Orange Water & Sewer Authority
Meadow Crest North Property
Orange County, North Carolina

Forest Stewardship Plan
DRAFT

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FOREST STEWARDSHIP PLAN
FOR THE
ORANGE WATER & SEWER AUTHORITY (OWASA)
MEADOW CREST NORTH

400 Jones Ferry Road
Carrboro, North Carolina 27510

Phone: 919-537-4214

Examined by: David Halley, Registered Forester/ Certified Forester®.

Location: The property is located on the north side of Teer Road, approximately two miles west of Orange Grove Road and directly across the street from Meadow Crest Drive in Orange County, North Carolina.

Access: Access is excellent. The property is located right on Teer Road. There are several overgrown farm roads (see sketch map on page 14) that if improved would provide excellent access to the interior of the property for management activities and fire protection. These farm entrances are either blocked with metal stakes or cabled to restrict traffic.

Ownership Details: The Meadow Crest North Land is a ± 80-acre property owned by the Orange Water and Sewer Authority (OWASA). Most of the property was purchased in 1993 by OWASA. The title and plat map for the property is listed in the Register of Deeds office, Orange County Book 1160, Page 549 (PIN #: 9830832373, 9830836310, 9830838619, 9830931654, and 9830938695) under the name of Orange Water & Sewer Authority. The last parcel on this property was sold to OWASA in 2004 (PIN# 9830738457) and is listed in the Register of Deeds office, Orange County Book 3395, Page 32.

Special Conservation Easement: Five acres of the twenty acres designated as a riparian forest buffer, identified as Management Unit CWMTF, is protected through a conservation easement dedicated to the State of North Carolina by OWASA per terms of a Clean Water Management Trust Fund (CWMTF) grant agreement. An approximation of the CWMTF easement boundaries are designated on the accompanying sketch maps (Pages 16 & 17) and labeled as CWMTF. This easement is listed in the Register of Deeds office, Orange County Book 3469, Page 126.

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 80 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 six 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.

Management Unit D

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 your 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

Several maps (Page 13-17) of the property with general locations of each Management Unit are located at the beginning of the Forest Stewardship Plan. Please refer to the maps as you read the Plan. Also, located on pages 55-57 of the Plan is a "Suggested Schedule of Management Activities" which summarizes the recommendations for management and a timetable. Please understand that the timetable and management activities in this Plan is not "written in stone". Changing objectives, updated information, timber markets, and available resources will require flexibility in planning. This Plan is presented as a guide and should be reviewed and revised as warranted. Although the Plan scope covers projects beyond 10 years, this Plan should be reviewed and revised in 10 years (2030).

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 500 feet above sea level in main creek. This piedmont terrain is characterized by a series of broad ridges that generally run east to west and are divided by narrow drainages. These drainages flow into intermittent and perennial streams that eventually flow into Cane Creek Reservoir, just north 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 and is all part of the Cape Fear River Basin.

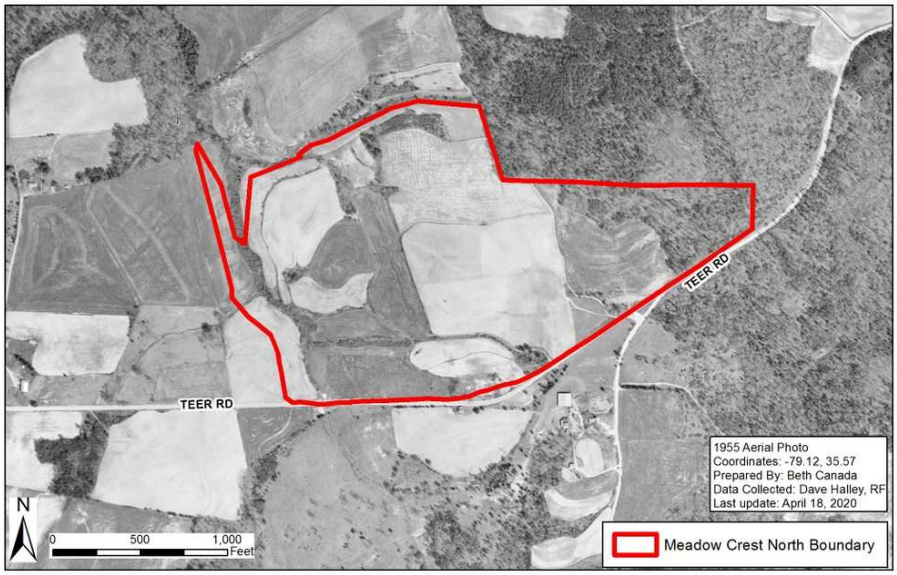
Cultural, Historical, and Archeological Resources: Portions of the property were once farmed, where the terrain and gentle slopes were most conducive to farming. Agricultural activities ceased on the property around the early 1990’s and the fields reverted to woodland. There are three historic woodlots that are located on the property and labeled as Historic Woodlots (HW) on the maps. The trees growing on these sites are much older than the rest of the property. There are no structures on these sites, but they may have been wooded areas where certain farming operations were carried out. We found one exceptionally large post oak (*Quercus stellata*) that measure 42 inches in diameter in one of these historic woodlots. There is also a grove of about 30 large loblolly pine trees in a small area near the road. Several of these older pines exceeded 25 inches in diameter and are near 70 years in age.

