FOREST STEWARDSHIP PLAN

Inland Bays Regional Wastewater Facility
Forested Spray Irrigation Tracts

Total +/-1,300 Acres

Tax Parcel Nos.: 234-22.00-8.00 & part of 10.00,
234-21.00-151.00 & 151.03

Rehoboth Bay & Indian River Watersheds

Sussex County Government
Engineering Department

C/o Hans Medlarz, Sussex County Engineer
2 The Circle
Georgetown, DE 19947
(302) 855-7728

October 2022

Reviewed By: Sam Topper & Kyle Hoyd
Delaware Forest Service
(302) 856–2893
https://agriculture.delaware.gov/forest-service/

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FOREST LOCATION:

This forest land is located on both sides of Lawson Road and Townsend Road (CR 303); generally, south of Harbeson, DE. The property is located within the Rehoboth Bay and Indian River Watersheds, in eastern Sussex County, DE. The property is tax parcel I.D. numbers are 234-22.00-8.00 & part of 10.00, 234-21.00-151.00 & 151.03. (See Exhibit A for exact site location).

STEWARDSHIP PURPOSE

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

1. Managing for long-term forest health, productivity, diversity, and quality.

2. Conserving or enhancing water quality, soil productivity, biodiversity, cultural, historical, and aesthetic resources.

3. Following a strategy guided by well-founded silvicultural principles to improve timber quality and quantity.

4. Setting high standards for foresters, loggers, and other operators as practices are implemented; and minimizing negative forest impacts.

5. Learning how natural woodlands benefit and affect surrounding communities.

LANDOWNERS OBJECTIVES:

1. Primary Objectives

- Restore and maintain wetland and stream processes in the Swan Creek headwaters.
- Improve water and soil quality by increasing amount and duration of photosynthesis season through species composition focused on transitioning to more mixed overstory and understory.
- Restore forest type from industrial pine plantation to a natural mixed forest.
- Fulfill obligations outlined in the DNREC Spray Irrigation Operations Permit (No. 359141-05)
- Maintain a natural forest, consisting of mixed, native species and free of invasive species.
- Manage for selective timber harvesting.

2. Secondary Objectives

- Manage deer hunting.
- Maintaining and enhancing wildlife habitat.
- Maintaining community and professional educational and demonstration opportunities.

FOREST STEWARDSHIP CONSIDERATIONS:

1. Aesthetics

Aesthetics is a consideration in that a healthy, diverse forest will be established (or maintained) in this area to keep the property in a natural forested state.

2. Threatened and Endangered Animals & Plants; Cultural Resources

According to existing maps and site information collected by DNREC, Division of Fish & Wildlife in September of 2022, there are no threatened and endangered animals, plants, or cultural resources on the properties. Please see the associated document in Appendix C.

3. Forest Health and Protection

Forest Health and Protection will be accomplished through a cooperative effort of the landowner and the Delaware Forest Service (DFS). The DFS will conduct periodic professional inspections to augment landowner visits.

4. Recreational Opportunities

Recreational opportunities are **not** goals of this plan due to the treated wastewater spray irrigation. Any recreational opportunities will be limited and reserved for the owner's wildlife management program.

5. Soil and Water Quality and Protection

This is a major consideration in this plan and management activities will be recommended and conducted with this goal in mind. Soil and water quality are being maintained by the presence of a healthy, actively growing forest cover on the property. Water quality is enhanced by the natural uptake of water by the trees and subsequent transpiration of this water. The root structure of the trees and associated vegetation will keep the soil in place and prevent erosion. Delaware's best management practices will be followed during any forestry harvesting operations to protect soil and water quality.

6. Riparian and Wetland Areas

The drainage system that flows through the property are the headwaters of the Swan Creek which flows directly into the Indian river. Restoring and maintaining this system is a primary goal of the plan. All activities recommended in the plan serve to achieve the goal of improved water and soil quality.

