affect surrounding native vegetation.

Norway Maple

Norway maple is a deciduous tree that averages 90 feet tall. The leaves have five sharply pointed lobes, similar to sugar maple leaves (Univ. of DE 1998). Norway maple can be distinguished from all native species of maples occurring in New Jersey by the milky sap present when the leaf petiole is broken off from a branch. The leaves are 4-7 inches long and are arranged opposite along the stem. The tree produces small greenish yellow flowers in April, and the seeds are held in wind-dispersed samaras that are 1½ - 2 inches long (Univ. of DE 1998). Leaves turn yellow in late autumn (Webb 1996).

Habitat

Norway maple readily establishes on disturbed sites, such as road and railroad embankments, vacant lots, and fallow fields. Norway Maple was not noted during the forest inventory but given the amount of development surrounding these properties it is likely encroaching the forest edges along property boundaries. It also invades and establishes in natural plant communities. It is particularly successful on alluvial soils in floodplain forests and along riverbanks (see specimen records cited). It also occurs in woodlands and forests where it invades through cleared edges or blow-downs within the interior. Tolerant of air pollution, drought and salt spray, it is commonly used as a street tree in cities and coastal communities (Nowak and Rowntree 1990).

Distribution

Indigenous to Europe and western Asia, Norway maple currently occurs from eastern Canada south to North Carolina, and west to Nebraska (USDA 1998). Scattered occurrences are reported from Idaho, Montana, Washington, and British Columbia (Kartesz 1999). Delaware, Maryland, Massachusetts, New York, Pennsylvania, Vermont, and Virginia list Norway maple as invasive. Clemants and Glenn (1999) map more than 150 occurrences for the northern part of the State (i.e., Monmouth County north to Sussex County). It occurs in all physiogeographic provinces.

Threats

Norway maple is an aggressive colonizer able to survive under a range of habitat conditions. The dense shade produced by the canopy decreases understory plant diversity, but does not affect establishment of its own seedlings (Wyckoff and Webb 1996).

Control

Norway maple can be controlled mechanically or with herbicides. In some situations, the use of herbicides could harm native plants. Seedlings and saplings can be hand-pulled or dug out. They will resprout if all the roots are not removed (Webb 1996).

Access

Access to these properties for forest management activities is very limited at this time. The most accessible tract is Arnell which would require an agreement with a private landowner to gain access to the roads that run through that property. Any other access would have to cross the stream and wetland along the road. In order to actively manage these properties access will have to be improved.

Access to Owner's Maintenance is possible from the road but would require extensive work. The Beckman/Kostrey tract is limited by steep slopes. Access for hiking trails and passive recreation is very good with road frontage for pullouts to be constructed and maintained.

Other trails could be created and maintained in order to complete forest management activities proposed on this property. Any new logging roads will be completed in accordance with the Flood Hazard Control Act and Freshwater Protection Act and will be constructed in accordance with the New Jersey Forestry and Wetlands Best Management Practices Manual.

Recreation

Recreation is a major priority for this property. The Township received a grant and will be working with the NY/NJ Trail Conference to design a trail system on these properties. These properties offer sufficient acreage for short loop trails as well as hilltops for views on Beckman/Kostrey with views of a lake and limited views from Owner's Maintenance tract.

These properties will also provide good opportunities for wildlife viewing and wildflower walks. The short trails may also provide educational opportunities given the diversity of terrain and forest ecosystems and habitats found in a relatively short distances. Clearly marked boundaries will prevent hikers from wandering off the municipal land and onto private property.

Access by ATV's should be closely monitored especially along the right of way on the Owner's Maintenance tract. ATV activity should be discouraged. Clearly delineate boundaries may provide some deterrent to illegal activity. It may be possible to GPS locate the current trails to aide in future possible enforcement activities.

Reforestation

Reforestation will be completed through natural regeneration via canopy openings. Other areas may be planted including the ridgetop on the Beckman/Kostrey tract and the Hemlock stand which has been decimated by the Woolley Adelgid also on the Beckman/Kostrey tract. Once invasive species have been removed along the roadway on the Arnell Tract this area should be replanted with native trees and shrubs to revegetate this area.