We recommend that a buffer be placed around these three historic woodlots. These areas should be protected during the timber harvesting activity adjacent to them. No active management is recommended to occur within these areas at this time. For each area, a buffer should be flagged around it and referred to it as a “no entry” area for timber harvest. This is to make sure harvesting equipment does not enter these buffers. In the older pine area, you might choose to do some light selective thinning to help improve the health and

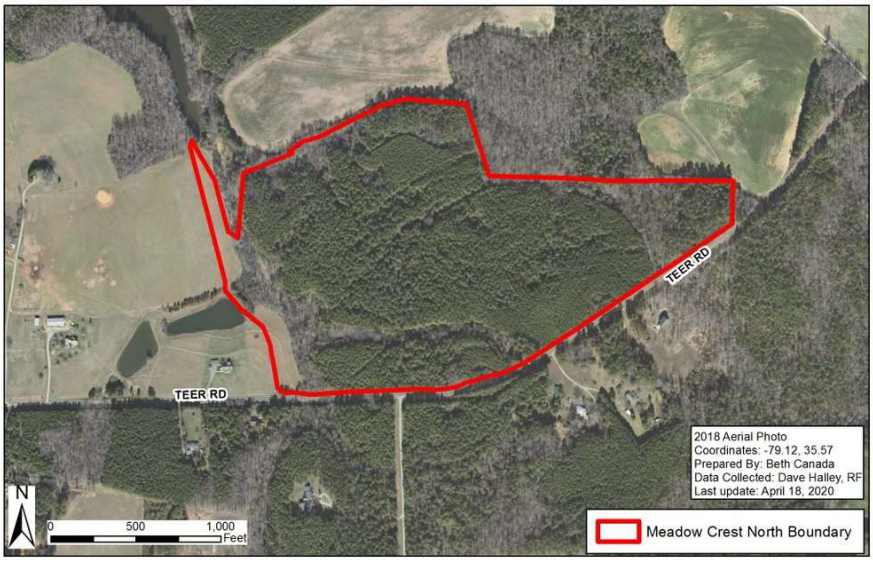
vigor of that older pine stand. Trees to be removed will be marked by True North prior to removal.

Here is a historic aerial photograph taken of the property in 1955 which compares it to a 2018 aerial photograph of the same property.

Meadow Crest North - 1955 Aerial Photo



Meadow Crest North - 2018 Aerial Photo



Threatened and Endangered 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. There are 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)*

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 buffer to avoid sedimentation from soil disturbance and pesticide applications from forestry operations that might occur near them.

The publication also lists Michaux's sumac (*Rhus michauxii*), small whorled pogonia (*Isotria medeoloides*), and smooth coneflower (*Echinacea laevigata*) as plant species of concern, threatened, or endangered; but their populations are historical, and no known populations currently exist in Orange County. 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 on the property or 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

Endangered mussel (Carolina Creekshell – *Villosa vaughaniana*) within two miles of property.

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). OWASA will continue to follow or exceed all applicable Best Management Practices related to Water Quality for North Carolina.

Forests of Recognized Importance: Based on American Forest Foundation criteria, there are no Forests of Recognized Importance (FORI) known to exist on the property. This 83-acre property provides critical watershed and erosion control protection for Cane Creek Reservoir, which is a main drinking supply for Carrboro and Chapel Hill.

