Orange Water & Sewer Authority
Teer West Property
Orange County, North Carolina

Draft Forest Stewardship Plan

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April 2023

DRAFT FOREST STEWARDSHIP PLAN
FOR THE
ORANGE WATER & SEWER AUTHORITY (OWASA)
TEER WEST PROPERTY

400 Jones Ferry Road
Carrboro, North Carolina 27510
Phone: (919) 537-4276

Examined by: David Halley, Registered Forester/Certified Forester, and Ben Maness, Forest Technician with True North Forest Management Services.

Location: The property is located on the west side of Flat Rock Road (formally Teer Road), approximately ¼ mile south of Bradshaw Quarry Road in Orange County, North Carolina.

Access: Access is excellent. A portion of the property is adjacent to Flat Rock Road. There is also an access point off Mebane Oaks Road on the western portion of the property. This is a shared gravel driveway. There is also a gated entrance road on the far south side of Flat Rock Road, but this is owned by the adjacent owner and would require permission to utilize. There currently are no interior forest roads on this property, except some old historic roads that have grown up.

Ownership Details: The Teer West Land is a ± 218-acre property owned by the Orange Water and Sewer Authority (OWASA). These properties were purchased from 1980 through 2004 by OWASA. The title and plat map for the properties are listed in the Register of Deeds office under the name of Orange Water & Sewer Authority.

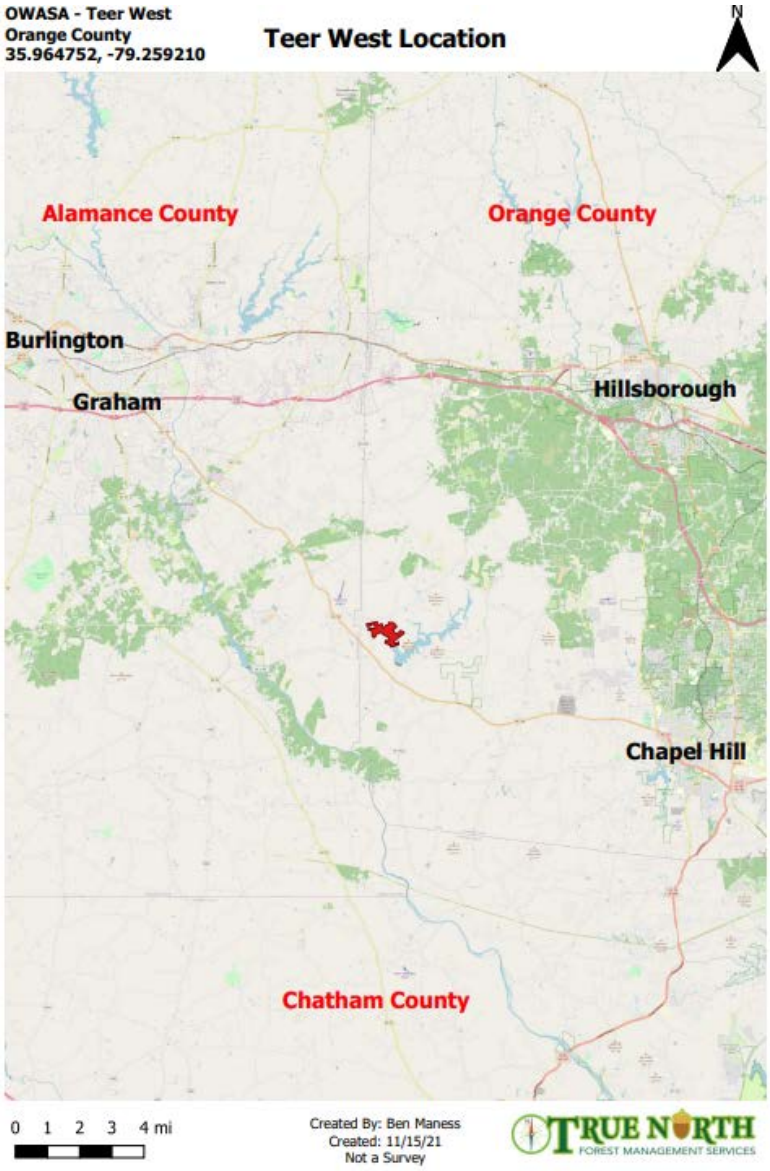
Parcel	Acreage	Purchased	Deed Book	Deed Page
9820744033	18.99	Sept 1980	348	130
9820658054	19.35	May 1981	362	570
9820645231	10.14	Oct 1983	440	126
9820668402	61.06	Oct 1984	488	521
9820661616	17.75	Jan 1992	957	99
9820850356	27.32	Aug 1992	1018	83
9820468419	55.16	July 2000	2108	247
98206658054	19.34	Feb 2004	3130	162
Total	**229.11**			

Note: 11 acres of this acreage is water (Cane Creek Reservoir)

Special Conservation Easement: Close to twenty acres (19.8) of this property is designated as part the riparian forest buffer and is identified as Management Unit NCLWF

Easement. It is protected through a conservation easement dedicated to the State of North Carolina by OWASA per terms of a North Carolina Land and Water Fund (NCLWF) (formerly known as Clean Water Management Trust Fund (CWMTF)) grant agreement. An approximation of the NCLWF easement boundaries is designated on the Management Unit sketch map (pages 19) and labeled as NCLWF Easement. This easement is listed in the Register of Deeds office, Orange County Book 2457, Pages 281-290 and Book 3632, Pages 169-182.

General Property Location



INTRODUCTION

This Forest Stewardship Plan is prepared to assist OWASA in developing a set of action steps to protect and enhance the natural resources of their property. This Plan's intent is to ensure that the forest management of the property is done in a manner that protects water quality now and for the future generations by following science-based principles to manage their forest lands, so they are healthy, diverse, resilient, and sustainable.

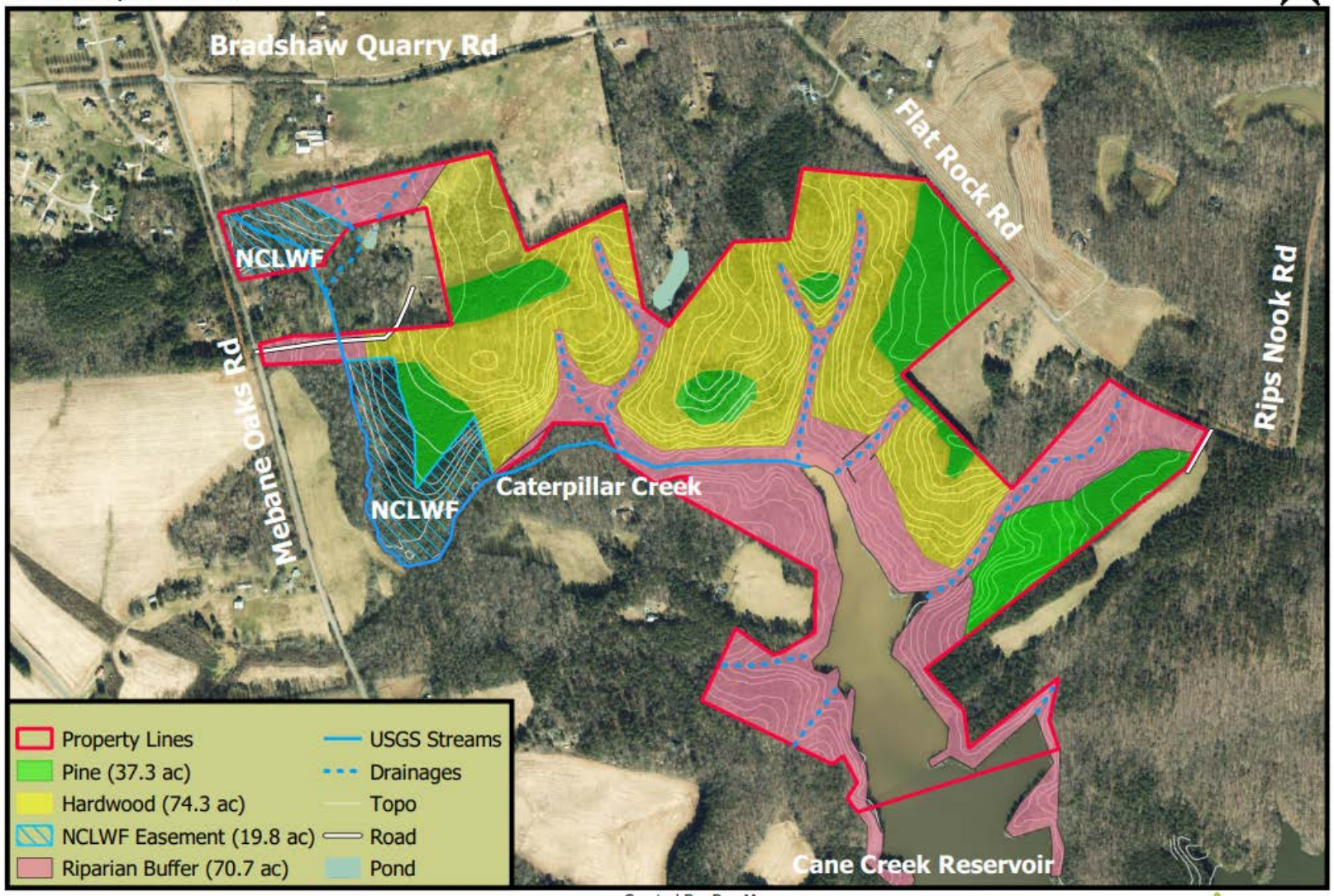
This Plan covers the examination of approximately 218 acres of predominantly forestland on the property. Based on forest-timber type, age of trees, and/or management recommendations the property has been divided into eight separate management units. Complete descriptions and management recommendations are provided for each of the Management Units. The boundaries and acreages of these Management Units are only estimates and have been derived from aerial photographs.

Here is the general breakdown of the different forest cover types identified on the Teer West property:

Forest Type	Acreage	% of Property
Pine	37	17%
Upland Hardwood	74	34%
Riparian Forest Buffer	78	36%
NCLWF Easement	20	9%
Young Forest	9	4%
TOTAL	**218**	**100%**

OWASA- Teer West
Orange County
35.964752,-79.259210

Teer West Division-Existing Forest Cover Type



Created By: Ben Maness
Created: 11/15/21
Aerial Date: 2017
Not a Survey

TRUE NORTH
FOREST MANAGEMENT SERVICES

This Plan has been specifically developed to match OWASA's ownership objectives with good land management practices. The plan contains a detailed description of the natural resources of the property along with specific management recommendations for consideration. To maximize the understanding of the terms used in this draft stewardship plan we recommend reviewing the "Glossary of Forestry Management Terms" that the North Carolina Forest Service has developed. This brochure should be helpful in looking up unfamiliar terms used in the proposal. A copy of the glossary is available at:

https://www.ncforestservice.gov/publications/Forestry%20Leaflets/FM01.pdf

Maps of the property are located at the beginning of the Forest Stewardship Plan (pages 17-19). Please refer to the maps as you read the Plan. This Plan also includes proposed timetables for specific management activities on each management unit (located on pages 62-63). However, it should be recognized that the actual timing and sequence of management activities will be different from that shown in this plan due to several factors, such as: available resources; weather conditions; and market conditions. The timetable and prescriptions should be flexible and adaptive to meet the needs and objectives of the landowners. Although the Plan scope covers projects beyond 10 years, this Plan should be reviewed and revised in about 10 years (2033). We have tried to estimate expenses for some of the conservation practices recommended in the Plan, but these too may vary depending on availability of contractors, timing, and material costs. Cost-share assistance can be obtained from State and Federal cost-share programs for many of the recommended forest management measures we have described in this Plan.

Topography: The topography of the property ranges from gently to moderately sloping (2 to 15% slopes). Topographic maps of the area show that the elevation of the property ranges from the high of 580 feet to just over 520 feet above sea level in the main creek. This piedmont terrain is characterized by a series of broad ridges that generally run north and south and are divided by narrow drainages. These drainages flow into intermittent and perennial streams that flow directly into Caterpillar Creek and the Cane Creek Reservoir, south of the property. The Cane Creek Reservoir is OWASA's main source of drinking water for Carrboro and Chapel Hill. The property's watershed ultimately flows into the Haw River which flows into Jordan Lake and is all part of the Cape Fear River Basin.

Cultural, Historical, and Archeological Resources: Portions of the property were once farmed, where the terrain and gentle slopes were most conducive to farming. Agricultural activities ceased on the property around the early 1980's and the farm fields slowly reverted back to trees or were planted in pine. We found no historic structures on this farm or were known to exist on the property. We did run across an old sunken road that probably served as a county or farm road at one point, but it was abandoned. It runs through Management Unit C3.

Here is a historic aerial photograph taken of the property in 1993 which compares it to a 2021 aerial photograph of the same property.

Teer West – 1993 Aerial Photo

Teer West – 2021 Aerial Photo

Threatened and Endangered (T&E) Species: During the examination of property no endangered species were encountered or are known to exist within OWASA's property boundaries. A cooperative publication called *Threatened and Endangered Species in Forests of North Carolina* listed several species as endangered/threatened in Orange County. The publication lists Small Whorled Pogonia (*Isotria medeoloides*) as plant species of concern, threatened, or endangered; but their populations are historical, and no known populations currently exist in Orange County.

The publication also includes two mollusks that have known populations in Cane Creek or in the Cape Fear River Basin. The first is Savannah Lilliput (*Toxolasma pullus*) and the second is Squawfoot or Creeper (*Strophitus undulates*). Both have a state status of "Threatened" but neither one is listed as federally endangered or threatened. Sedimentation is the greatest threat to these mollusks.

Squawfoot (*Strophitus undulates)*

After submitting the boundaries of the property to the North Carolina Natural Heritage Program's Natural Heritage Data Explorer a report was produced listing the occurrences T&E species within two miles of the property's boundaries. That report identified the occurrence of a North Carolina Threatened mussel (Squawfoot/Creeper – *Strophitus undulates*), and a North Carolina Threatened mussel (Notched Rainbow – *Villosa constricta*) on or within two miles of property.

After review, the NC Natural Heritage Program updated us that the Neuse River Waterdog (*Necturus lewisii*), Atlantic pigtoe (*Fusconoaia masoni*), and Smooth coneflower (*Echinacea laevigata*) are listed as federally threatened species in Orange County. And that Dwarf wedgemussel (*Alasmidonta heterodon*), Pondberry (*Lindera melissifolia*), and Michaux's Sumac (*Rhus michauxii*) are now listed as federally endangered in Orange

County. The Tricolored Bat (*Perimyotis subflavus*) is also being proposed as Federally Endangered. The NC Natural Heritage Program currently has records of existing Tricolored Bat, Neuse River Waterdog, and Atlantic Pigtoe in Orange County. Their records show that the other updated listed species are historical.

Following North Carolina Best Management Practices for forestry operations should help avoid negative impacts on the mollusks and their habitat. With our riparian forest buffer plan and a "no harvest" 100 to 150-foot riparian buffer zone on all streams, we should have more than enough undisturbed buffers to avoid sedimentation from soil disturbance and pesticide applications from forestry operations that might occur near them.

For additional information on these species or other state-listed threatened and endangered species in North Carolina contact the North Carolina Wildlife Resources Commission (919-707-0050) or the North Carolina Natural Heritage Program (919-733-4181). Our proposed plan includes North Carolina's forestry Best Management Practices and exceeds the mandatory requirements of the Forest Practices Guidelines Related to Water Quality.