All regeneration will be closely monitored during this planning period. If this is unsuccessful due to aspect excessive deer populations or lack of seed sources in the immediate area, fencing and planting will be required on this property and a plan amendment will be completed. The single most important activity that could benefit forest regeneration would be to reduce the deer population via a carefully planned deer reduction program.

Soil Protection

Soil protection is a critical part of this plan and will be completed by implementing Best Management Practices. Special attention will be paid to soil retention throughout this planning period, especially in the extremely wet areas of the property, on the Arnell Tract and streamside areas of the Beckman/Kostrey Tract. Areas of steep slopes on all three tracts will be avoided with mechanized equipment. Any trees felled in steep slope areas will be felled parallel to the slope and left to reduce the speed and amount of runoff.

Removal of trees via mechanized vehicle where skidding, if access issues are remedied, should be completed during the winter when soils are frozen and less susceptible to disturbance. Increasing vertical structure and age class diversity of the forests will also provide long term soil protection by providing sustainable long term forest cover.

Timber Management

Timber management is the highest priority on these tracts but will be possible as trees mature further increased the amount of timber available for a logging operation to take place. Access issues would have to be worked out prior to any timber being removed from these sites. A harvest plan should also be completed prior to a commercial harvest which will lay out landings, logging roads and skid trails which will minimize impact to the surrounding forest, soil and water resources and regeneration which will be the future forest.

Site productivity on this property is good for growth of forest products. Forest stand improvement activities will improve growth of future crop trees left in the forest stand while creating openings in the canopy to promote advanced regeneration. Incremental growth will provide added value to the

future timber sale. If overall forest health declines or if potential timber trees do not appear healthy enough to survive through the planning period a limited timber sale may be administered on the property once access issue are worked out.

Freshwater Wetlands Protection Act (FWPA)

All activities occurring within the wetland governed under the FWPA will be conducted in conformance with this forest management plan upon approval by the New Jersey Forest Service.

No stumps shall be removed from the freshwater wetlands or open waters or wetland transition areas. These areas which are currently in forest cover will not be permitted to undergo land use change unless a FWPA permit is attained prior to the activity.

No new roads will be constructed in the areas under jurisdiction of the FWPA. Existing roads will be maintained in there current condition will provide access for future forest management activities. Should the land use change these roads will be removed.

Forest Management Best Management Practices (BMP's)

I. Streamside Management Zones – No activity will occur within 50 feet of the open waters. These areas at this time are forest and scrub-shrub habitat around some of the wetlands. Soils in this streamside management zone are susceptible to erosion. Forest management work which may occur within this zone would be related to stream restoration or to protect soil resources or water quality.

II. Filter Strips - Filter strips will be maintained between any roads, skid trails and loading areas. Filter strips will be planned, mapped and laid out prior to any timber harvest.

III. Stream Crossings – Stream crossings would designed consistent with forest management BMP's. Temporary bridges may be installed after consultation with NJDEP.

IV. Access Roads – Access roads were constructed previously on this property. These roads will be maintained in there current condition as they have not impeded flow of water, chemical or biological characteristics of wetlands. All roads have been naturally revegetated to stabilize soils.

V. Timber Harvesting – All timber harvests on this property will be completed in compliance with the Forest Management BMP Manual. Skid trails and logging decks will be planned and laid out prior to any harvesting activities.

VI. Site preparation – Site preparation to facilitate natural regeneration will be implemented as necessary. Native regeneration on this site should be sufficient once invasive species and White-tailed Deer populations are reduced.

VII. Forest Pesticides – All pesticides shall be applied by a certified pesticide application in reaction to a significant threat to forest health from an insect or disease vector.

VIII. Reforestation – At this time reforestation will occur through natural regeneration given the species make up and seed source currently found on this property. Reforestation is discussed further above.

IX. Fire Protection – Forest fire is not a significant threat on this property at this time with the exception of where soils are thinner and drier such as in stands 3, 4 and 15.

Forest Sustainability

Sustainability is a complex idea involving economic, environmental and social factors. Sustainability criteria and indicators were identified by the Montreal Process and include:

1. Conservation of biologic diversity.
2. Maintenance of productive capacity of forest ecosystems.
3. Maintenance of forest ecosystem health and vitality.
4. Conservation of soil and water resources.
5. Maintenance of forest contribution to the carbon cycle.
6. Maintenance and enhancement of long term, multiple socio-economic benefits to meet the needs of society.
7. Legal, institutional and economic framework for forest conservation and sustainable management.