No forested terrene wetlands are present except on tax parcel 234-21.00-151.03. Best Management Practices and will be sensitive to this area. The owner will maintain the integrity of the soils by keeping the area forested. All silvicultural activities utilizing large equipment, such as timber harvesting, will be done only during dry weather to prevent any water or soil degradation.

7. Timber Value

Producing forest products for eventual sale is one of the goals of this plan. This forest stewardship plan is designed to maintain a natural, native forest while enhancing and maintaining wildlife habitat, and producing timber for selective thinning in an irrigated environment.

8. Wildlife

Providing a variety of wildlife habitat areas, including deer hunting habitat is a goal of this plan and will be accomplished as a secondary benefit of the timber harvesting activities and subsequent reforestation, along with wildlife habitat improvement measures. This area will provide a variety of habitat types during the rotational period of the forest, augmented by the wildlife practices installed by the owner. Very little needs to be done to favor the establishment of wildlife populations, other than promote and provide changes which will affect the plant succession in the area.

FOREST SOILS:

Detailed information regarding forest soils is found in Appendix A.

GENERAL WOODLAND DESCRIPTON:

There is one large stand of conifer type woodland on this property. The stand is a productive site for growing timber. Wildlife usage of the site is moderate, with songbirds observed, along with evidence of deer, and gray squirrel populations.

The stand has a long history of industrial timber management and is currently in a Loblolly pine (Pinus taeda) plantation condition. Different areas were harvested and

replanted from 1985 through 1992 and the entire area thinned in 2010/11. The remaining trees are evenly spaced and evenly sized. There is an existing road system through the properties. It is typical of semi-mature pine plantations in Delaware.

1. Stand Analysis

The entire stand, comprised of +/-1,300 acres, is a small sawtimber sized pine plantation. The overstory is well stocked, the thinning in 2011 reset the stocking to desirable levels for maximum growth. The mid-story contains regeneration from the openings created during the thinning. The stand is comprised mostly of Loblolly pine (95% by basal area stocking), followed by Red maple and White oak (1.5% by basal area stocking each). It also contains minor components of other mixed hardwoods such as Southern Red oak, Sweetgum, Sassafras and Holly (2% total). The stand contains roughly 35,000 board feet per acre of sawtimber and 30 tons per acre of pulpwood.

2. Primary Recommended Silvicultural Practices

It is the goal of this plan to transition this forest from an industrial pine plantation to a more natural forest, consisting of a mix of overstory and understory native species. The intent of the plan is to increase soil and water quality of the Delaware bay headwaters by increasing photosynthesis and water uptake by increasing the amount and diversity of overstory and understory vegetation.

The plan will employ multiple strategies to achieve the goal. Flexibility to experiment with different management strategies will be necessary in order to take advantage of variations in current species composition and structure, as well as the availability of materials and contractors. It will take multiple projects over multiple years to convert the entire site to a more natural, mixed state. The optional methods described below are a menu to choose from at various points in the forest development.

The process includes harvesting timber as part of the spray irrigation system installation to create small openings, approximately 3 three acres in size for light penetration, followed by site-preparation (if needed) and regeneration activities (natural, artificial, or both).

The new stands will likely need some protection as they become established. This process will be repeated until all spray sites have been converted. General timeline is 0-2 years for thinning, 2-5 years for regeneration, and 2-8 years for establishment maintenance.

The owner has existing relationships with multiple potential contractors and the Delaware Forest Service (DFS) will assist as needed developing timber sale projects. Initially care must be taken to avoid damaging existing desirable species while in later thinning operations protection of spray irrigation equipment becomes a priority. Harvests should take the shape of a selection harvest in areas with existing desirable

regeneration, and clear-cuts in areas lacking sufficient desirable species.

Site Preparation/Regeneration Options:

- Site preparation is usually conducted as part of the timber harvesting through on-site chipping. It may also be achieved by chemical application or in some instances prescribed fire. Site preparation is not usually needed to replant in forested settings but may be needed in instances of pine plantation reversion.