Forests of Recognized Importance: Based on American Forest Foundation criteria, there are no Forests of Recognized Importance (FORI) known to exist on the property. However, this property does protect water resources that provide a benefit to metropolitan areas. This 218-acre property provides critical watershed and erosion control protection for Cane Creek Reservoir, which is a main drinking supply for Carrboro and Chapel Hill. NCDWR Surface Water Classification for this farm is: *Water Supply II – Undeveloped: High Quality Waters: Nutrient Sensitive Waters: Critical Area.*

Cane Creek Reservoir

Exotic (Non-native), Invasive Species: Based on our field visits, OWASA does have populations of exotic (non-native), invasive species on the property. The primary exotic invasive on the property is Autumn olive (*Elaeagnus umbellate*). This aggressive non-native scrub is widespread throughout the property and will suppress benefits of desirable native species if not addressed. The other non-native exotic species we encourntered, but in few numbers and areas were Japanese stilt grass (*Microstegium vinineum*), Chinese wisteria (*Wisteria sinensis*), Tree-of-Heaven (*Alianthus altissima*), Chinese privet (*Ligustrum sinense*) and multi-floral rose (*Rosa multiflora*).

Autumn olive (nonnative invasive) on property

There is one very large and well-established population of Chinese wisteria in one of the riparian forest buffers and adjacent to Management Unit A4 on the southern side of the property. It is the black cross hatched area that is labeled “Wisteria” on the Forest Management Map (page 19). This extremely aggressive non-native invasive vine has almost completely choked out the understory and has climbed up into the midstory and overstory trees. We estimate the affected area encompasses eight to nine acres. We expect the wisteria escaped from a an old homesite near the property. Eradication of this non-native invasive would be expensive and require multiple treatments. Unfortunately, the wisteria is also growing on an adjacent landowner to the north. Without a combined effort, controlling this invasive would be difficult . Eradication without neighbor cooperation

is improbable. Any recommended treatments to control non-native invasive will have to be designed and applied to not impact water quality or associated native species.

Chinese Wisteria

The disturbances created by a timber harvest can rapidly promote the expansion of invasive exotic species on the property, so monitoring and control will be important. Of note is Tree-of-Heaven (*Ailanthus altissima*), which the NC Department of Agriculture has identified as important to the life cycle of an emerging threat – the invasive exotic spotted lanternfly (*Lycorma delicatula*), which has been a very destructive pest in other states. Tree-of-Heaven appears to be the preferred host for late-stage nymphs and adults. The Spotted Lanternfly is not much of a threat to woodlands and is more of a concern for trees in orchards and landscape nurseries.

Spotted Lanternfly

Here are two links to information on spotted lanternfly:
https://caldwell.ces.ncsu.edu/2019/07/spotted-lanternfly/
https://www.ncagr.gov/PLANTINDUSTRY/plant/entomology/documents/SpottedLanternflyPestWatch.pdf

Further management will involve monitoring and eradicating populations of exotic, invasive species we find, if biologically possible and economically feasible. A good resource for identification and control of these species is the U.S. Department of Agriculture's publication called *Nonnative Invasive Plants of Southern Forests: Field Guide for Identification and Control* (GTR SRS-62).

Property Lines: The property lines are currently not well marked. The property lines need to be repainted. Prior to any management activities these property lines should be refreshed with paint to avoid any miscommunications.

It is important that these property lines be refreshed every five to eight years. Defining these property lines has helped to establish the boundary between OWASA and their neighbors. Clearly marked lines provide several benefits including: reduced trespass, encroachment, timber theft, and recreational liability. Even more importantly it has helped with our forest management work and kept us from encroaching onto adjacent properties during our management activities. The NCLWF Buffers also buffer areas we plan to manage so it is important that they also are delineated and marked on the ground.

Management Unit C

Key Protection Measures:

Several key management measures will be common throughout the entire tract and are essential for minimizing impacts on the environment and adjacent landowners. These are:

1. Protection of Water Quality

Water quality protection is OWASA's highest priority on managed lands. All plans developed will outline what strategies or measures are being utilized to protect water quality during land disturbing activities. They will describe or require the use of best practices to minimize soil disturbance, erosion, and sedimentation. At a minimum OWASA will follow or exceed North Carolina Forest Service Forest Practices Guidelines Related to Water Quality and follow or exceed the appropriate state watershed buffer rules. This property falls within the Jordan Lake Watershed Buffer Rule requirements.

Protection of riparian buffer areas on the tract will be an essential component of OWASA's water quality protection objective. Through field investigation and review of high-resolution topographic maps, we identified riparian buffer areas in which timber removal should either not occur or only be conducted if essential to control disease, insect damage, etc. Our investigation identified about 97.9 acres of buffer area for this property that should be protected, which includes riparian buffers (including the NCLWF buffer) along the reservoir, perennial streams, and intermittent stream channels. The riparian buffer widths will be a minimum of 50 feet; however, OWASA has voluntarily adopted a strategy of creating 300-foot buffers adjacent to the reservoir, 150-foot buffers along perennial streams and 100-foot-wide buffers along intermittent streams. **Riparian forest buffers have been designated for roughly 45% of this property.**

Our recommended riparian buffer areas are significantly greater than that required under the State's Jordan Lake Watershed Riparian Buffer Rules, which require only a 50-foot-wide buffer area along perennial and intermittent streams. Our plan is to flag, paint and carefully monitor the riparian buffer areas to ensure that they are protected during timber harvesting activities on the property.

It is also important that OWASA marks and protects the boundaries of conservation easements protected by the NCLWF during active forest management on areas near them. This property has close to twenty acres in a NCLWF conservation easement buffer and is shown on the management map (page 19). These NCLWF buffers are included as part of our riparian forest buffer plan.

2. Reduce the Risk of Wildfires

The Plan recommends the use of prescribed burning to reduce the risk of damaging wildfires, to aid in forest regeneration, and to improve the biological diversity and restoration on-site. These burning events will be carefully planned and tightly controlled

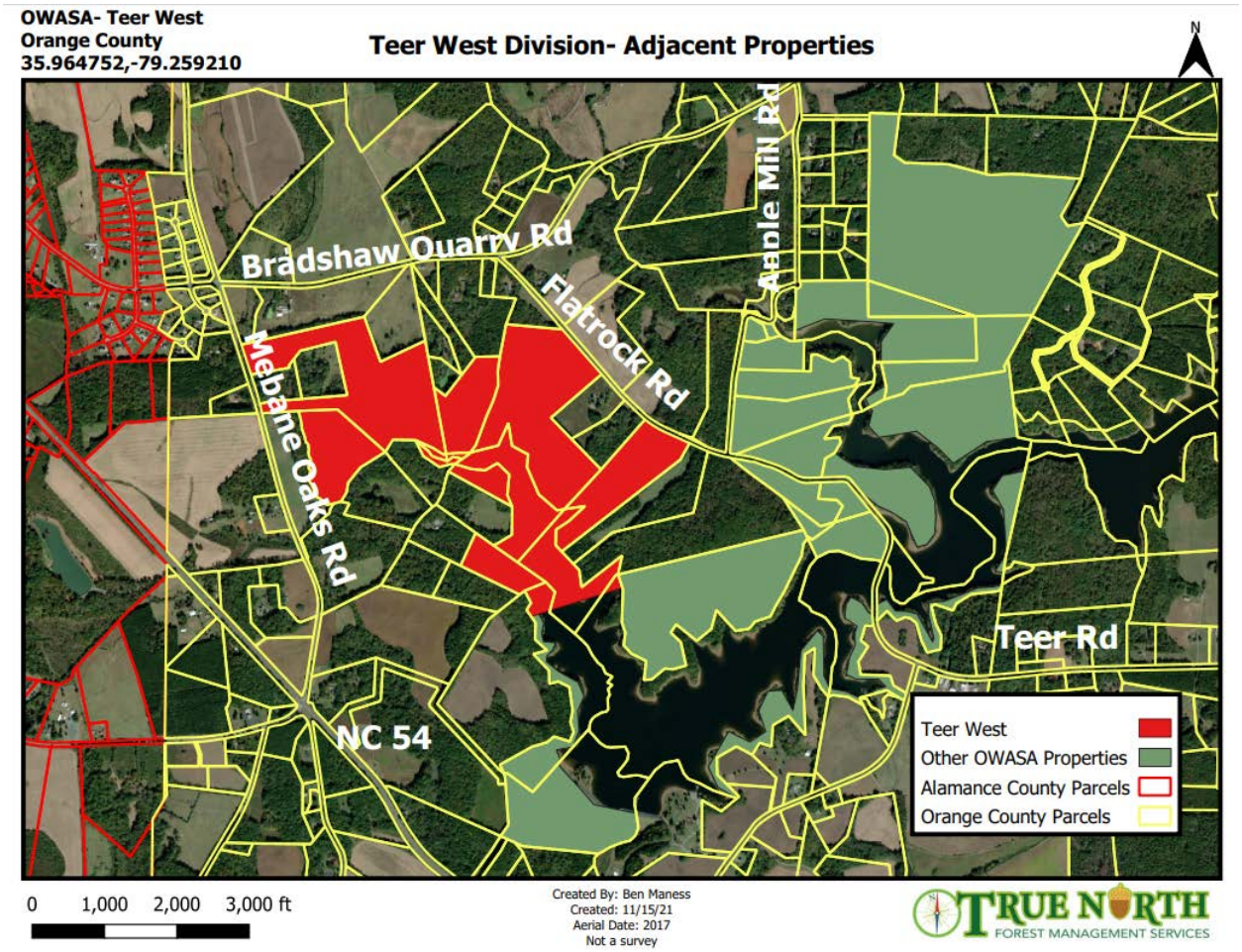
by trained experts to significantly reduce the chance of fire spreading and to minimize the impacts from smoke. Prescribed burns will be closely coordinated with the North Carolina Forest Service, and advanced notice will be provided to surrounding property owners. The intention of the periodic prescribed burns is to reduce understory fuel levels that will reduce the impact and intensity of a possible wildfire.

Any access roads within this property will be designed and located to complement our wildfire risk management objective, such as maintenance of fire breaks and ensuring timely access for fire-fighting equipment. A network of roads and firebreaks will also serve as another line of defense against wildfire spread. Where possible, and can be done safely, streams and wet drainages should be utilized as natural fire breaks during prescribed burns. This will help to avoid or minimize the potential soil erosion problems that can occur from the soil disturbance created from heavy equipment blading or plowing fire lines. Where possible low intensity prescribed fire should be allowed to creep through these riparian forest buffers or burned outward from the stream. A study done by the North Carolina Forest Service and the U.S. Forest Service in an adjoining county showed no negative water quality impacts when this practice is implemented. The study also showed that soil disturbance from fire lines created within the transitional ecotone of the riparian corridor creates a potential soil erosion problem and a wildlife barrier. So, where appropriate, hand dug lines or hand fire lines created with leaf-blowers and hand rakes, can help to minimize soil disturbance within these riparian areas.

NC Forest Service on prescribed burn at OWASA's Cane Creek Mitigation Tract April 2018

3. Mitigate Adverse Impacts on Neighbors and Surrounding Community.

As part of their management objectives OWASA will strive to mitigate any adverse impacts forest management activities may have on their neighbors. This objective involves providing neighbors with opportunities to review the draft Forest Stewardship Plans near their properties and to provide them opportunities to provide input, share their concerns, and where applicable, suggest how OWASA might mitigate any adverse impacts to their neighbors while still being able to meet its management needs. All plans will also address and design aesthetic or viewshed buffers where appropriate. OWASA staff will keep adjacent landowners and other interested parties informed on their efforts and the schedule of forest management activities at those properties.



OWASA'S MISSION

We are a community-owned utility providing our customers high quality and reliable water, wastewater, and reclaimed water services through responsible and creative stewardship of the resources we manage.

FOREST MANAGEMENT VISION STATEMENT

Protect water quality now and for future generations by following science-based principles to manage our forest lands so they are healthy, diverse, resilient, and sustainable.

LANDOWNER OBJECTIVES

The primary objectives OWASA has identified for management of its forest resources are:

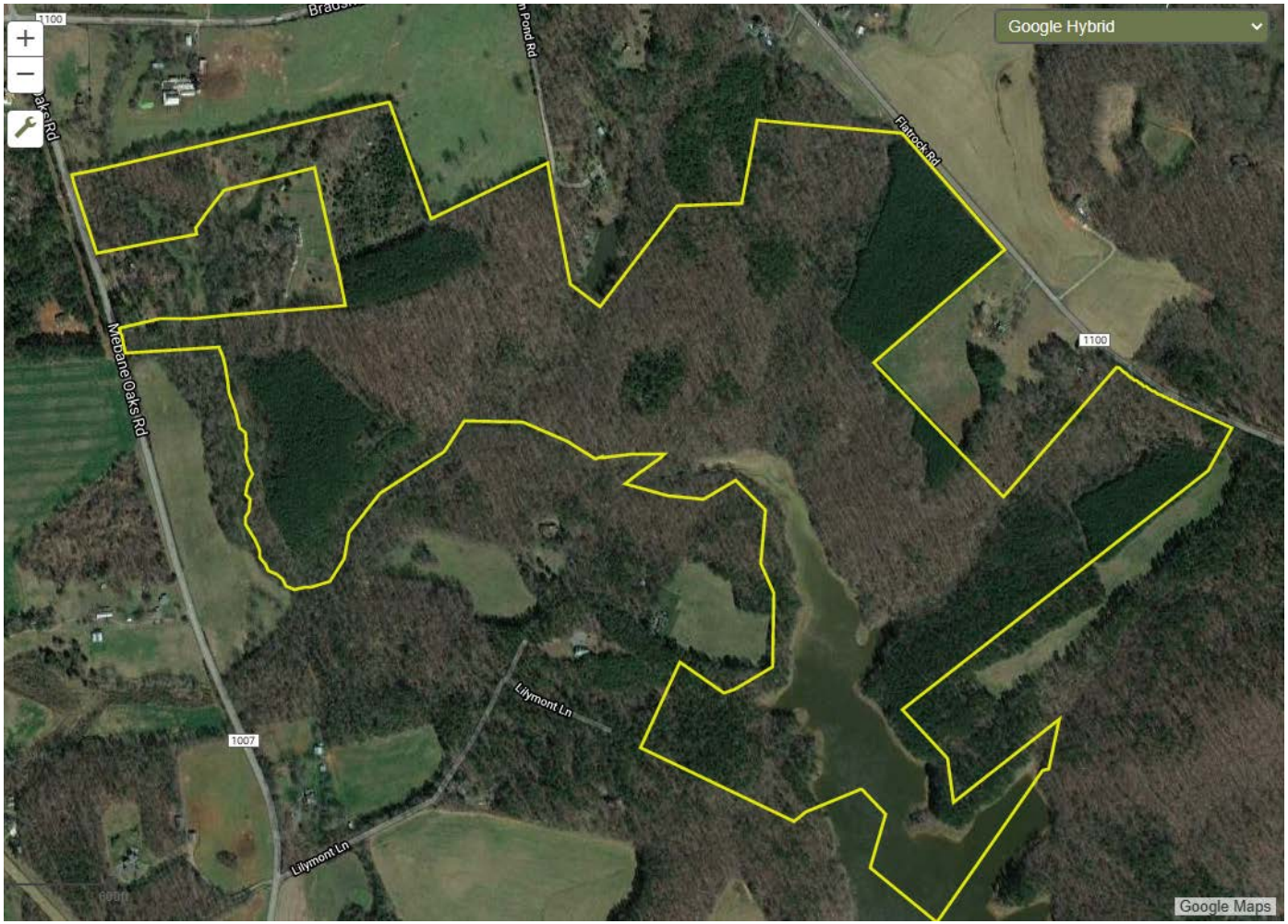
- To protect water quality, OWASA's highest priority.
- To improve ecological health of forested lands.
- To reduce the risk of wildfires.
- To improve wildlife habitat and species diversity.
- To sustainably manage OWASA's resources.
- To engage the community and partner organizations.
- To minimize the adverse impacts on neighbors and surrounding community.