Most of the above listed criteria have been addressed in this Forest Stewardship Plan.

Recommended Management and Implementation Schedule:

No forest management activities should occur on this property without prior consultation with the Forester and Municipal Committee responsible for management of these tracts to assure that the plan is being followed. Failure to follow the plan without submitting an amended plan being completed may lead to the loss of Farmland Assessment status. If forest health declines a timber sale may be conducted prior to the prescriptions in this plan and a revised plan will be completed.

2009 Clearly delineate the property boundaries of all of these properties.
Remove invasive species and clean up littler from the wetland area in Stand 7.
Monitor Gypsy Moth populations on all three tracts.
Develop a deer management plan or strategy.
Work with NY/NJ Trail Conference on trail design and layout on all three tracts.
Cut downed woody debris so it lays on the ground in stand 12.
Develop an ATV policy for Township owned land.
Evaluate American Chestnut tree in stand 13 for use in the American Chestnut Foundation breeding program.

2010 Remove invasive species from all of the Arnell Tract.
Survey all three tracts for Gypsy Moth populations.
Finalize and implement a deer management strategy.
Finalize and open the trail system to the public.
Improve pull outs for parking to access hiking trails.
Discuss management strategy with the power utility for Stand 3.
Assess the success of invasive species removal in Stand 7 and replant if possible.
Monitor ATV activity on all three tracts, GPS all existing trails.

2011 Remove invasive species from the Owners Maintenance tract.
Under plant conifer species in stands 14 and 15.
Survey vernal pool habitats for herptile species.
Survey wetland areas for rare plants.
Finalize a strategy for managing stand 3 with utility company.
Evaluate resprouting of invasive species in stand 7 and replant this site.
Plant White Pine seedlings in Stand 14 to maintain conifer cover in this stand.

2012 Remove invasive species from the Beckman/Kostrey Tract.

Inspect Owners Maintenance tract for resprouting invasive species.

Monitor Deer browse pressure on Owner's Maintenance.

Survey plant species in stand 6 and assure that all the Garlic Mustard has been removed.

Evaluate the possibility of fencing a small portion of this stand to gauge deer impact.

Fell trees parallel to the slope in stand 12 to reduce soil erosion if Hemlocks die in large numbers.

Evaluate the possibility of prescribed burn and plant a couple of Pitch Pine in Stand 15.

2013 Remove firewood from stand 8 if access has been established remove material for firewood, if not girdle unacceptable growing stock or fell and leave on site.

Assess native forest regeneration in stand 4.

Monitor ATV trails and remap them.

Monitor soil erosion in Stand 13.

2014 Open the canopy in Stand 4 to improve forest regeneration. Trees may be removed in groups to facilitate growth in the understory

Remove trees in small groups in stand 9 to facilitate old growth type character in this standby creating gaps for groups of young trees to develop. Possibly fence 1 gap to gauge deer browse pressure.

Maintain aesthetics in the area of the residential homes during these projects. requirements for Farmland Assessment.

2015 Remove about 2 cords of firewood from stand 1 in order to meet the income requirements for Farmland Assessment.

Evaluate stand 13 and assess if a thinning is required at this time.

2016 Open the canopy in Stand 5 to improve forest regeneration. Trees may be removed in groups to facilitate growth in the understory.

2017 Evaluate the growth of White Pine trees underplanted in stand 14 and girdle poorly formed trees.

2018 Reinventory the property and prepare the second Forest Management Plan.

Glossary

Acceptable Growing Stock – Tree of good form and quality which would be satisfactory crop trees in the final stand on this site, or as a potential high value product within 20 years.

Basal Area – The cross sectional area of a tree trunk at 4.5 feet above the ground. The total basal area is the amount of ground surface that would be occupied if every tree was severed at 4.5 feet above the ground.

Board foot – Used to express the volume that can be sawed from logs greater than 12 inches in diameter. A board foot would be equal to a piece of wood 1 foot by 1 foot and 1 inch thick.

DBH – Diameter at Breast Height. The diameter of a tree measured at 4.5 feet above the ground.

Even-aged stand – A stand of trees in which all of the trees are within the same aged class (within 20 years).