Cane Creek Reservoir

Exotic, Invasive Species: Based on our field visits, OWASA does have some 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 continue to be a problem if not addressed. Other species we ran across, but not such large numbers or populations, were Japanese stilt grass (*Microstegium vinineum*), Tree-of-Heaven (*Alianthus altissima*), Chinese privet (*Ligustrum sinense*) and multi-floral rose (*Rosa multiflora*).

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 and 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).

Autumn olive (nonnative invasive) on property

Property Lines: The property lines on the property are well marked. The property lines are currently painted. Prior to any management activities these property lines should be refreshed with paint. It appears that an adjacent landowner is monitoring and posting his property lines with OWASA. We found sections of "purple" posted paint along the northern property line.

It is important that these property lines be repainted and maintained on a regular basis, every five to eight years. Defining these property lines has helped to establish the boundary between OWASA and their neighbors. It should also help to reduce 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.

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.

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 20 acres of buffer area for this property that should be protected, which includes riparian buffers along about 3,400 linear feet of perennial streams and 2,500 linear feet along intermittent stream channels. The riparian buffer widths will be a minimum of 50 feet; however, OWASA has voluntarily adopted a strategy of creating 150-foot buffers along perennial streams and 100-foot wide buffers along intermittent streams. **Riparian forest buffers have been designated for roughly 25% 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 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 Clean Water Management Trust Fund (CWMTF) during active forest management on areas near them. This property has five acres in a CWMTF conservation easement buffer and is shown on each of the management maps (Page 16 & 17).

2. Reduce the Risk of Wildfires

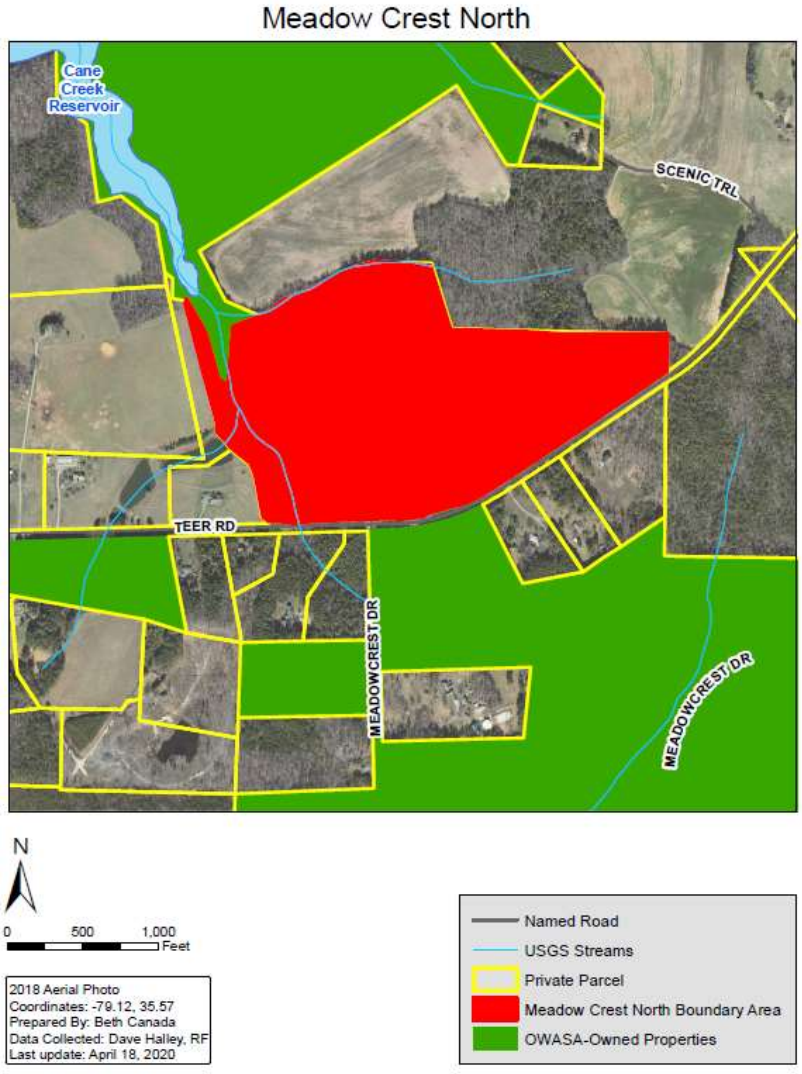
The Plan recommends the use of prescribed burning to reduce the risk of damaging wildfires, to aid in forest regeneration, and to improve the biological diversity and restoration on-site. These burning events will be carefully planned and tightly controlled by trained experts to significantly reduce the chance of fire spreading and to minimize the impacts from smoke. Controlled 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.