- Methods of regeneration include the following:

    - In areas with existing desirable species, natural regeneration may be enough. At least two growing seasons should be given before deciding if natural regeneration is adequate.
    - Areas without existing seed source will need to be planted. Planting options include the DFS planting program sourcing 1-2-year-old bare root seedlings from DFS' Maryland State nursery or owner supplied seedlings from any other nursery.
    - Planting larger containerized seedlings or spade-ball saplings are also an option. Planting stock and contractor would have to be sourced.
    - Planting may be done over several years as regeneration and establishment dictate.

Establishment/Maintenance Options:

- Chemical treatments of regenerated stands, limited to ground applications, are sometimes used to control selected competition and/or invasive species.

- Pre-commercial thinning is a practice used often to assist with establishing natural and artificial regeneration where ground crews use brush saws to remove undesirable regeneration that may be crowding desirables.

- Protecting regeneration from deer browse will be implemented with either area fencing or tree tubes. Area fencing being more expensive than tree tubes, but more effective.

- Fire is sometimes used to reduce competition in the young seedling stage, particularly in oak stands. DFS can conduct owner prescribed fire.

Long-Term Maintenance Options:

The long-term goal is to achieve a mixed forest composed of stands of similar forest type but different life stages. This mosaic of age classes allows for diversity of species, diversity of habitat, resiliency, and maintains areas of young vigorous growth and maximum water uptake. To that end, the long-term plan will seek to develop up to 4 stands that differ in age by at least 10 years. That will allow for a continuous,

sustainable harvest and age-class distribution.

3. Secondary Recommended Silvicultural Practices

Establishing and Maintaining Wildlife Habitat:

This forest will continue to provide habitat for a variety of wildlife species. Different wildlife species, such as bobwhite quail, wild turkey, whitetail deer, and dozens of songbirds will utilize the habitat created by the changing vegetation during the life of the forest. As changes in the vegetative cover take place in the form of trees maturing, dying, or through silvicultural practices done on the site, so will the number and variety of wildlife species. Controlling the deer population and resulting browse will be a critical factor in the success of the plan. Hunting is the most effective way to control deer population. Deer hunting, through the County's public hunting program will be implemented to achieve successful hardwood regeneration.

Education and Demonstration:

Active, sustainable forest management benefits all adjoining residents, not only the owner. Showcasing successful, active managers helps spread the word that active management is an achievable and beneficial landowner goal. It is the hope of DFS that showing sites like this may encourage more owners to engage in active forest management on their lands.

IN WITNESS WHEREOF, the parties agree this Forest Stewardship Plan achieves the goals for Sussex County's Inland Bays Regional Wastewater Facility Forested Spray Irrigation Tracts and therefore set their hands and seals on this Plan on the respective date(s) set forth below.

SUSSEX COUNTY

By: _____

(SEAL)

Michael H, Vincent, President
Sussex County Council

Date: _____ Attest: _____

Tracey Torbert, Clerk of the
Sussex County Council

DELAWARE DEPARTMENT OF AGRICULTURE

By: _____

(SEAL)