Floor species – Plants found growing on the forest floor, typically less than one foot in height.

Forest Stand Improvement – The intermediate cuttings used to improve the composition, condition or growth of a forest stand.

Overstory – Trees which form the uppermost layer in the forest canopy.

Poletimber – Trees which are not large enough to be considered sawtimber but are suited for other products, firewood for example, typically, trees between 6 and 10 inches in diameter class.

Sawtimber – Trees which are large enough to saw boards from, trees greater than 12 inches in diameter.

Site index – A term used to describe the productivity of a site based on the height of dominant trees at a certain aged, usually 50 years. The higher the site index the more productive the site.

Shrub species – Woody plants which grow between 1 and 15 feet.

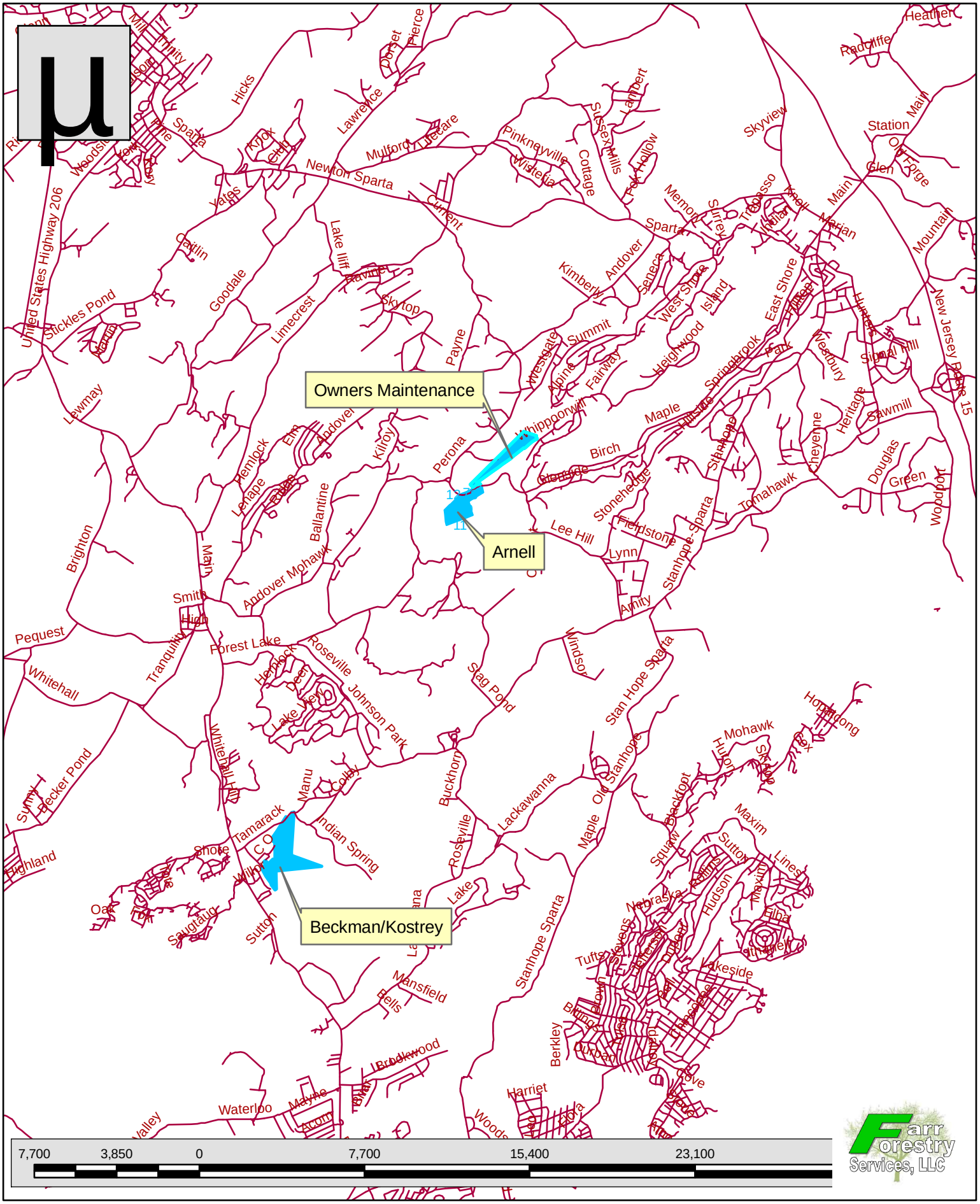
Stand – A community of tree which possess uniformity in regard to species composition, tree aged, condition and arrangement, enough to be distinguished from adjacent communities.