Active and sustainable management of the forest resources on the property will be key to achieving these objectives. Forest management efforts should reflect a multiple-use approach and specific efforts should focus on protecting water quality, improving wildlife habitat, enhancing forest health, reducing wildfire risk, protecting aesthetics, and protecting soil productivity. The goal should be to create a mosaic of interconnected management units that are bound by good land stewardship and sustainability. By adhering to this management philosophy, the land will become more productive and land management goals will be successfully met.

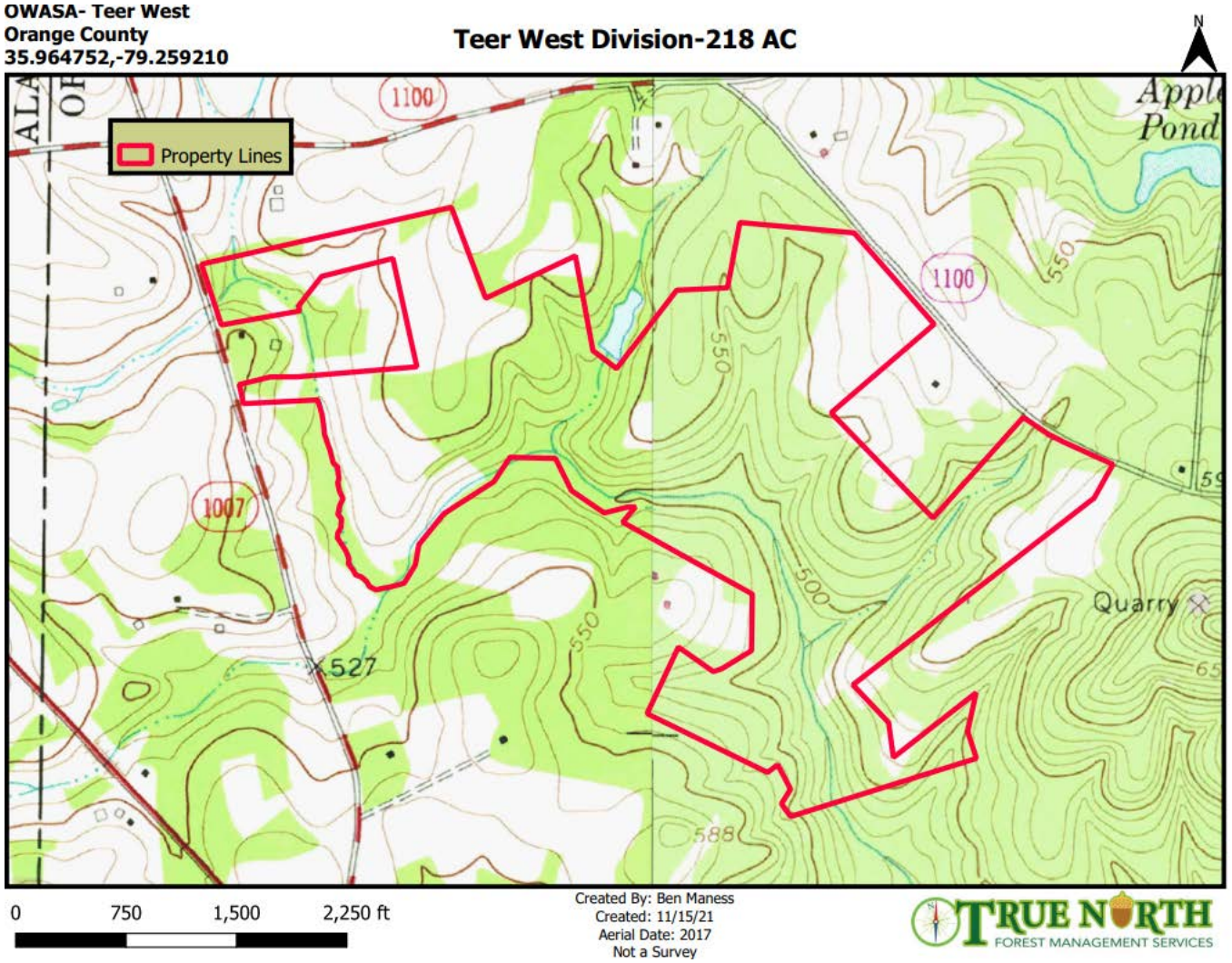
The OWASA Board of Directors approved a vision, guiding principles along with strategies for its Forest Management Program in September 2019. These can be found on their website at:

https://www.owasa.org/wp-content/uploads/2020/04/OWASA-Forest-Mngt-Program_Vision-Guiding-Principles.pdf

OWASA - TEER WEST PROPERTY
AERIAL PHOTOGRAPH

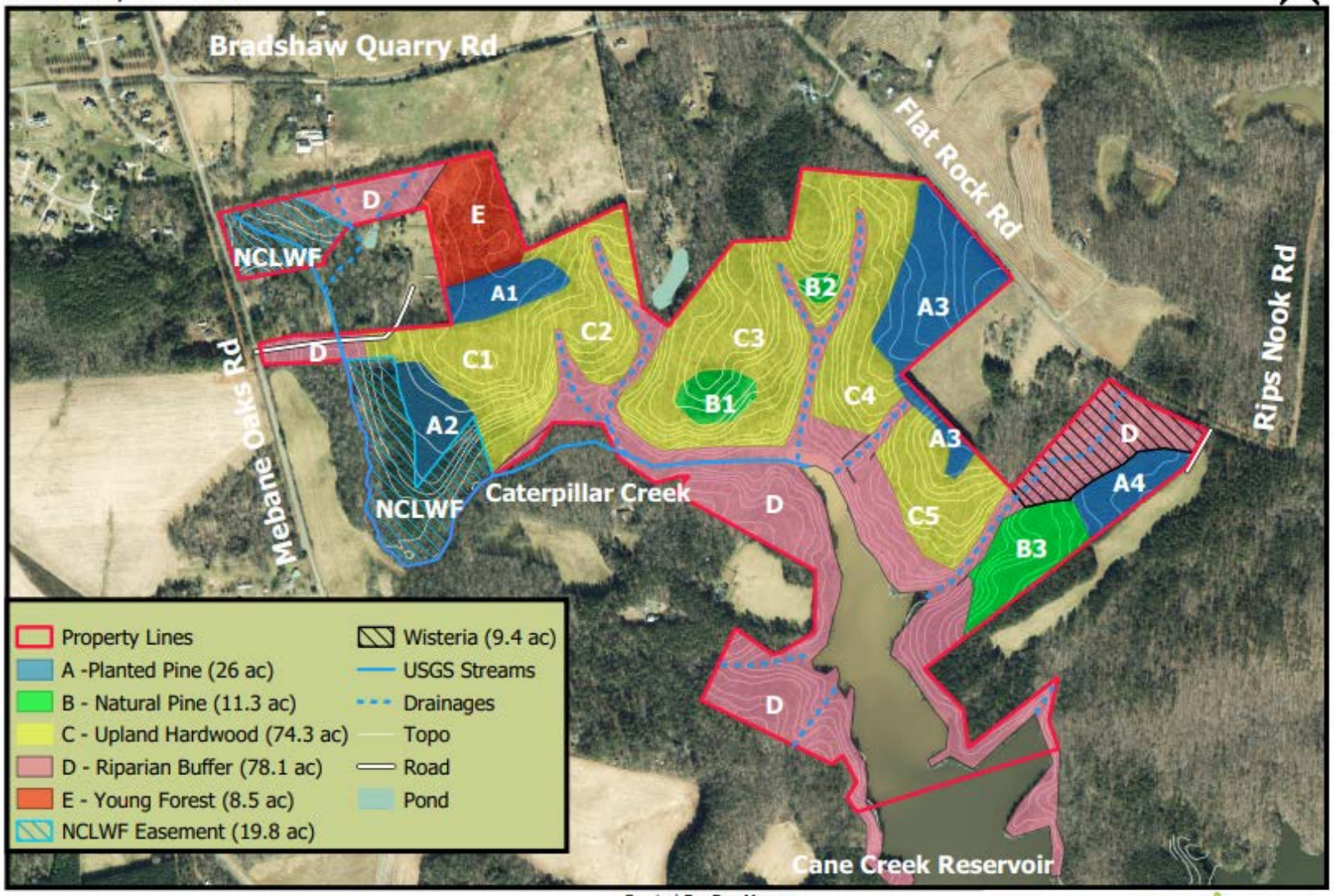


OWASA – TEER WEST PROPERTY
USGS TOPOGRAPHIC MAP



OWASA- Teer West
Orange County
35.964752,-79.259210

Teer West Division-218 Acres



0 750 1,500 2,250 ft

Created By: Ben Maness
Created: 11/15/21
Aerial Date: 2017
Not a Survey

TRUE NORTH FOREST MANAGEMENT SERVICES

OWASA completed a prioritization of all their forest lands and Teer West ranked one of the highest on the priority list for active management to ensure the forest remains healthy and our water quality is sustained. There are six separate Management Units on the Teer West Property. Here are the descriptions and recommendations for each of the management units on Teer West property:

MANAGEMENT UNIT A

DESCRIPTION

Acres (Map Color):	26 (Blue) A1 = 4.2 acres, A2 = 4.3, A3 = 13.1 acres, and A4 = 4.4 acres
Landcover Type:	Planted Pine
Dominant Species Present:	Loblolly pine
Understory Species:	Not much understory vegetation. Some sweetgum, red cedar, Eastern hophornbeam, willow oak, yellow poplar, and Autumn olive (invasive).
Age (Established):	23 years (1998) and 19 years (2002)
Size:	**6 to 12 inches in diameter (10-inch DBH average)**
Stocking:	Very overstocked (200 to 240 square feet of basal areas per acre)**.** The basal area per tree is the cross-sectional area of each tree at breast height. Breast height is 4.5 feet above the ground. Basal area per acre is the sum of these cross-sectional areas for all trees in an acre.
Quality:	Good
Growth Rate:	Good, but slowing down
Soil/Water:	Mostly Herndon silt loam (HrB) and Georgeville silt loam (GeB). Well drained. For detailed description and location of soil types see the Custom Soils Report at the end of the plan.
Topography:	Gently sloping (2 to 6 percent slopes)

Management Unit History: This Management Unit represents old agricultural fields that OWASA planted in loblolly pine in 1998 (A1, A3 and A4) and in 2002 (A2). It appears they were planted on 10 x 10-foot centers or 435 trees per acre. These were likely agricultural crop fields at one time. This was a working farm prior to OWASA's purchase of these blocks starting around 1984 and ending around 2000. These pine plantations have not been commercially thinned.

Management Unit A2

RECOMMENDATIONS (Management Unit A)

This management unit is due for its first thinning. Pine plantation forests are normally thinned a first time when they reach 18 to 20 years old or when their average diameter is between six to eight inches. This pine forest is now twenty-three and nineteen years old and their average diameter are 9 to 12 inches. Growth is now starting to slow down due to overcrowding and competition for sunlight. An active thinning program is essential to maintain a heathy pine forest. Removing trees that are of poor form or defect and/or ones growing too closely together will help to eliminate the overcrowding and competition for sunlight among the pine trees in the stand. Thinning will give more space, water, sunlight,

and nutrients to the trees that remain, increasing their growth rate and improving the overall forest habitat and health.

A **first thinning** of pine is mainly just a row thinning. In pine plantations every four or fifth row is normally removed in a first thinning to provide access. Once the thin row is removed the logging company then removes small diameter, poor quality trees along these access rows to reduce the overall stocking. In this type of thinning the stand is usually not marked, which means the cutter establishes the rows and then selects and removes trees along the rows without them being marked. Therefore, it is important to work with an operator with first thinning experience and a reputation for good work.

Example of pine thinning

Approximately eight to ten years following the first thinning (2033-36), a **second follow up thinning** will likely be recommended. A second thinning will do a much better job of thinning and reducing the stocking of trees between the rows. This will greatly improve the growing conditions of the entire stand, not just the trees adjacent to the rows that were cut out during the first thinning. This second thinning should reduce the density to about 80 to 90 square feet of basal area per acre or leave about 200 to 250 trees per acre. I recommend that OWASA have us mark the second thinning by painting the trees to keep or remove. The thinning crew would only remove trees that have been painted or not painted, depending on how it was marked. This way OWASA has the benefit of a professional forester walking through the stand ahead of time and marking the stand to provide the optimal growing conditions between each tree.

Example of a marked thinning after completion
(In this stand we marked the trees to keep)

Seldom are pine thinnings done as a lump sum sale. Therefore, we will have to negotiate with a timber company to pay OWASA on a per-ton-per-product-class of wood removed. In this type of payment method, the timber company will pay OWASA as the wood is cut. For each thinning True North can assist OWASA finding a reputable thinning crew, negotiating an acceptable per unit timber price, and assist OWASA in writing a timber sale contract. We can also assist in monitoring the thinning operation to ensure the proper extraction and protection of OWASA's residual stand and to ensure they adhere to Best Management Practices designed to protect the land and the watershed.

Prior to any thinning and final harvest, we will need to flag out riparian forest buffers we deem necessary to protect water quality. These will need to be identified on the ground and flagged out to protect them during harvesting.

All the thinnings of this Management Unit should be done during a dry period. Thinning the property when it is dry will keep from rutting and compacting soils and damaging the productivity of the soil for forest growth. This Management Unit should be thinned during the drier months of the year, which is usually the spring through early fall (April – October).

The thinning of these dense stands of loblolly pine will increase the amount of sunshine able to reach the forest floor. The effect of this increased understory sunlight will promote the abundance of herbaceous and woody stem growth in the understory. This will provide

additional food and escape cover for many species of wildlife such as wild turkey, northern bobwhite, eastern cottontail, white-tailed deer, and a variety of songbirds. This benefit will gradually decline as the crowns of the pines start to close again.

This restored pine forest, following a first and second thinning, will probably benefit bird species such as: northern flicker, red-headed woodpecker, brown-headed nuthatch, summer tanager, eastern wood-pewee, yellow-throated and blue-headed vireo, yellow-throated warbler, whip-poor-will, chuck-will's widow, and of course the pine warbler.

Incorporating in-stand **understory burning** through these stands, following the first thinning, every three to four years will also significantly improve and benefit wildlife habitat and reduce wildfire risk. We would like to see OWASA start a periodic prescribed burning program in this loblolly pine stand following the first thinning. The overall objective of repeated understory burning will be to promote herbaceous ground-level vegetation to improve browse and concealment for forest animals. Prescribed burning is probably one of the most cost-effective and essential management tools for improving wildlife habitat and forest health. The biggest benefit of controlled burning is that it will reduce and knock back the hardwood midstory and understory. Once hardwood trees get above five feet, they are too high to be eaten by most wildlife and they shade out the understory and block needed sunlight for germination of native legumes and forbs.

Management Unit A2: Current lack of understory vegetation

Fire can change that ground level shading by controlling these midstory species. Prescribed burning is highly effective at controlling midstory species such as sweetgum, yellow poplar, and red maple because they are thinned barked and cannot tolerate heat

from fire. These thin-barked hardwoods are usually only “top-killed”, but this will allow sunlight to reach the ground. This increased sunlight will promote, along with the bare ground conditions, the germination of native legumes and forbs important for winter food for wildlife. “Top-killed” means the fire gets hot enough to kill the portion of the tree above the ground, but not hot enough to damage the root system. The following spring “top-killed” hardwoods will usually re-sprout from their roots and provide lush vegetation close to the ground for animals to browse on.

Prescribed burn in pine

Fire also breaks down seed coats of hard-seeded legumes and other food plants through heat scarification, which increases the germination of these species the following spring. The fire will also release nutrients and minerals and create a fertilizer effect. By removing the heavy layer of litter and reducing hardwood brush, understory burning will encourage the growth of young, succulent plants, and significantly improve the conditions for wildlife.