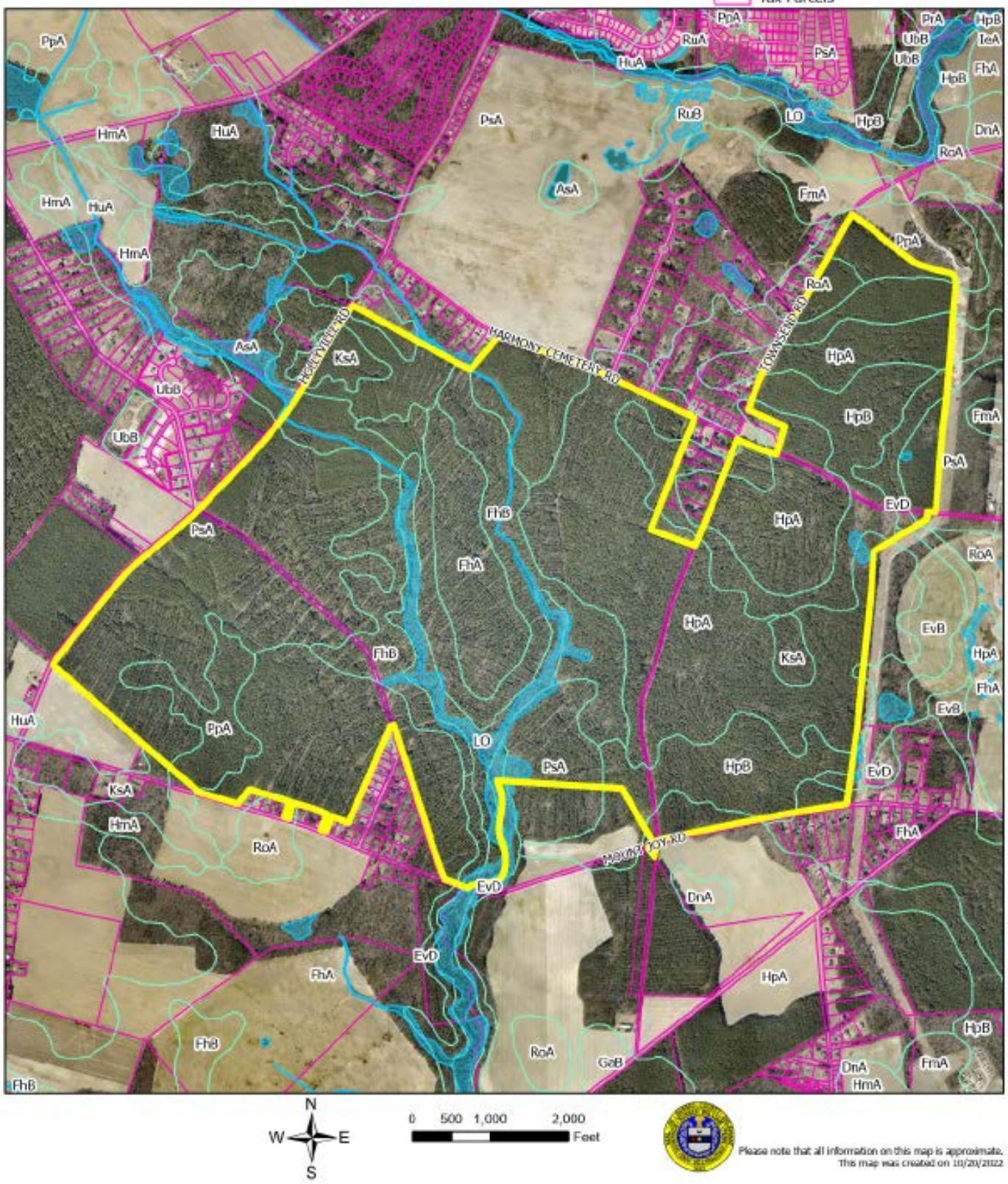
Sam Topper, Senior Forester

Date: _____ Attest: _____

_____

Print Name and Title

Exhibit A
Inland Bays Regional Wastewater Facility
Forested Spray Irrigation Tracts



APPENDIX A

Soils Information

The following is a list of the soils found on the property. Also included is a USDA forestland productivity report highlighting the tree species best suited for the site.