Unacceptable Growing Stock – Tree which a re not desired in a stand because of poor form. These trees can be used as firewood or providing habitat for wildlife.

Understory – Trees and other woody plants growing beneath the overstory and above the shrub layer.

Uneven-aged stand – A forest stand composed of trees in a variety of age classes.

Locator Map


Owners Maintenance
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Beckman/Kostrey
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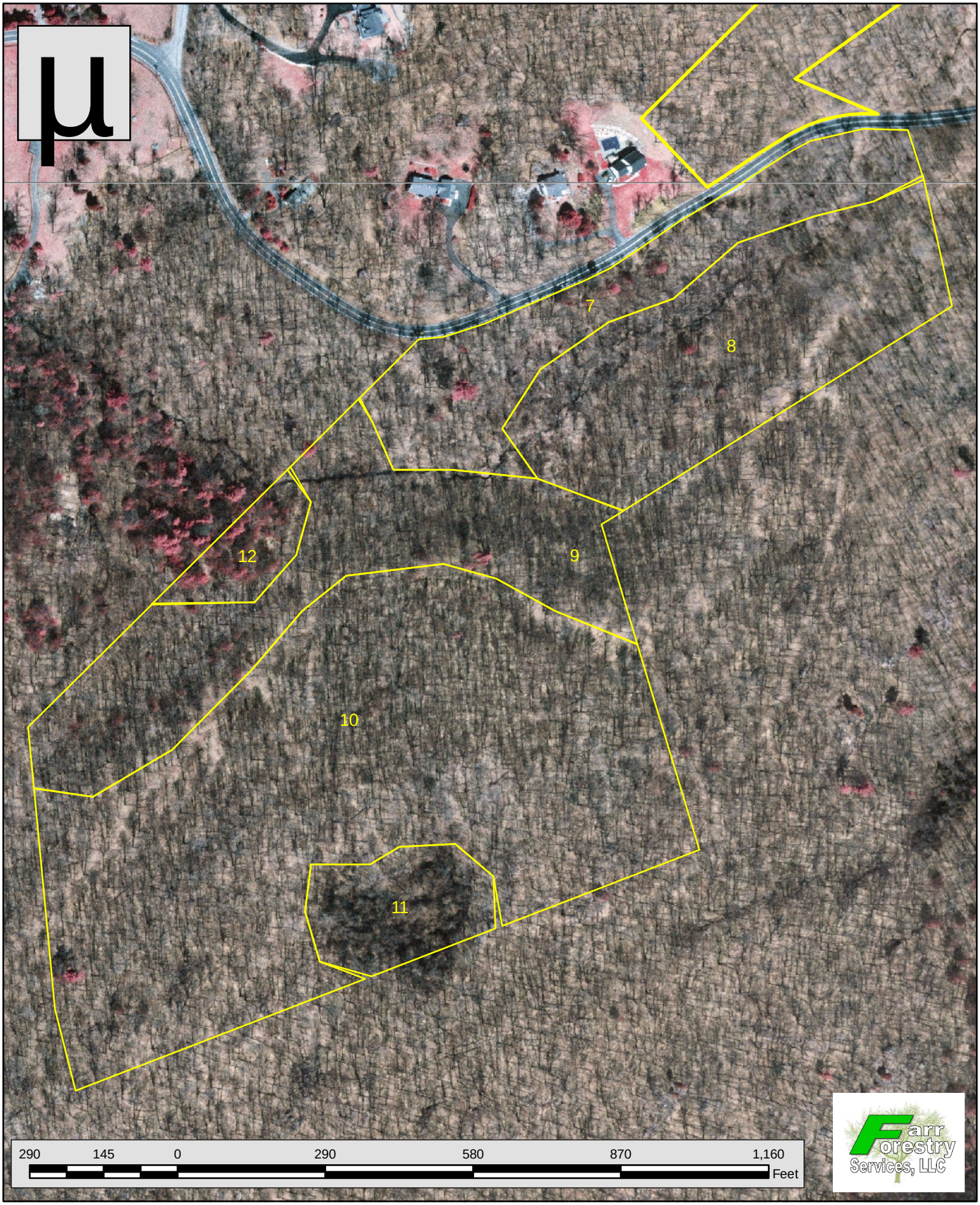
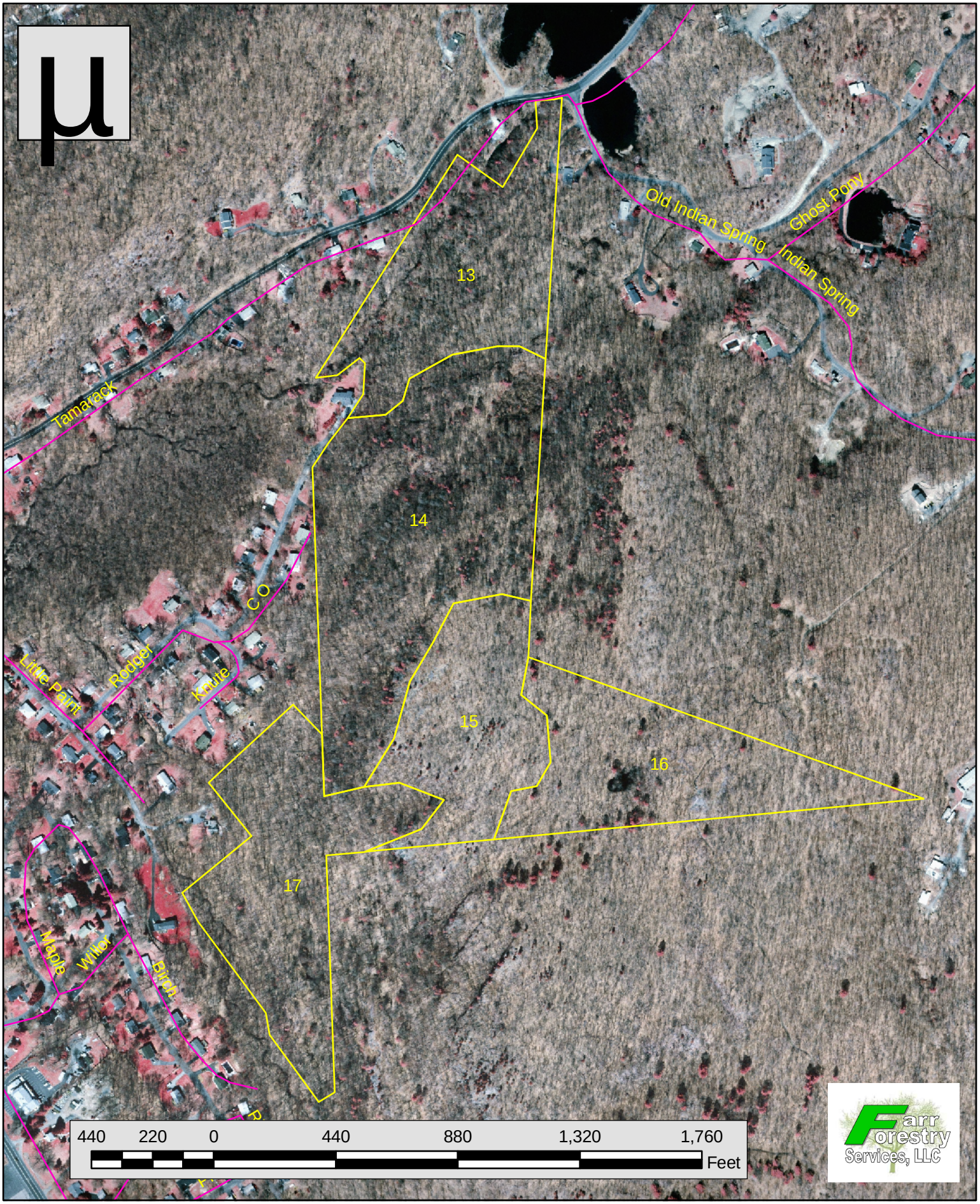
7,700
15,400
23,100
Farr Forestry Services, LLC

Township of Byram Arnell



Township of Byram Beckman/Kostrey



Township of Byram Owners Maintenance