Prescribed burning for this type of woodland is usually conducted during the cool season (December through March). But to get the full benefit of the understory burning, it should be repeated every 3 to 4 years. By removing the heavy layer of litter, the fuel present on the forest floor is reduced, thereby reducing the risk of an uncontrolled wildfire damaging the forest or surrounding properties.

Prior planning and preparation are crucial to a successful prescribed burn program. It will require the establishment of trails and firebreaks throughout the stand, which are normally developed just prior to commencing the burn.

Example of an understory pine burn next to firebreak

All controlled burns on OWASA property can be coordinated by True North and the North Carolina Forest Service. It may be possible to have the North Carolina Forest Service perform the prescribed burning with their forces. Their 2021 rate for development of fire lines (bladed line) and conducting the burn is $30/acre. The Orange County Ranger has confirmed their willingness to assist OWASA with these efforts.

Special care will be taken to provide advance notice to surrounding property owners. These prescribed burns will be well planned and tightly controlled to significantly reduce the chance of the fire spreading and to minimize adverse off-site impacts from smoke. Fire weather data (wind speed and direction, relative humidity, fuel moisture, temperature, etc.) will be evaluated and monitored prior to any controlled burn to determine the safest and most efficient burning times and conditions. During the controlled burning operation all the necessary fire suppression equipment will be on site, so that in the unlikely event of a breakover, the situation can be quickly controlled with equipment already on site.

Keeping firebreaks open and accessible is essential to responsible forest management. For this reason, it is recommended that bladed, not plowed lines, be established. Bladed lines are much easier to maintain and provide multiple benefits, serving as firebreaks and providing access for other management activities. These revegetated bladed areas also serve as wildlife corridors and as feeding areas for wildlife.

In the future we will evaluate our final harvest and regeneration options for this management unit. Prior to a recommendation for a final harvest and stabilization, each

potential harvest area should be analyzed to determine the desired timing and reforestation plan. Loblolly and shortleaf pine can certainly be grown for 60 to 70 years without any major health issues. If we choose to maintain some or all this pine stand longer, we will need to keep a close eye on the health and vigor of these stands with more periodic site visits. As they get older, they are more susceptible to insect infestation due to lower vigor. They will eventually start to succumb to natural mortality. So, at some point if natural mortality, insect infestation, or storm damage becomes excessive, we should look at going ahead with a final harvest and regenerating it back to new vigorous forest.

We think it is important to keep a good mix of both pine and hardwood forests on the property to maintain a variety of habitat types. Wildlife and songbird species are adapted to and prefer both types of forests. Keeping a mix will be important long term. The goal is not to create more pine stands but to keep the current mix. Pine stands represent a low percentage (18%) of this property, so it will be important to maintain the current pine sites on this property. Because of their shorter timber rotations, multiple income producing events (thinnings), and higher productivity levels pine forests can also serve as an economic driver to provide the necessary periodic income producing events to properly steward the property.

Forest Management Schedule (Management Unit A)

Acres	1st Thin (Row)	Understory Burning	2nd Thin (Marked)	Understory Burning
26	2023-25	2025-26 2028-29	2033-36	2035-36 2038-39

MANAGEMENT UNIT B

DESCRIPTION

Acres (Map Color): 11 (Green)
B1 = 3.1 acres, B2 = 0.9 acres, and B3 = 7.3 acres

Landcover Type: Natural Pine

Dominant Species Present: Mostly loblolly pine and Virginia pine with some white oak, yellow poplar, and shortleaf pine.

Understory Species: Red maple, sweetgum, red cedar, sourwood, hickory, Eastern hophornbeam, flowering dogwood, black cherry, and American holly.

Age (Established): 30 to 40 years (1981-1991)

Size: 12" to 18" DBH (DBH: Diameter at breast height. Breast height is 4.5 feet above ground)

Stocking: Low to overstocked (60 to 160 square feet of basal area per acre)

Quality: Good to fair

Growth Rate: Fair to slow

Soil/Water: Herndon silt loam (HrB and HrC) and Georgeville silt loam (GeB). Well drained. For detailed description and location of soil types see the Custom Soils Report.

Topography: 2 to 10 percent slopes

Management Unit History: This Management Unit represents three natural pine forests on the property. No treatments have been made on these forest stands in the past. There has been some recent mortality from competition and several trees have blown down in recent storms, especially Virginia pine. These units were most likely small gardens or fenced in pastures before they were abandoned.

RECOMMENDATIONS (Management Unit B)

We are designating these small pine stands for a **final regenerative harvest.** Following harvest, we would replant them in either loblolly pine or shortleaf pine. The size of harvest,

its location, and soil productivity will help us determine which pine species is best suited for reforestation following harvest. Shortleaf pine restoration is best suited for smaller, inaccessible sites, or in areas with poor to moderate soil productivity. Shortleaf pine will grow on good deep upland sites, but loblolly and many other species will grow much faster than shortleaf pine on these sites. Instead of where it can grow, we will focus on where it has the best chance to achieve dominance over its competitors.

Loblolly pine restoration will be better suited for larger, more accessible sites, with moderate to high soil productivity. Larger and more accessible sites have more to do with getting them thinned operationally when they get older. Based on size, Management Units B1 (3.1 acres) and B2 (0.9 acres) are better suited for shortleaf pine restoration. Based on soil conditions, accessibility, and larger acreage Management Unit B3 (9.9 acres) is better suited for loblolly pine restoration.

Management Unit B3

An herbicide site prep treatment will almost certainly be necessary following the final regenerative harvests to ensure the planted pine seedlings are free to grow from hardwood and herbaceous competition. A selective herbicide would be selected that will

retard the growth of these species just long enough to allow the young pine to establish dominance. Hand spraying target species will also allow us to maintain hardwood species we would like to keep such as oak and hickory, and soft mast species such as dogwood, blackgum, sourwood and American holly. Treating large stump sprouts and seedlings of red maple, yellow poplar, and sweetgum will help keep these species from dominating the site.

Following a final harvest, we will need to evaluate each harvest block, develop a specific site preparation treatment, and schedule the cutover for tree replanting to shortleaf pine or loblolly pine. When it comes to shortleaf pine, containerized seedlings have shown a much higher survival rate than bare root seedlings. So, any shortleaf planting should be done with containerized seedlings. If we replant in shortleaf pine, we recommend an 8-foot by 10-foot spacing or 544 trees per acre. Shortleaf pine is also a species of concern in North Carolina due to its population declines.

If we find any mature shortleaf pine in these stands, we should mark to keep them. During the preharvest planning we should locate overstory shortleaf pine trees in these stands and paint them in highly visible paint and instruct the logging company to not damage or harvest them.

Management Unit B1

Forest Management Schedule (Management Unit B)

Acres	Final Regenerative Harvest	Reforest in Shortleaf or Loblolly Pine
11	2023-25	2024-26

Management Unit B2 (fallen Virginia pine)

MANAGEMENT UNIT C

Acres (Map Color):	74 (Yellow) C1 = 14.3 ac, C2 = 10.1 ac, C3 = 27.8 ac, C4=12.2 ac, and C5=10.0 ac
Landcover Type:	Upland Hardwood
Dominant Species Present:	White oak, red oak, yellow poplar, hickory, green ash, post oak, southern red oak, with scattered loblolly and shortleaf pine.
Understory Species:	Red maple, sweetgum, sourwood, blackgum, hickory, white oak, sourwood, Autumn olive (invasive), American beech, and eastern red cedar.
Age (Established):	60-80 years (1941-1961)
Size:	12 to 24 inches in diameter (DBH)
Stocking:	Low to adequate
Quality:	Fair to very good
Growth Rate:	Good
Soil/Water:	Herndon silt loam (HrB & HrC), Georgeville silt loam (GeB & GeC), some Tarrus silt loam (TaD). See Custom Soil Report for detailed description and location of soil types.
Topography:	2 to 15 percent slopes

Mgt. Unit History: This seventy-nine-acre unit is the heart of the property and represents about 36% of the entire Teer West property. The hardwoods in this unit are highly diverse in species and age, but in general this is a mature upland hardwood forest with large canopy trees. There appears to have been some selective cutting in the past especially for either firewood or red cedar for posts. A few canopy gaps exist from either fallen or blown down trees and from some natural mortality.

RECOMMENDATIONS (Management Unit C)

To help maintain species diversity on the property we would like to maintain this upland hardwood forest. This management unit has a high percentage of mature red and white oak trees in its main canopy. Loblolly pine, hickory, yellow poplar, and sweetgum make up a smaller component of the canopy of this management unit. These mature upland hardwoods have an abundance of acorn and nut producing trees, which are providing

excellent feeding areas and winter food sources for wild turkeys, squirrels, and deer. During the late fall and winter, this is where we would expect to find a lot of turkey sign (scratching) because they are looking for acorns.

Management Unit C

At this time, we would like to start incorporating some periodic small regenerative harvests into these upland hardwoods to increase the age diversity and create some blocks of young hardwood regeneration, both yellow poplar and oak. We want to keep most of the mature hardwood intact, but we would like to start creating some early successional habitat within these large blocks of mature hardwood.

For a portion of this unit, we would like to use a **Yellow Poplar Seed Tree Harvest** to naturally regenerate yellow poplar. In this method, we will mark to keep six to eight well distributed mature yellow poplar per acre. During this Seed Tree Harvest the logger will be instructed to harvest all the merchantable trees and midstory except the marked yellow poplar seed trees. We are recommending this treatment of Management Unit C1 (14 acres). Management Unit C1 is a very productive soil type, and it has the most mature yellow poplar trees in the overstory than the rest of the Management C Units. Yellow

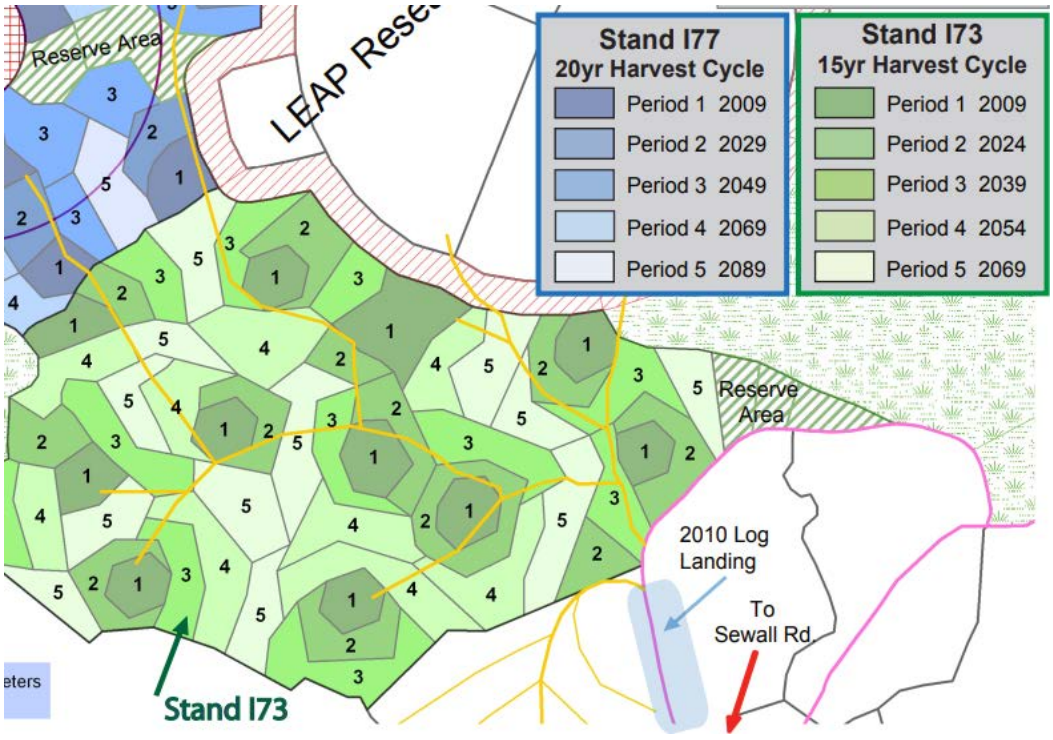
poplar is normally better suited than oak on the more productive soil types on gentle to moderately sloping sites or on the toe slopes near riparian forest buffers. On these sites, a final regenerative harvest is normally enough to regenerate yellow poplar. But to improve the chances of yellow poplar regeneration and to avoid the unsightliness of a large clearcut we would prefer to leave scattered poplar seed trees. Leaving these scattered seed trees will help buffer the harvest and provide an additional seed source for natural regeneration. Natural regeneration of yellow poplar is quite easy because its seed is viable for up to ten years. So once the main canopy is removed yellow poplar regeneration should be plentiful.

Management Unit C1

The other type of hardwood regenerative harvest we would like to recommend on the remaining upland hardwood sites of this unit is an expanding gap shelterwood system, known by its German name "**Femelschlag"** to promote natural oak regeneration. This multi-aged system is created through multiple entries into the stand. The process is started by going into a mature upland hardwood stand and creating small canopy gaps (< 1-acre small clearcuts). The gaps are kept small enough to create the diffuse sunlight (shade) levels that favor oak regeneration. Too big of an opening (> 1 acre) will favor co-occurring sun-loving species to regenerate. Many of these species, such as yellow poplar and pine, will germinate from seed and quickly overtop small oak regeneration. Keeping the gaps small improves the light conditions needed for oak regeneration but does not allow too much direct sunlight to the forest floor to promote the development of sun-loving competitors.

Then on an interval of every 15 to 20 years these initial Femelschlag gaps are expanded. Once the oak regeneration has established in these gaps, the gaps are then expanded by cutting trees around the edge of the gaps. Overstory hardwood, oaks in this case, are "retained" around the perimeter of these gaps and expanding gaps to help regenerate the openings in oaks. Even within these small openings a few mature oak trees can be kept (especially in the middle of the gaps) to provide the necessary diffuse sunlight that favors oak regeneration. This multi-aged silvicultural method retains mature undisturbed forest areas, but over time it provides a range of horizontal, and vertical forest structure.

See the example map below of an expanding gap system used at a University Forest in Maine. The different colors represent the different gaps created (harvested) over time. Period 1 is the first entry into the forest, when the first gaps are created. Period 2 is the second entry (15-20 years later), and so on. The initial openings are "expanded" in subsequent entries. The gaps that are created will be the focus areas for oak establishment following harvest. Once established, the regeneration is tended to with prescriptions that ensure adequate oak regeneration. This will be accomplished with different treatments, but the most effective tool is utilizing "growing season" prescribed burns once the oak regeneration is well established (6-8 years following harvest). Growing season burns will help "tip the scale" in oak regeneration's favor by controlling less fire tolerant species like yellow poplar, red maple, loblolly pine and sweetgum. These trees do not tolerate hot fire in their early development and are often controlled with growing season burns. This "Femelschlag" method is also currently being used in the Pisgah National Forest near Brevard, North Carolina, and at the Duke Forest.



The harvested gaps are anywhere from quarter-acre to one-acre in size and they are well distributed throughout the forest. Yellow poplars are still going to grow in these gaps, particularly in the center, but the shady edges of these gaps will favor oak and hickory. Using fire once the oak is established will improve its chances. We may also consider planting the center of these gap openings with oak seedlings from a nursery.

Another variation of the Femelschlag system is to create long narrow linear gaps (60 to 100 feet wide). They also create the diffuse light conditions preferred by oak along its edges but from an operational standpoint it can be easier for a logging company to create these linear rows than harvesting scattered small group openings. These linear gaps are also expanded once oak regeneration is established. We should consider utilizing both these Femelschlag methods. With our adaptive management approach, we are trying different regenerative approaches on this unit to see what oak regeneration prescriptions work best. We are also trying to create some demonstration areas that we can share with neighbors and interested parties on how these different techniques can be implemented to promote oak. Reproduction of oaks has been declining across the southeast region and its decline is expected to be a significant problem in the future. Mature oak forests are not being replaced by new oaks forests, especially if they have been clearcut without advanced oak regeneration in place. OWASA would like to utilize its forests to educate forest landowners on how to restore oak successfully.