Soil Symbol	Soil Name	Acres	% of Total
AsA	Askecksy loamy sand, 0 to 2 percent slopes	21.7	1.75%
EvB	Evesboro loamy sand, 0 to 5 percent slopes	0.75	0.06%
EvD	Evesboro loamy sand, 5 to 15 percent slopes	24.2	1.96%
FhA	Fort Mott-Henlopen complex, 0 to 2 percent slopes	166.3	13.43%
FhB	Fort Mott-Henlopen complex, 2 to 5 percent slopes	140.5	11.34%
HpA	Henlopen loamy sand, 0 to 2 percent slopes	314.4	25.38%
HpB	Henlopen loamy sand, 2 to 5 percent slopes	160.5	12.95%
KsA	Klej loamy sand, 0 to 2 percent slopes	19.4	1.56%
LO	Longmarsh and Indiantown soils, frequently flooded	40.5	3.27%
PpA	Pepperbox loamy sand, 0 to 2 percent slopes	46.0	3.71%
PsA	Pepperbox-Rosedale complex, 0 to 2 percent slopes	295.6	23.86%
RoA	Rosedale loamy sand, 0 to 2 percent slopes	9.1	0.73%
		1300.0	100.00%

Forestland Productivity

Sussex County, Delaware

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
AsA:				
Askecksy, undrained	Blackgum	75	79	Cherrybark oak, Loblolly pine, Swamp chestnut oak, Water oak, Willow oak
	Loblolly pine	80	110	
	Red maple	65	40	
	Swamp chestnut oak	70	50	
	Sweetgum	75	68	
	Willow oak	70	57	
Askecksy, drained	---	---	---	Cherrybark oak, Loblolly pine, White oak, Willow oak
HmA:				
Hammonton	Loblolly pine	70	101	Loblolly pine, Northern red oak, Southern red oak, White oak, Yellow-poplar
	Northern red oak	70	52	
	Red maple	75	47	
	Southern red oak	75	57	
	Sweetgum	80	79	
	White oak	80	55	
	Yellow-poplar	85	81	
HuA:				
Hurlock, undrained	Blackgum	70	75	Cherrybark oak, Loblolly pine, Swamp chestnut oak, Water oak, Willow oak
	Loblolly pine	85	120	
	Red maple	70	43	
	Southern red oak	70	50	
	Swamp chestnut oak	80	65	
	Sweetgum	70	57	
	White oak	75	47	
	Willow oak	70	57	
Hurlock, drained	---	---	---	Loblolly pine, Northern red oak, Southern red oak, White oak, Yellow-poplar
IeA:				
Ingleside	Loblolly pine	70	101	Eastern white pine, Loblolly pine, Northern red oak, Southern red oak, White oak, Yellow-poplar
	Northern red oak	80	62	
	Red maple	75	47	
	Southern red oak	85	75	
	Sweetgum	80	79	
	White oak	80	55	
	Yellow-poplar	90	90	

Forestland Productivity

Sussex County, Delaware

Map symbol and soil name	Potential productivity			Trees to manage
	Common trees	Site index	Volume of wood fiber	
			Cu ft/ac	
KsA:				
Klej	Loblolly pine	80	110	Cherrybark oak, Loblolly pine, White oak, Willow oak
	Red maple	65	40	
	Southern red oak	70	50	
	Swamp chestnut oak	65	45	
	Sweetgum	75	68	
	White oak	70	40	
	Willow oak	70	57	
	Yellow-poplar	75	68	
PsA:				
Pepperbox	Loblolly pine	80	110	Loblolly pine, Northern red oak, Southern red oak, White oak, Yellow-poplar
	Northern red oak	75	57	
	Red maple	65	40	
	Southern red oak	80	65	
	Sweetgum	80	79	
	White oak	75	47	
	Yellow-poplar	80	74	
Rosedale	Loblolly pine	75	105	Eastern white pine, Loblolly pine, Northern red oak, Southern red oak, White oak, Yellow-poplar
	Northern red oak	70	52	
	Red maple	65	40	
	Southern red oak	80	65	
	Virginia pine	70	109	
	White oak	70	40	
	Yellow-poplar	75	68	
RoA:				
Rosedale	Loblolly pine	75	105	Eastern white pine, Loblolly pine, Northern red oak, Southern red oak, White oak, Yellow-poplar
	Northern red oak	70	52	
	Red maple	65	40	
	Southern red oak	80	65	
	Virginia pine	70	109	
	White oak	70	40	
	Yellow-poplar	75	68	
RuA:				
Runclint	Loblolly pine	70	101	Loblolly pine, Virginia pine, White oak
	Northern red oak	70	52	
	Red maple	65	40	
	Southern red oak	70	50	
	Virginia pine	70	109	
	White oak	70	40	
	Yellow-poplar	70	64	