This Femelschlag system is very similar to the **Modified Oak Shelterwood System** we are using at the Cane Creek Mitigation Property and supports the same oak silvicultural science that we are taking advantage of on that property. In the Modified Oaks Shelterwood System, we are also doing multiple harvest entries to promote oak regeneration in the understory, but we are doing it on the entire stand. The Femelschlag method is a modification of the shelterwood system in that instead of thinning the entire stand, only a portion of the stand is removed. Most of the mature hardwood forests are left intact and undisturbed in the Femelschlag. The same diffuse sunlight conditions are created to favor oak regeneration, but that diffuse sunlight conditions are best created on the edges and borders of these gaps and not in the center. But, if they are kept small, the “oak rings” that establish around these small gap openings will represent a higher percentage of the total area, than if the gaps were larger.

The science behind shelterwood systems is that they improve the diffuse light to the understory which helps promote **advanced oak regeneration** in the understory**.** The system is designed to improve understory light levels, but not allow too much direct sunlight to the forest floor. We know that if too much sunlight reaches the forest floor many co-occurring species will regenerate and compete with the oak. The goal of both the Modified Oak Shelterwood System and the Femelschlag System is to allow just enough diffuse light to the understory to encourage oak development but discourage the germination of competing species.

Here is a summary of the Modified Oaks Shelterwood system treatments we are using at the Cane Creek Mitigation Property and how it compares to the Femelschlag system:

1. Preparatory Cut with Midstory Removal – This is the first step in the Modified Oak Shelterwood System that we are using at the Mitigation Property. The purpose of this cut is to remove species that are not desired so that they do not contribute seeds to the establishment cut. This cut however removes no more than 25-30% of the undesirable trees from the main canopy. In addition to the overstory thinning as much of the midstory trees as possible are removed to set the stage for oak regeneration to start in the understory. This initial process also involves treating aggressive stump sprouts (maple, poplar, beech, sweetgum) with a contact herbicide to keep them from growing back and reestablishing in the midstory again. The midstory removal is essential to providing the increase in diffuse light, which research has shown to be critical to development of small oak seedlings. Once the desired oak understory is established, subsequent cuttings and treatments give the oak seedlings more sunlight and growing space.

In the Femelschlag System all the merchantable trees are removed from the gaps, but the gaps are kept small enough to control the amount of sunlight that reaches the forest floor. We may modify this some by removing the midstory trees surrounding the edges of these Femelschlag gap openings to favor more advanced oak regeneration on the fringes. Having access to a whole tree chipper will help to encourage the removal these normally unmerchantable trees for fuel chips. We would also recommend follow up herbicide treatments of aggressive stump sprouts from maple, beech, sweetgum, and yellow poplar) in these gap openings.

Understory response following a Preparatory Cut

2. Release Prescribed Burning – which is done six to eight years after the preparatory cut to favor oak. Oak is well adapted to fire and growing season burns will tip the scales in oak's favor. This is done during the early growing season (early April) but only after the new oak regeneration is of sufficient size and abundance to tolerate a growing season burn. Following a Preparatory Cut, the increased sunlight to the forest floor will stimulate a flush of new growth from all types of woody and non-woody vegetation in the understory. Non-oak species, such as yellow poplar, red maple, sweetgum, sourwood, and pine are very aggressive in responding to this increased sunlight. To out-compete their neighbors during this initial increase in sunlight many of these non-oak species will concentrate much of their early development to shoot (height) growth so they can overtop and shade out their neighbors. In contrast, oak responds by spending most of its early development on root development. This inherent difference in initial growth patterns usually leads to oaks demise because they are shaded out by the strong shoot growers. But this strong initial root development can also be an advantage because they are more fire tolerant than many of their competitors. They have a greater ability to survive hot fires because they have a better-established root system.

Oak sprouts following prescribed burn at Cane Creek Mitigation Property

The oak seedlings must be of enough size to survive a fire. This requires that we wait six to eight years following a Preparatory Cut in conjunction with some herbicide treatments

before the oak seedlings are established and of enough size before a prescribed burn is recommended. Oak seedlings should have a root collar diameter (RCD) of greater than 0.5 inches before they can survive a prescribed growing season burn. Studies have shown that 70% mortality occurs in oak seedlings that have a root collar diameter less than 0.25 inches, but just 5% mortality in oak seedlings greater than 0.5 inches. This means we must wait at least six to eight years for the oaks to reach this root collar size. By allowing them to get this size, fire will select for the oak and against the other woody species. At this stage it would be nice to have at least a stocking of 100 competitive oaks (3 – 4 feet tall) per acre before conducting the release burn. Release burning is done in mid to late spring, which is April through mid-May. The burning window is from bud swelling on the non-oak hardwoods to full leaf expansion of the canopy trees. Generally, a **release fire** should be moderate to high intensity with flame lengths of more than 2 feet to ensure complete top kill of the understory layer. Summer fires can also be used from mid-August through September when relative humidity is low enough to allow the fire to carry through the understory, typically between 20 and 35 percent. Done properly, release burning can dramatically change the species composition in the understory to one that favors oak. It is important to understand that winter burns (dormant season) have very little impact on changing the species composition, because they are not effective at killing the non-oak competition. Based on our oak regeneration surveys at the Cane Creek Mitigation Property, we have designated and started these growing season understory burns and have already seen its benefit on favoring oak regeneration.

We will also utilize growing season burns in the Femelschlag System to “tip the scale” in oak regeneration’s favor. Instead of just burning the gap openings we will probably run the burns through the entire upland hardwood areas. This will not benefit oak regeneration much (due to lack of sunlight) but it will “top kill” midstory hardwoods. “Top killed” means the fire gets hot enough to kill the portion of the tree above the ground, but not hot enough to damage the root system. The following spring or summer “top killed” hardwoods will usually re-sprout from their roots and provide lush vegetation close to the ground for animals to browse. Most midstory hardwood trees in this mature forest are currently too tall to browse even by deer, so this puts the leaves back on the ground so they can be eaten. This additional browse will also take pressure off the oak regeneration that will regenerate back in the small openings.

3. Shelterwood Harvest – Once the oaks are well established a second prescriptive cut is done that generally removes between 50 to 60 percent of the stand with a high percentage of “left” trees being mature canopy oak and hickories. This gives the established oak seedlings more sunlight and growing space to further help the advanced oak regeneration become established. The goal of this harvest will be to maintain between 25 and 50 of the best quality mature oaks (and hickory) per acre. We recommend that trees selected for saving be marked prior to harvest, and the logger instructed to harvest everything else but these trees. Undesirable trees (e.g. maples, sweetgums, and yellow poplar) and poor-quality oaks should be removed in this harvest.

This step is not utilized in the Femelschlag System because all the trees are removed in the first treatment, but the gaps are expanded on 15-to-20-year intervals to release the established oak seedlings on the edges of these gap openings.

4. Final Removal/Regenerative Cut – the final stage is to conduct a final regenerative harvest to release established oak seedlings in the understory. This final step in the sequence is conducted when the oak regeneration has reached adequate size (at least one inch in root collar diameter or four feet tall) and occurs about five to 10 years after the Shelterwood Harvest. This is when you remove the full canopy in a regeneration harvest. The larger oak advanced regeneration can then compete with species that will grow rapidly in height.

In the Femelschlag this is essentially the first treatment. All the merchantable trees are removed. The only difference is there is no advanced regeneration in the understory when this happens. The advance oak regeneration will come from the edges of these initial cuts. Then in subsequent treatments the gaps will be expanded by cutting trees around the edge of the gaps. The forest is regenerated in concentric circles that eventually meet.

The Femelschlag method will require our expert knowledge of hardwood silviculture and site analysis to implement correctly. This will require proper flagging and marking of the gap openings and careful selection and oversight of the logging company that will perform this type of harvest and future harvests to ensure that they do not damage surrounding upland hardwood forests during the harvesting operation. A light touch, low impact harvesting method will be essential during the cuts. A logging company we continue to contract with will have to have experience in removing trees without damaging the residual stand or the site. We can assist OWASA in locating an experienced contractor and monitoring the harvest to ensure your objectives are met.

My suggestion is to take this Management Unit and break it up into five regenerative harvests periods staggered every 15-years over the next 60 years. If we stagger the harvests every fifteen years, most of the undisturbed mature canopy of this forest will be kept intact. We will only be disturbing about 20% of the forest during each entry period. This method will put more sunlight on the forest floor to help the oak regeneration become more established. Once established these stands could easily be maintained 100 to 130 years. Understory burns can still be conducted under this entire management unit, not just the gaps, to improve and create more favorable understory vegetation for wildlife and songbirds. These early understory burns should be kept out of the Yellow Poplar Seed Tree areas, because yellow poplar does not tolerate fire because of its thin bark. Hot early season burns would kill or severely damage young yellow poplar.

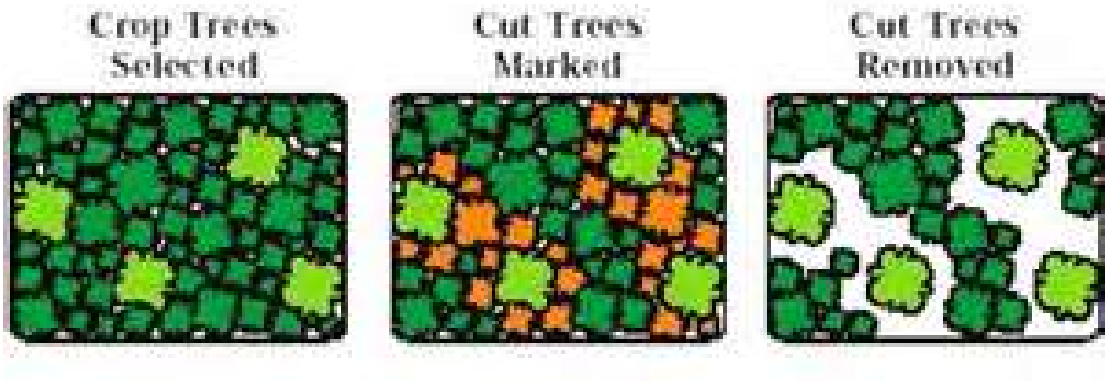
If the regenerative gaps are kept small and well scattered, we will be able to maintain the aesthetic qualities of an unbroken forest. This staggered system will also produce excellent wildlife habitat, including openings with abundant forage and browse, a large

amount of edge, and maintaining mast-producing trees. This system will also encourage multiple tree canopy layers, which will benefit all types of forest dwelling birds. Staggering harvests should increase local bird diversity by providing microhabitats not otherwise available within undisturbed forests. The early successional habitat created by these small harvests should benefit species such as indigo buntings and common yellowthroats.

The Shelterwood System and the Seed Tree systems are very similar as a regeneration method. Both use natural regeneration to create an even aged stand. However, the Seed Tree method focuses a very few trees that will be wind dispersed. Whereas the Shelterwood method maintains more trees as a protective aspect and favors hard mast (acorns) trees that do not disperse well.

Follow Up After Poplar Seed Tree and Femelschlag Harvests: Evaluating the success of oak and yellow poplar reproduction will be important after these regenerative harvest prescriptions. Follow-up evaluation should occur about five years after the harvests. The reproduction for each of these prescriptions should be evaluated for a **Crop Tree Release** treatment about 10 to 20 years after the harvest. Crop Tree Release Treatments can further tip the scale in favor of maintaining oak and poplar in the future stands.

To control the species that successfully regenerate in these new forests, I am recommending that OWASA consider conducting a precommercial crop tree release when the stands are young (pole size: 3 to 8 inches in diameter). Crop tree release is a practice of selecting future crop trees and releasing their crown on all four sides to insure they become free to grow and establish themselves as a dominant tree in the stand. I have recommended releasing crop trees when these stands are approximately 10 to 20 years old because that is when the trees should have developed a clear 17-foot stem from the bottom of the tree. The first 17 feet represents the first log and if it is clear (no branches) it will represent 80% of the tree's future value. Crop tree management singles out and "releases" only the "best" trees. This release requires the removal of just those non-crop trees that are in direct competition with the selected crop trees. Crop tree management applies a "crown touching release" -- cutting down all trees with crowns that interfere with the crop tree.



The overall objective of a crop tree release in these openings will be to release just 25 - 30 crop trees per acre. I recommend that we mark all the crop trees prior to doing any cutting. Choose trees that have straight stems, no forks below 17 feet, no evidence of disease or insect damage, no dead crown branches, and have high vigor. Species selection is also important. With OWASA's overall objectives, I would favor oaks, yellow poplar, and hickory as the crop trees.

Once we have marked the Management Unit you can start releasing your crop trees. The crowns of your crop trees should be released on at least three, preferably four, sides. You only fell (cut down) or treat the trees with an herbicide that are in direct competition with your marked crop tree's crown. You want to select a crop tree that has a well-developed crown that will quickly develop and occupy the additional growing space created by the thinning. So, make sure when you select a crop tree you look up at its crown. Understand that you are not removing everything in the stand except these 25 - 30 crop trees. You are only removing the trees whose crowns are competing directly with your marked crop tree.

Forest Management Schedule (Management Unit C)

Acres	Poplar Seed Tree Harvest	Mark and Harvest Small Gaps – Femelschlag Method	Growing Season Release Burns	Crop Tree Release
74	2023-25 C1 (14 ac)	2023-25 (12 ac)	2029-2031	2033-43 (26 ac)
		2038-39 (12 ac)	2044-46	2048-58 (12 ac)
		2053-54 (12 ac)	2059-61	2063-73 (12 ac)
		2068-69 (12 ac)	2074-76	2078-88 (12 ac)
		2083-84 (12 ac)	2089-91	2093-03 (12 ac)

MANAGEMENT UNIT D

DESCRIPTION

Acres (Map Color): 78 (Pink)

Landcover Type: Riparian Forest Buffer

Dominant Species Present: Yellow poplar, sweetgum, loblolly pine, hickory, black walnut, green ash, American beech, sycamore, bald cypress, willow oak, and white and red oak.

Understory Species: Sweetgum, red maple, boxelder, dogwood, green ash, eastern hophornbeam, spice bush, Christmas fern, mulberry, slippery elm, Autumn olive (invasive), and American hornbeam.

Age: 60 to 80 years

Size: 8 to 22 inches in diameter (DBH)

Stocking: Adequate

Quality: Fair to good

Growth Rate: Excellent

Soil/Water: Mostly Georgeville silt loam (GeB), Chewacla (Ch), and Tarrus silt loam (TaD), with some Herndon silt loam (HrC). Well drained to somewhat poorly drained. See Custom Soils Report for detailed location and description of soil types.

Topography: 0 to 15 percent slopes

Management Unit History: This Management Unit represents all the riparian forest buffers adjacent to Cane Creek Reservoir, the creeks, and major drainages on the property.

RECOMMENDATIONS (Management Unit D)

We have designated this area of the property as a Riparian Forest Buffer. We recommend that no timber harvesting occur within the boundaries of these buffers and that they should be left undisturbed. At this time, we should concentrate our efforts on the upland forests.

These riparian forest buffers provide water quality protection, species diversity and wildlife habitat.

Leaving these riparian buffers undisturbed will allow them to act as an effective natural filtering system. The forest soils along these streams and drainages will act as natural "sponges" to intercept, store, and slowly release water into streams. At the same time, nitrogen, phosphorus, and other nutrients will be taken up by tree roots and converted into plant parts. As a result, streams will be of higher quality if the riparian forests protect them. Trees in the riparian buffer also provide shade on the streams, which help moderate water temperatures.

These riparian forests also supply food, cover, and water for a large diversity of animals on the property and serve as migration routes and stopping points between habitats for a variety of wildlife. The diverse plant communities within these riparian forests are important in attracting and maintaining diverse species of wildlife including streamside bird communities. Area-sensitive and forest interior species, including many Neotropical migrants, can be accommodated in these riparian forests. Some neotropical migrants frequently associated with riparian habitats include the Acadian flycatcher, Louisiana waterthrush, northern waterthrush, prothonotary warbler, northern parula, hooded warbler, Kentucky warbler, and blue-gray gnatcatcher.

Caterpillar Creek

The increased humidity of riparian forests also makes them important habitat for amphibians, snakes, and turtles. This area will also provide a corridor for wildlife to travel as they move through adjacent cover types. There are also several dead snags and den trees in the drainage that should be maintained to provide homes for tree nesting animals such as squirrels, raccoons, woodpeckers, and some tree-nesting waterfowl such as wood ducks.

Cane Creek Reservoir

During future thinnings and harvests these riparian buffer areas should be flagged out prior to any harvesting. There should be no need to cross these buffers except to obtain access to the thinning and harvesting work. The location of this drainage crossing will be designated, restricted to as few temporary crossings as feasible , and its design and construction will utilize Best Management Practice recommendations.

The non-native invasive Autumn olive is quite prolific in all of OWASA's riparian forest buffers. It may not be feasible to eradicate without a very aggressive eradication effort. The eradication of Autumn olive in riparian forest buffers and uplands would require the use of selective herbicides and would require several follow up treatments and periodic

monitoring. Burning would not control Autumn olive. Our recommendation is to start on the upland sites first and work toward the riparian forest buffers.

True North proposes the following recommendations be considered regarding riparian forest buffer areas on the property:

1. Areas designated as riparian forest buffer be excluded from active forest management. That little or no timber harvesting occurs within the boundaries of these riparian forest buffers except essential to control disease and insect damage, provide required access, or control non-native, invasive species.

2. Designate a 300-foot no-cut forest buffer designated along the Cane Creek Reservoir.

3. All perennial streams have at least a 150-foot no-cut buffer designated on both sides of the stream, and that the buffer be expanded when necessary to accommodate wildlife, aesthetics, and water quality objectives.

4. All intermittent streams have at least a 100-foot no-cut buffer designated on both sides of the stream, and that the buffer be expanded when necessary to accommodate wildlife, aesthetics, and water quality objectives.

5. Additional riparian forest buffers be designated on ephemeral channels, groundwater recharge areas, and vernal pools, and other areas where it is determined to be appropriate to protect water quality or wildlife habitat.

Ephemeral drainage bottom

6. Application of pesticides (herbicides) and fertilizers should be prohibited in the riparian forest buffer, **except as may be needed for buffer restoration (i.e., invasive species control).** The use of approved herbicides should only be applied to upland areas with adequate buffers designated adjacent to the treatment area to prevent any drift or movement of the herbicide into the riparian forest buffer that would risk loading of these chemicals and cause adverse effects to water quality. Every effort should be made to identify alternative methods of pest control.

7. Riparian buffer widths meet or exceed the minimum regulations of the guidelines established by the North Carolina Forestry Best Management Practices (BMP) Manual and comply with the statewide mandatory Forest Practices Guidelines Related to Water Quality.

8. All riparian buffers will be clearly marked (flagged, painted, or signed) on the ground prior to commencing any active forestry management measures adjacent to them so that operators can easily see them.

9. A written pre-harvest plan map be developed prior to any timber harvesting activity scheduled on the property. At a minimum, the pre-harvest map will locate streams, designate riparian forest buffers, designate aesthetic buffers, show road access and layout, show access need for stream crossings, and designate possible deck locations.

10. All riparian forest buffers will be clearly delineated on all maps and addressed in all forestry related contracts.

11. Riparian forest buffers only be crossed when access cannot reasonably be gained any other way. Any required stream crossings will be developed in a manner that meets or exceeds applicable Best Management Practices for stream crossings and mandatory Forest Practices Guidelines Related to Water Quality. If required, the stream crossing should only be done with portable temporary bridge mats. These have proven to have the least impact on streams.

12. The North Carolina Forest Service work cooperatively with OWASA by conducting regular on-site inspections while any forestry operations are undertaken at the property to evaluate any site-specific issues related to proper use of Forestry Best

Management Practices and compliance with NC Forest Practices Guidelines Related to Water Quality.

13. Riparian forest buffers be inspected regularly by ground or by air to evaluate forest health, identify possible insect or disease problems, and insure adequate buffer protection.

By following these recommendations, riparian areas should restrain visible sediment and maintain water quality of nearby streams and water bodies. .

Where Caterpillar Creek empties into the Cane Creek Reservoir

MANAGEMENT UNIT NCLWF

DESCRIPTION

Acres (Map Color): 20 (Blue Striped)

Landcover Type: North Carolina Land and Water Fund (NCLWF) Buffer

Dominant Species Present: Yellow poplar, sweetgum, loblolly pine, hickory, black green ash, walnut, American beech, hackberry, willow oak, and white and red oak.

Understory Species: Sweetgum, red maple, boxelder, dogwood, green ash, eastern hophornbeam, and American hornbeam.

Age: 20 to 60 years

Size: 8 to 18 inches in diameter (DBH)

Stocking: Adequate to overstocked

Quality: Fair to good

Growth Rate: Excellent

Soil/Water: Tarrus silt loam (TaD), Chewacla (Ch), Georgeville silt loam (GeB & GeC) and Herndon silt loam (HrC & HrC). Well drained to somewhat poorly drained. See Custom Soils Report for detailed location and description of soil types.

Topography: 0 to 15 percent slopes

Management Unit History: This Management Unit represents the area protected under a NCLWF conservation easement. A small portion of this NCLWF buffer used to include part of the pine plantation (A2) that was established in 2002.

RECOMMENDATIONS (Management Unit NCLWF)

Leave to grow. This Management Unit has a restrictive conservation easement on it held by the NCLWF. No harvesting of timber or agricultural use is allowed within this area. The perpetual easement should be referenced in all future forest management contracts and designated on all maps as a “NCLWF Buffer - No entry” area. Because the easement is restrictive, there are only a few activities that can happen within its bounds. For example,

selective timber harvesting cannot be done for stand improvement, but can be done for fire containment and control, disease control, restoration of hydrology, and/or control of non-native plants, but with prior approval of the Fund. The NCLWF should be contacted before considering any activity within this easement buffer to see if it is allowed or permitted under the easement language. In addition, the easement cannot be crossed for timber removal, as the easement prohibits commercial or industrial activity and all right of passage for such purpose. This restrictive buffer is in two blocks on the far western boundary of the property and is adjacent to a riparian forest buffer, so it will be well protected from any planned management activities. Improved signage along this buffer would help with identifying the border of this easement. This will probably require a surveyor to locate the boundary of this easement and would be imperative should OWASA decide to take on any management activities within the non-easement area adjacent to it.

NCLWF signage

MANAGEMENT UNIT E

DESCRIPTION

Acres (Map Color): 8.5 (Red)

Landcover Type: Overgrown Field

Dominant Species Present: Loblolly pine, Virginia pine, Tree-of-Heaven (invasive), red cedar, white oak, Autumn olive (invasive) and sweetgum.

Understory Species: Native grasses, red maple, blackgum, sourwood, sweetgum, and blackberry.

Age (Established): 17 years old (2004)

Size: 1-8" in diameter

Stocking: Understocked

Quality: Poor

Growth Rate: Good

Soil/Water: Mostly Herndon silt loam (HrB & HrC). Well drained. For detailed description and location of soil types see the Custom Soils Report.

Topography: 0 to 3 percent slopes

Management Unit History: This Management Unit represents an abandoned field that has been allowed to grow up. It was bush hogged up until 2004 and then was halted after OWASA purchased the property.

RECOMMENDATIONS (Management Unit E)

OWASA has two options for this Management Unit.

Option 1: Leave to grow and allow it to continue to naturally regenerate in a mixed hardwood/pine forest. Consider some invasive non-native species control targeting Tree-of-Heaven and Autumn olive. Include this area in future prescribed burning of adjacent stands (Mgt. Unit A1).

Options 2: Restore to shortleaf pine. This would require a mulching machine to mulch up the existing trees or have the trees push into piles and burned to clear the site. Prior to planting the site prepared area would be treated with a selective herbicide to control weeds and hardwood sprouts. Following treatment, the site would be planted in shortleaf pine seedlings.

Management Unit E

Forest Management Schedule (Management Unit E)

Acres	Option 1: Leave to Grow Control Invasives	Option 2: Site Prepare Site - Mulch or Doze	Option 2: Herbicide Treatment	Option 2: Plant Shortleaf Pine
8.5	2023-25	2023-25	2023-26	2024-28

Teer West Forest Stewardship Plan and OWASA's Forest Stewardship Program

The focus of OWASA's forest management plans is to provide the proper care of their forests so they stay healthy and vigorous and continue to provide them with the benefits of a well-managed forest. Each plan developed must be consistent with the established objectives and guiding principles they developed for their Forest Management Program. This plan is a prioritization of actions that should be undertaken to make that happen. OWASA wants to be good stewards of the forests under their care. They want to leave a positive legacy for the next generation and contribute to a more sustainable community. They understand that our forests are high value assets, and not just in terms of dollars and forest products. Connecting those values to timber harvesting is a leap for many people, but what we have come to appreciate, is that forestry practices, if done in a sustainable and in an ecological way, will not only protect, but will enhance almost all other values. We understand that forest management requires deliberate human intervention ranging from actions aimed at safeguarding and maintaining the forest ecosystem and functions, to favoring specific socially or economically valuable species or groups of species for improved production of goods and services. But, as good stewards, and under the guidance of experts in natural resources management, OWASA wants to use their forests in a way, and at a rate, that conserves biological diversity, maintains the productive capacity of our forest ecosystems, maintains forest health and vitality, conserves soil and water resources, improves access and that does not cause damage to other ecosystems. Sustainable forest management principles will guide them and will help to ensure that the values they derive from our forests now will not be compromised in the future.

Here is a summary of how their objectives and guiding principles have been applied:

Soil and Water Protection:

The protection and enhancement of soils is an important part of forest management and OWASA's highest ownership objective. This is especially critical during harvest operations when construction or disturbance of roads, skid trails and decks will cause the removal of the protective litter layer and expose the soil to the direct impact of rain. If poorly planned and the implementation of BMP's are ignored, these access features will accelerate soil erosion – the detachment, transport and deposition of soil particles. However, proper planning of road and trail locations and implementation of BMPs will reduce erosion rates. Research examining BMPs recommended in the NC BMP manual are known to be compatible with water quality protection.

Planning will be the key to minimize these impacts. Much of that will be done during the pre-harvest planning designed to eliminate or minimize soil disturbance and water quality impacts. We will include practices in our management to eliminate, or at least minimize, these impacts on site productivity and water quality. We will follow or exceed Best

Management Practice (BMP's) and comply with North Carolina's Forest Practices Guidelines Related to Water Quality.

Maintenance of these BMP's will also be important. For example, sediments deposited in road turnouts will need to be removed when nearing the capture capacity, Eroded sections of the road will need to be reshaped and stabilized. Mowing of roads will need to be done annually to maintain our vegetative cover (grasses) and prevent them from growing up in trees. Additional gravel may need to be put down during active logging to protect roads and crossings from logging traffic.

Forest Practices Guidelines Related to Water Quality:

All the forestry site disturbance activities on-site will have to comply with Forest Practices Guidelines Related to Water Quality. FPG's are a set of nine performance standards that must be followed on all forestry activities to maintain the forestry exemption under the NC Sedimentation Pollution Control Act. Failure to follow these performance standards will result in a referral to the appropriate enforcement agency. As OWASA's forestry consultants, we will design and implement practices to follow FPG's. Since most of the performance standards are related to stream protection, our aggressive Riparian Forest Buffer design should all but eliminate any risk of not meeting performance standards.

Forestry Best Management Practices (BMP's):

Forestry BMP recommendations are effective and practicable means of preventing or reducing nonpoint source pollutants to a level compatible with water quality goals. The BMP manual provides practical, effective and economically feasible recommendations aimed at protecting water quality. Most of the recommendations were developed based on research evaluations and experience from practicing professional foresters. The BMP Manual is available on the NC Forest Service website at:

https://www.ncforestservice.gov/water_quality/**bmp_manual**.htm

The manual was written by NC Forest Service staff with support from the NC Forestry Technical Advisory Committee. Implementing recommendations with this manual will help us find solutions to water quality issues that we need to address during the harvesting and reforestation of the property. For example, the manual should be helpful in designing and communicating proper forest road construction, stabilization, and maintenance. Another helpful guide from the USFS is their publication "Environmentally Sensitive Maintenance Practices for Dirt and Gravel Roads". It is available at:

http://www.fs.fed.us/t-d/pubs/pdf/11771802.pdf

Healthy Forests are Critical to Our Water Quality:

Clean, safe, and sustainable water resources are essential to a healthy economy, environment, and quality of life. Healthy, well-managed forests are critical in securing clean, affordable drinking water for our future. Through the Southern Group of State Foresters, a series of seven short high-quality videos were created to highlight healthy forests as critical to the future of our drinking water. Topics covered in these videos include connection between forests and water, the importance of source water protection, and the forest landowner and water utility roles in protecting water quality. These videos can be viewed on YouTube linked at:

https://www.youtube.com/playlist?list=PLjo3SIjzmracxvVEeyBIm_pBcXLhxLP50

Forest Roads:

Research and experience have shown that the mere cutting of trees is not the cause of erosion damage in the forest. The potential erosion in the forest is from the roads and skid trails used to remove the forest products. Poorly planned and installed roads can contribute to tremendous amounts of sediment and debris into nearby streams.

Forest road seeded with switch grass at OWASA's Cane Creek Mitigation Property

It will be important to plan road systems that can provide efficient access throughout the property without creating chronic sources of sediment. Unfortunately, there are no inexpensive “shortcuts” when building roads. It will require enough funds, especially during active logging, to build and maintain a good road.

The following are a set of recommendations for control of erosion on OWASA’s roads:

1. Avoid logging during wet seasons or wet periods.
2. Avoid the need for any stream crossings.
3. Keep skid trails and haul roads on grades of less than 10%; with steeper grades not exceeding 200 feet in length.
4. Utilize a bulldozer instead of a skidder to construct roads.
5. Gravel areas where soil types or wet conditions prevent proper drainage or poor traction.
6. Design roads to divert runoff in manageable increments. Ensure that the runoff is captured in a stable area.
7. Allow for proper drainage of rain off road into vegetated areas. Install water diversion ditches on steeper sections of the road to divert water off the road and into protected areas.
8. Remove overstory trees adjacent to main haul roads to remove heavy shade to “day light” roads. Increased sunlight to roads will help to dry them more quickly following wet periods.
9. Inspect the roads frequently during logging to ensure drainage structures are maintained.
10. Upon completion of logging, stabilize and seed all roads, main skid trails, and deck sites.

Possible Adverse Impacts to Neighbors:

Another one of OWASA’s land objectives is to mitigate any adverse impacts to neighbors or surrounding communities. There appears to be at least six occupied homes on Flat Rock Road, Bradshaw Quarry Road and Mebane Oaks Road. There is also a shared driveway off Mebane Oaks Road that has one home on it.

The proposed pine thinnings should have no negative visual impact and will improve the overall appearance of the woods following thinning. No aesthetic buffers are necessary on the thinning areas that are along Flat Rock Road. There are small final harvest areas scattered throughout the farm, but they are interior and will not be visible by any occupied residences.

No access is required through other properties, except possibly on the south side of the property off Flat Rock Road. If necessary, we would require a formal access agreement to utilize this road to thin Mgt. A3 and harvest Mgt. Unit B3. The property has direct access from Flat Rock Road, but there are no existing road entrances. We recommend that the

entrances be built prior to any timber sale and that at least one load of gravel be put down at the main entrance to Flat Rock Road to avoid tracking dirt onto the highway. The dirt driveway off Mebane Oaks Road will probably require graveling and/or re-graveling following the thinning plan for that side of the farm.