APPENDIX B

GENERAL PINE MANAGEMENT INFORMATION

Survival of the trees in this year is more important than much growth. Since the Inland Bays Regional Wastewater Facility Forested Spray Irrigation Tracts are irrigated inadequate rainfall during the first years will not be an issue and only competition from other growth will be a source of forest development failure. Weed control chemicals such as Arsenal, Oust, or Roundup can be used on or around the trees themselves as practical or economically feasible.

Plantation inspections every other month for the first two years is highly desirable. The landowner or agent can do these inspections. Special attention should be given to the following:

1. The condition of the trees
    a. Color
    b. Vigor
    c. Presence of new growth

2. Suspicion of, or the presence of harmful insects
    a. Chewed needles
    b. Discolored or dead growing tips
    c. Web material on the trees
    d. The presence of frass (a sawdust-like material)
    e. The insects themselves

3. Appearance of disease
    a. Discoloration of needles
    b. Fungus growth on stems or branches
    c. Wilting of growing tips
    d. General lack of vigor

4. Competition of surrounding vegetation

If any of these conditions are seen, owner is to contact a professional forester for evaluation and treatment.

After the first three years of growth, inspections need not be as often, but there really is no substitute for regular visits to the plantation. Periodic inspection of the stand keeps the landowner informed about the condition of his woodlot. This is helpful in correcting small problems before they become more pronounced. At three years of age, the stand should be checked for competition from invasive brush that may have invaded the site.

At five-year intervals, a professional forester should check the stand for growth. An initial pulpwood thinning is possible at age fifteen if the trees have made enough growth. Professional forestry advice should determine the extent and amount of the thinning.

A professional forester should also make additional 5-year inspections after the initial thinning. Professional reevaluating for additional thinning should be done after another 15-year period of

growth. If the trees have grown enough, this thinning will produce small sawlogs and piling, with some pulpwood. The remaining stand is then grown to maturity, which should be in an additional fifteen to twenty years. The mature diverse forest will only be thinned to maintain continued access to the spray irrigation system.

Throughout the growth period of the stand, be careful to maintain well-marked boundaries, and to exercise access control and prevention of wildfires. Maintaining well-marked property lines allows the owner reasonable assurance that adjacent property owners will not inadvertently trespass. Property boundaries can serve a dual purpose by also acting as firebreaks to control wildfires.

GENERAL HARDWOOD MANAGEMENT INFORMATION

Crop Tree Selection

Diversify crop tree selection by species to provide more stable mast crops and to reduce the likelihood of suffering total crop failure because of a destructive agent such as gypsy moth.

1. White oak is often one of the most valuable oak species, but it is also one of the slowest growing. It is very susceptible to epicormic branching and, in many areas has been quite vulnerable to mortality after gypsy moth defoliation. White oak is a desirable species for selection as a wildlife crop tree because its acorns are preferred by many wildlife species.

2. Northern red oak is one of the most valuable oak timber crop trees and is fast growing. It is very desirable as a mast producer for wildlife because of it relatively abundant production.

3. Black and scarlet oak are more likely to develop cavities that white oak or hickory. However, cavities in longer-lived species (like white oak and hickory) provided available shelter for wildlife for a longer period.

Regardless of the species, favor crop trees with vigorous crowns in the dominant and co-dominant positions. Favor trees showing bark characteristics that indicate rapid growth and straight grain. Avoid trees with epicormic branches.