One negative impact to neighbors may be logging equipment noise and the temporary added traffic on Flat Rock Road and Mebane Oaks Road. Based on an estimate of volume to remove during thinning and harvesting operation the logging operation should not last more than two months with good weather.

There is prescribed burning planned for this property in the future. Burning, especially smoke created from the burning can have a temporary adverse impact on neighbors, if not planned properly. Burn plans will be developed prior to the burn to identify the most ideal burning conditions to achieve objectives the burn, identify fire lines needed to properly contain the fire, and how to best manage and direct the smoke created from the burn. The notification of neighbors about the burn will also be part of the planning process.

OWASA staff will meet with neighbors to share the draft of this plan and listen to concerns, and where applicable, developed measures or conditions to mitigate those concerns.

Improving Wildlife Habitat and Species Diversity:

OWASA's wildlife objective is to enhance forest conditions for wildlife health and species diversity and abundance by creating a forest of diverse habitat types and conditions. Active forest management will improve wildlife habitat by creating early successional habitat, increase age diversity, promote wildlife friendly oak-hickory forests, maintain undisturbed riparian corridors, and increase the amount of understory herbaceous plants and grasses for cover and browse.

Some management activities designed to benefit wildlife habitat and diversity on this property include:

- Thinning pine and hardwood woods will allow more sunlight to reach the forest floor, which will promote more herbaceous and native species in the understory for cover and food sources for wildlife.

- Harvesting stands and small group openings will promote more age diversity and provide more diverse habitat types and conditions.

- Promoting the development and maintenance of mature oak/hickory forests that provide acorns/nuts which are a critical winter food source for deer, turkey, and squirrels.

- Conducting understory burns to manipulate understory vegetation to be more beneficial to wildlife.

- Maintaining soft mast species in the understory and midstory for food sources for songbirds and wildlife.

- Creating and protecting riparian forest buffers to accommodate and enhance habitat for terrestrial and aquatic wildlife.

- Creating wider than typical riparian forest buffers to create an undisturbed travel corridor wide enough to accommodate wildlife such as deer and migratory songbirds.

- Protecting riparian and wetland areas for amphibians and reptiles.

- Establishing native grasses along roadways and in logging decks will provide cover and nesting areas for songbirds and wild turkey, and escape cover for small mammals.

- Maintaining and creating dead snags will provide bugging habitats for songbirds and woodpeckers, roosting locations for turkey, and homes for cavity-dwelling wildlife like raccoons and owls.

Improving Ecological Health of Forested Land:

True North has recommended thinning the upland forests to help maintain their vitality and vigor. Maintaining forest vitality and vigor will make OWASA's forests less vulnerable to insect infestation and disease impacts. By thinning we will reduce crowding and redistribute the growth potential to the most desirable trees on site and improve the overall health, vigor, and growth of the remaining stand. By thinning we are also able to avoid some of the potential mortality by harvesting selected trees. By removing or controlling invasive species, where practical, we help improve the growing conditions of native plants and vegetation. By conducting Femelschlag harvests we will help to maintain and restore native oak-hickory forests.

Reduce the Risk of Wildfires:

By creating fire breaks, thinning dense stands, and conducting understory burns we will reduce the excessive accumulated forest fuel present and reduce the risk of uncontrolled wildfires.

Sustainably Manage OWASA's Resources:

Income from timber harvests can be used to pay for stewardship activities on the property such as boundary line maintenance, understory burning, invasive species control, tree planting, fire breaks, road development and road maintenance.

Engage the Community and Partner Agencies:

We will invite partner agencies to review the draft of this forest stewardship plan and plan to incorporate their comments into this forest stewardship plan. We recognize that our partners provide expertise in managing lands for different purposes. For all forest stewardship plans we will request their expert guidance as we develop and implement our plans; partner with them to use our land for demonstration, education, and training opportunities; and work with them to evaluate the ecological and cultural resources on our land and to study and document the outcomes of our forest management program.

We will protect important natural heritage areas identified by the North Carolina Natural Heritage Program (NHP) and work with NHP to register them or protect them through conservation easements or NHP registry agreements where appropriate. We will also work closely with the NC Wildlife Resources Commission and NC Audubon to perform before and after species surveys where they deem the surveys an effective use of their staff time.

We will share information with neighboring landowners, the public, and others about why and how we manage our forest land. We will do this through a variety of methods that may include meetings, tours, website updates, and email. We will also provide meaningful and varied opportunities for the community to provide feedback on our Forest Management Program, our Forest Stewardship Plans, and the implementation of those plans.

We have tried to develop a management proposal that reflects a multiple-use approach to ensure several different objectives can be achieved simultaneously. Our intent is to create a mosaic of interconnected management units that are bound by good land stewardship. By adhering to this management philosophy, the land should become more productive, and OWASA's objectives can be successfully met. This plan will have to be adaptive. Through periodic review and evaluation of our work we will revise the plan as necessary to ensure our objectives are being met and will continue to be met.

Submitted by:

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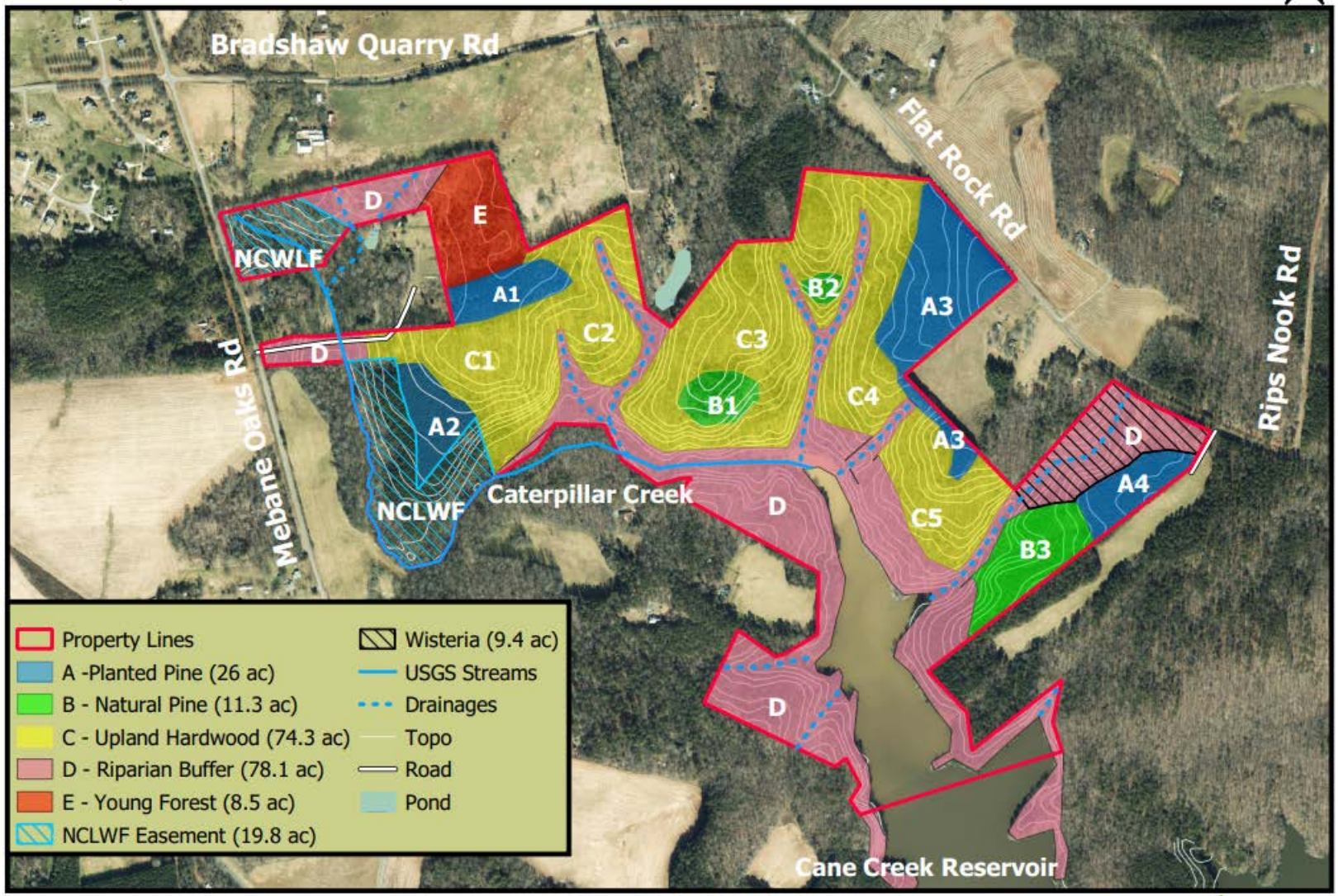
OWASA- Teer West
Orange County
35.964752,-79.259210

Teer West Division-218 Acres



0 750 1,500 2,250 ft

Created By: Ben Maness
Created: 11/15/21
Aerial Date: 2017

TRUE NORTH
FOREST MANAGEMENT SERVICES

SUGGESTED SCHEDULE OF FOREST MANAGEMENT ACTIVITIES

TEER WEST PROPERTY
Orange County
(As of January 2023

W: Winter S: Spring U: Summer F: Fall

Year	Season	Acres	Mgt Unit	Activity*	Accomplished
2023-24	U-F			Build entrances and access roads. Gravel entrances	
2023-24		218		Repaint property lines and install NCLWF signs	
2023-25	S-F	26	A	Conduct first thin	
2023-25	S-F	11	B	Final regenerative harvest	
2023-25	S-F	12	C2-C5	Mark and harvest Period 1 Femelschlag Gap Openings	
2023-24	S-F	14	C1	Mark and conduct Poplar Seed Tree Harvest	
2022-25	S-F	8	E	Site prepare and replant in shortleaf pine* or LTG	
2024-25	S-F	11	B	Site prepare and replant in shortleaf or loblolly pine*	
2023-28	S-F	218	A-E	Invasive species control*	
2030-32	F-W	26	C1 + gaps	Crop Tree Release Period 1 gaps and seed tree harvests*	
2033-36	S-F	26	A	Conduct second marked thinning	
2033		218	A-E	Update Forest Stewardship Plan	
2038-39	S-F	12	C (gaps)	Mark and harvest Period 2 Femelschlag Gap Openings	
2048-58	F-W	12	C (gaps)	Crop Tree Release Period 2 openings	
2053-54	S-F	12	C (gaps)	Crop Tree Release Period 3 gaps*	
2063-73	F-W	12	C (gaps)	Crop Tree Release Period 3 openings	

***A financial incentive program may cover the activities starred above. Please contact the North Carolina Forest Service for specific advice and availability of cost-share funds. Once approved contact NCFS before starting practices so they can check for cost-share compliance.**

This schedule may need to be adjusted depending on financial needs, timber markets, timing of actual harvest, and availability of contractors.

Understory Burning Schedule
(As of January 2023)

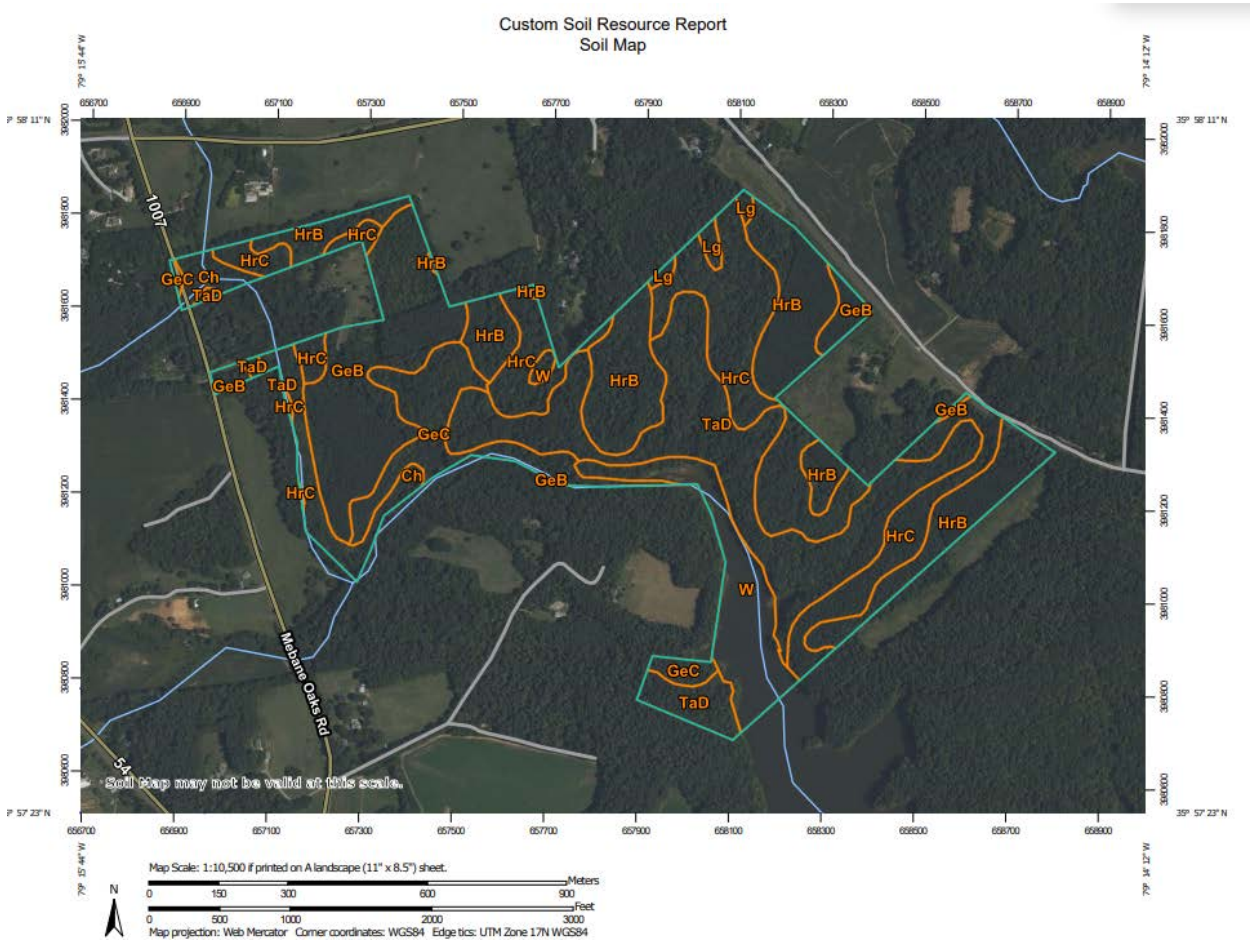
W: Winter S: Spring U: Summer F: Fall

Year	Season	Acres	Mgt. Unit	Activity*
2025-26	F-W	26	A	Cool season burn*
2028-29	F-W	26	A	Cool season burn*
2031-33	S	12+	C + gaps	Growing season burn*
2035-36	F-W	26	A	Cool season burn*
2038-39	F-W	26	A	Cool season burn*
2044-46	S	12+	C + gaps	Growing season burn*

***A financial incentive program may cover the activities starred above. Please contact the North Carolina Forest Service for specific advice and availability of cost-share funds. Once approved contact NCFS before starting practices so they can check for cost-share compliance.**

This schedule may need to be adjusted depending on financial needs, timber markets, timing of actual harvest, and availability of contractors.

SOILS



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ch	Chewacla loam, 0 to 2 percent slopes, frequently flooded	10.1	4.8%
GeB	Georgeville silt loam, 2 to 6 percent slopes	30.3	14.5%
GeC	Georgeville silt loam, 6 to 10 percent slopes	15.5	7.5%
HrB	Herndon silt loam, 2 to 6 percent slopes	42.8	20.6%
HrC	Herndon silt loam, 6 to 10 percent slopes	46.0	22.1%
Lg	Lignum silt loam, 0 to 3 percent slopes	1.7	0.8%
TaD	Tarrus silt loam, 8 to 15 percent slopes	46.0	22.1%
W	Water	16.0	7.7%
Totals for Area of Interest		**208.3**	**100.0%**

Forest Preharvest Planning

Detailed Soils Report

Common Harvest Activity	Most Favorable Rating	Most Favorable Soil Map Unit(s)	BMP Awareness
Construction Limitations for Haul Roads and Log Landings	Moderate	Lg: Lignum silt loam, 0 to 3 percent slopes; GeB: Georgeville silt loam, 2 to 6 percent slopes; GeC: Georgeville silt loam, 6 to 10 percent slopes; HrB: Herndon silt loam, 2 to 6 percent slopes; HrC: Herndon silt loam, 6 to 10 percent slopes; TaD: Tarrus silt loam, 8 to 15 percent slopes; TaE: Tarrus silt loam, 15 to 25 percent slopes	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Harvest Equipment Operability	Moderately Suited	Lg: Lignum silt loam, 0 to 3 percent slopes; GeB: Georgeville silt loam, 2 to 6 percent slopes; GeC: Georgeville silt loam, 6 to 10 percent slopes; HrB: Herndon silt loam, 2 to 6 percent slopes; HrC: Herndon silt loam, 6 to 10 percent slopes; TaD: Tarrus silt loam, 8 to 15 percent slopes; TaE: Tarrus silt loam, 15 to 25 percent slopes; Ch: Chewacla loam, 0 to 2 percent slopes, frequently flooded	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Erosion Hazard: Off-Road Off-Trail	Slight	Lg: Lignum silt loam, 0 to 3 percent slopes; GeB: Georgeville silt loam, 2 to 6 percent slopes; GeC: Georgeville silt loam, 6 to 10 percent slopes; HrB: Herndon silt loam, 2 to 6 percent slopes; HrC: Herndon silt loam, 6 to 10 percent slopes; Ch: Chewacla loam, 0 to 2 percent slopes, frequently flooded	Follow BMP's. Minimize Area of Disturbed Soils.
Erosion Hazard: Road/Trail	Slight	Lg: Lignum silt loam, 0 to 3 percent slopes; Ch: Chewacla loam, 0 to 2 percent slopes, frequently flooded	Follow BMPs. Minimize Area of Disturbed Soils. Apply Slash/Laps on Skid Trails. Keep Grade Below 10% Where Possible.
Soil Rutting Hazard	Severe	Lg: Lignum silt loam, 0 to 3 percent slopes; GeB: Georgeville silt loam, 2 to 6 percent slopes; GeC: Georgeville silt loam, 6 to 10 percent slopes; HrB: Herndon silt loam, 2 to 6 percent slopes; HrC: Herndon silt loam, 6 to 10 percent slopes; TaD: Tarrus silt loam, 8 to 15 percent slopes; TaE: Tarrus silt loam, 15 to 25 percent slopes; Ch: Chewacla loam, 0 to 2 percent slopes, frequently flooded	Have a Back-Up Plan for When to Stop Logging. Only Use Logging Equipment and Methods Suited for the Site Conditions: Low-Ground-Pressure, High Lead, Shovel Logging are examples.
Suitability for Log Landings	Moderately Suited	Lg: Lignum silt loam, 0 to 3 percent slopes; GeB: Georgeville silt loam, 2 to 6 percent slopes; GeC: Georgeville silt loam, 6 to 10 percent slopes; HrB: Herndon silt loam, 2 to 6 percent slopes; HrC: Herndon silt loam, 6 to 10 percent slopes; TaD: Tarrus silt loam, 8 to 15 percent slopes	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Suitability for Roads on Natural Surface	Moderately Suited	Lg: Lignum silt loam, 0 to 3 percent slopes; GeB: Georgeville silt loam, 2 to 6 percent slopes; GeC: Georgeville silt loam, 6 to 10 percent slopes; HrB: Herndon silt loam, 2 to 6 percent slopes; HrC: Herndon silt loam, 6 to 10 percent slopes; TaD: Tarrus silt loam, 8 to 15 percent slopes	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly.Stay Away From Streams. Keep Grade Under 10%.

Forest Preharvest Planning

Detailed Soils Report

Mapunit Soil Characteristics and Ratings

Map Unit **Georgeville silt loam, 2 to 6 percent slopes** represents **13.3%** of the tract, and the dominant soil component of the Map Unit is **Georgeville** which makes up **90%** of the Map Unit.

Tract ID:	556661	Tract Name:	
Mapunit Symbol:	GeB	Drainage Class:	Well drained
Mapunit Name:	Georgeville silt loam, 2 to 6 percent slopes	Flooding Frequency:	None
		Horizon A (Surface):	Silt loam
Mapunit Major Component:	Georgeville	Horizon B (Sub-layer):	Silty clay loam
Taxonomic Class:	Fine, kaolinitic, thermic Typic Kanhapludults		
Frost Free Days:	215	Hydric Rating:	Nonhydric

Common Harvest Activity	Rating	BMP Awareness
Construction Limitations for Haul Roads and Log Landings	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Harvest Equipment Operability	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Erosion Hazard: Off-Road Off-Trail	Slight	Follow BMP's. Minimize Area of Disturbed Soils.
Erosion Hazard: Road/Trail	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Soil Rutting Hazard	Severe	Have a Back-Up Plan for When to Stop Logging. Only Use Logging Equipment and Methods Suited for the Site Conditions: Low-Ground-Pressure, High Lead, Shovel Logging are examples.
Suitability for Log Landings	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Suitability for Roads on Natural Surface	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly.Stay Away From Streams. Keep Grade Under 10%.

⚠ Soil conditions indicate additional planning or professional advice may be needed to ensure water quality is sufficiently protected during harvest operations. We recommend that you contact the N.C. Forest Service for technical assistance.

Forest Preharvest Planning

Detailed Soils Report

Mapunit Soil Characteristics and Ratings

Map Unit **Georgeville silt loam, 6 to 10 percent slopes** represents **11.9%** of the tract, and the dominant soil component of the Map Unit is **Georgeville** which makes up **90%** of the Map Unit.

Tract ID:	556661	Tract Name:	
Mapunit Symbol:	GeC	Drainage Class:	Well drained
Mapunit Name:	Georgeville silt loam, 6 to 10 percent slopes	Flooding Frequency:	None
		Horizon A (Surface):	Silt loam
Mapunit Major Component:	Georgeville	Horizon B (Sub-layer):	Clay
Taxonomic Class:	Fine, kaolinitic, thermic Typic Kanhapludults		
Frost Free Days:	215	Hydric Rating:	Nonhydric

Common Harvest Activity	Rating	BMP Awareness
Construction Limitations for Haul Roads and Log Landings	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Harvest Equipment Operability	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Erosion Hazard: Off-Road Off-Trail	Slight	Follow BMP's. Minimize Area of Disturbed Soils.
Erosion Hazard: Road/Trail	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Soil Rutting Hazard	Severe	Have a Back-Up Plan for When to Stop Logging. Only Use Logging Equipment and Methods Suited for the Site Conditions: Low-Ground-Pressure, High Lead, Shovel Logging are examples.
Suitability for Log Landings	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Suitability for Roads on Natural Surface	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly.Stay Away From Streams. Keep Grade Under 10%.

⚠ Soil conditions indicate additional planning or professional advice may be needed to ensure water quality is sufficiently protected during harvest operations. We recommend that you contact the N.C. Forest Service for technical assistance.

Forest Preharvest Planning

Detailed Soils Report

Mapunit Soil Characteristics and Ratings

Map Unit **Herndon silt loam, 2 to 6 percent slopes** represents **20.4%** of the tract, and the dominant soil component of the Map Unit is **Herndon** which makes up **90%** of the Map Unit.

Tract ID:	556661	Tract Name:	
Mapunit Symbol:	HrB	Drainage Class:	Well drained
Mapunit Name:	Herndon silt loam, 2 to 6 percent slopes	Flooding Frequency:	None
		Horizon A (Surface):	Silt loam
Mapunit Major Component:	Herndon	Horizon B (Sub-layer):	Silty clay loam
Taxonomic Class:	Fine, kaolinitic, thermic Typic Kanhapludults		
Frost Free Days:	225	Hydric Rating:	Nonhydric

Common Harvest Activity	Rating	BMP Awareness
Construction Limitations for Haul Roads and Log Landings	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Harvest Equipment Operability	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Erosion Hazard: Off-Road Off-Trail	Slight	Follow BMP's. Minimize Area of Disturbed Soils.
Erosion Hazard: Road/Trail	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Soil Rutting Hazard	Severe	Have a Back-Up Plan for When to Stop Logging. Only Use Logging Equipment and Methods Suited for the Site Conditions: Low-Ground-Pressure, High Lead, Shovel Logging are examples.
Suitability for Log Landings	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Suitability for Roads on Natural Surface	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly.Stay Away From Streams. Keep Grade Under 10%.

⚠ Soil conditions indicate additional planning or professional advice may be needed to ensure water quality is sufficiently protected during harvest operations. We recommend that you contact the N.C. Forest Service for technical assistance.

Forest Preharvest Planning

Detailed Soils Report

Mapunit Soil Characteristics and Ratings

Map Unit **Herndon silt loam, 6 to 10 percent slopes** represents **20.8%** of the tract, and the dominant soil component of the Map Unit is **Herndon** which makes up **80%** of the Map Unit.

Tract ID:	556661	Tract Name:	
Mapunit Symbol:	HrC	Drainage Class:	Well drained
Mapunit Name:	Herndon silt loam, 6 to 10 percent slopes	Flooding Frequency:	None
		Horizon A (Surface):	Silt loam
Mapunit Major Component:	Herndon	Horizon B (Sub-layer):	Silty clay loam
Taxonomic Class:	Fine, kaolinitic, thermic Typic Kanhapludults		
Frost Free Days:	215	Hydric Rating:	Nonhydric

Common Harvest Activity	Rating	BMP Awareness
Construction Limitations for Haul Roads and Log Landings	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Harvest Equipment Operability	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Erosion Hazard: Off-Road Off-Trail	Slight	Follow BMP's. Minimize Area of Disturbed Soils.
Erosion Hazard: Road/Trail	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Soil Rutting Hazard	Severe	Have a Back-Up Plan for When to Stop Logging. Only Use Logging Equipment and Methods Suited for the Site Conditions: Low-Ground-Pressure, High Lead, Shovel Logging are examples.
Suitability for Log Landings	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Suitability for Roads on Natural Surface	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly.Stay Away From Streams. Keep Grade Under 10%.

⚠ Soil conditions indicate additional planning or professional advice may be needed to ensure water quality is sufficiently protected during harvest operations. We recommend that you contact the N.C. Forest Service for technical assistance.

Forest Preharvest Planning

Detailed Soils Report

Mapunit Soil Characteristics and Ratings

Map Unit **Tarrus silt loam, 8 to 15 percent slopes** represents **25.0%** of the tract, and the dominant soil component of the Map Unit is **Tarrus** which makes up **75%** of the Map Unit.

Tract ID:	556661	Tract Name:	
Mapunit Symbol:	TaD	Drainage Class:	Well drained
Mapunit Name:	Tarrus silt loam, 8 to 15 percent slopes	Flooding Frequency:	None
		Horizon A (Surface):	Silt loam
Mapunit Major Component:	Tarrus	Horizon B (Sub-layer):	Clay loam
Taxonomic Class:	Fine, kaolinitic, thermic Typic Kanhapludults		
Frost Free Days:	215	Hydric Rating:	Nonhydric

Common Harvest Activity	Rating	BMP Awareness
Construction Limitations for Haul Roads and Log Landings	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Keep Grade Below 10% Where Possible.
Harvest Equipment Operability	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Erosion Hazard: Off-Road Off-Trail	Moderate	Additional BMP Installation, Monitoring, and Maintenance May Be Needed. Keep Grade Below 10% Where Possible.
Erosion Hazard: Road/Trail	Severe	Additional BMP Installation, Monitoring, and Maintenance Are Expected - Plan Accordingly. Higher Risk and Costs Are Possible. Engineering Expertise May Be Needed. Keep Grade Below 10% Where Possible. Where Possible, Cover Bare Soil With Slash/Laps During Operations. Establish Groundcover Immediately As Needed.
Soil Rutting Hazard	Severe	Have a Back-Up Plan for When to Stop Logging. Only Use Logging Equipment and Methods Suited for the Site Conditions: Low-Ground-Pressure, High Lead, Shovel Logging are examples.
Suitability for Log Landings	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Suitability for Roads on Natural Surface	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly.Stay Away From Streams. Keep Grade Under 10%.

⚠ Soil conditions indicate additional planning or professional advice may be needed to ensure water quality is sufficiently protected during harvest operations. We recommend that you contact the N.C. Forest Service for technical assistance.

Forest Preharvest Planning

Detailed Soils Report

Mapunit Soil Characteristics and Ratings

Map Unit **Chewacla loam, 0 to 2 percent slopes, frequently flooded** represents **7.4%** of the tract, and the dominant soil component of the Map Unit is **Chewacla** which makes up **90%** of the Map Unit.

Tract ID:	556661	Tract Name:	
Mapunit Symbol:	Ch	Drainage Class:	Somewhat poorly drained
Mapunit Name:	Chewacla loam, 0 to 2 percent slopes, frequently flooded	Flooding Frequency:	Frequent
		Horizon A (Surface):	Loam
Mapunit Major Component:	Chewacla	Horizon B (Sub-layer):	Sandy clay loam
Taxonomic Class:	Fine-loamy, mixed, active, thermic Fluvaquentic Dystrudepts		
Frost Free Days:	225	Hydric Rating:	Predominantly Nonhydric

Common Harvest Activity	Rating	BMP Awareness
Construction Limitations for Haul Roads and Log Landings	Severe	Additional BMP Installation, Monitoring, and Maintenance Are Expected - Plan Accordingly. Higher Risk and Costs Are Possible. Engineering Expertise May Be Needed. Keep Grade Below 10% Where Possible. Where Possible, Cover Bare Soil With Slash/Laps During Operations. Establish Groundcover Immediately As Needed.
Harvest Equipment Operability	Moderately suited	Extra BMP Installation, Monitoring, and Maintenance Are Needed. Install BMPs to Divert Runoff and Catch Sediment. Stabilize Bare Soil Promptly. Stay Away From Streams. Keep Grade Under 10%.
Erosion Hazard: Off-Road Off-Trail	Slight	Follow BMP's. Minimize Area of Disturbed Soils.
Erosion Hazard: Road/Trail	Slight	Follow BMPs. Minimize Area of Disturbed Soils. Apply Slash/Laps on Skid Trails. Keep Grade Below 10% Where Possible.
Soil Rutting Hazard	Severe	Have a Back-Up Plan for When to Stop Logging. Only Use Logging Equipment and Methods Suited for the Site Conditions: Low-Ground-Pressure, High Lead, Shovel Logging are examples.
Suitability for Log Landings	Poorly suited	Additional BMP Installation, Monitoring, and Maintenance Are Expected - Plan Accordingly. Higher Risk and Costs Are Possible. Engineering Expertise May Be Needed. Keep Grade Below 10% Where Possible.
Suitability for Roads on Natural Surface	Poorly suited	Additional BMP Installation, Monitoring, and Maintenance Are Expected - Plan Accordingly. Higher Risk and Costs Are Possible. Engineering Expertise May Be Needed. Keep Grade Below 10% Where Possible.

⚠ Soil conditions indicate additional planning or professional advice may be needed to ensure water quality is sufficiently protected during harvest operations. We recommend that you contact the N.C. Forest Service for technical assistance.