1. Many oak trees originate from seedling sprouts or stump sprouts. Stump sprouts can produce good quality timber if the stem originates from a low stump. Companion sprouts with a U-shaped connection may be cut at different times, but V-shaped sprout connections should usually be treated as a unit (cut both or neither). The rigidity with which this guideline should be applied varies by species and length of cutting cycle to be used in the stand.

2. Where the species composition is less than 50 percent oak, the stand's susceptibility to defoliation by gypsy moth is reduced. Generally, oaks with vigorous crowns are more likely to survive defoliation. Oaks on mesic sites (soil conditions that are medium, regarding moisture – not wet or dry) have a greater vulnerability to mortality if defoliated.

Natural Regeneration

1. Oak natural regeneration is relatively easy to establish on areas that have an adequate seed source available and a red oak site index less than 70. Better sites are more challenging to regenerate because of competition from other species. Well-developed, advanced regeneration is a key to successful establishment of oak stands. Most oak natural regeneration is established when there is a bumper crop of acorns that provides enough food for insects and wildlife with some left over to germinate.

2. Management activities that establish regeneration and encourage its development can be started at any time especially 20 to 30 years prior to final harvest.

3. Maintaining a closed overstory canopy while applying herbicide to midstory and understory competitors is often necessary to provide a microclimate suitable for regeneration establishment and development. When seedlings are 3-4 feet tall, provide additional moisture, light, nutrients, and growing space by opening the main crown canopy with a partial cut.

4. Evaluate the adequacy of the established oak regeneration.

Artificial Regeneration

1. Oak seedlings may be planted in old fields and forested sites; however, they usually require post-planting release from competing vegetation for at least 3 years. Tree shelters can be used to provide protection from animal damage and to accelerate early seedling shoot development.

2. Direct seeding of oaks using viable acorns is another regeneration alternative. Use of tree shelters can greatly reduce the number of acorns needed to obtain an oak component in a new stand.

The first five years of growth of a new forest area probably to most critical years in its life. During the first growing season after establishment, the seedlings are under tremendous stress from competition for water, light and nutrients. Survival of the trees in this year is more important that growth rate. Inadequate rainfall during the first year is extremely stressful on young seedlings. If competition from other vegetative growth is also present, then failure of the stand is very possible. Rainfall is not controllable, but we can control competition from grasses, brush and other trees to some extent, whether through chemicals or mechanical means if practical or economically feasible.

APPENDIX C

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF FISH & WILDLIFE
RICHARDSON & ROBBINS BUILDING
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

DIRECTOR'S OFFICE

PHONE
(302) 739-9910

October 17, 2022

Hans Medlarz
Sussex County
2 The Circle
Georgetown, DE 19947

Re: DNREC-GWD 2022 Inland Bays Wastewater Facility

Dear Hans:

On Wednesday, September 14, 2022, Bill McAvoy, staff biologist from the DNREC Division of Fish and Wildlife, surveyed the above referenced property for evidence of state rare plants and natural communities. The property was surveyed on foot and no state rare or federally listed plants or unique plant communities were found. Furthermore, we foresee no negative impacts to the forested areas of concern.

As a result, at present, this project does not lie within a State Natural Heritage Site, nor does it lie within a Delaware National Estuarine Research Reserve which are two criteria used to identify "Designated Critical Resource Waters" in the Army Corps of Engineers (ACOE) Nationwide Permit General Condition No. 22. A copy of this letter shall be included in any permit application or pre-construction notification submitted to the Army Corps of Engineers for activities on this property.

We are continually updating our records on Delaware's rare, threatened and endangered species, unique natural communities and other significant natural resources. If the start of the project is delayed more than a year past the date of this letter, please contact us again for the latest information.

Please feel free to contact me with any questions or if you require additional information.

Sincerely,

Danielle Ellis