The network of 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. Also, where appropriate, hand dug lines or hand fire lines created with leaf-blowers and hand rakes, can help to minimize soil disturbance.

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:

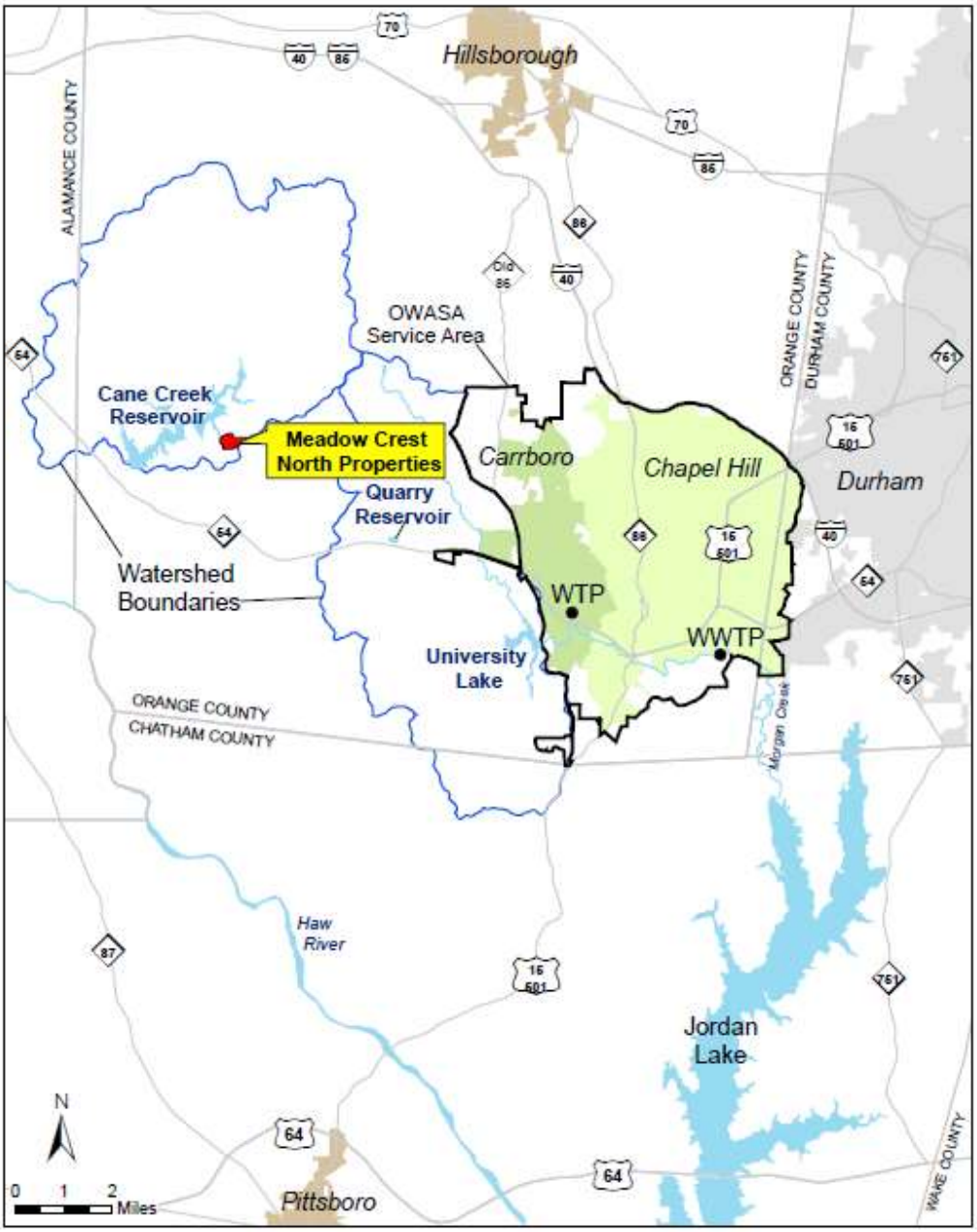
- To protect water quality, OWASA's highest priority.
- To improve ecological health of forested lands.
- To reduce the risk of wildfires.
- To improve wildlife habitat and species diversity.
- To sustainably manage OWASA's resources.
- To engage the community and partner organizations.
- To minimize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

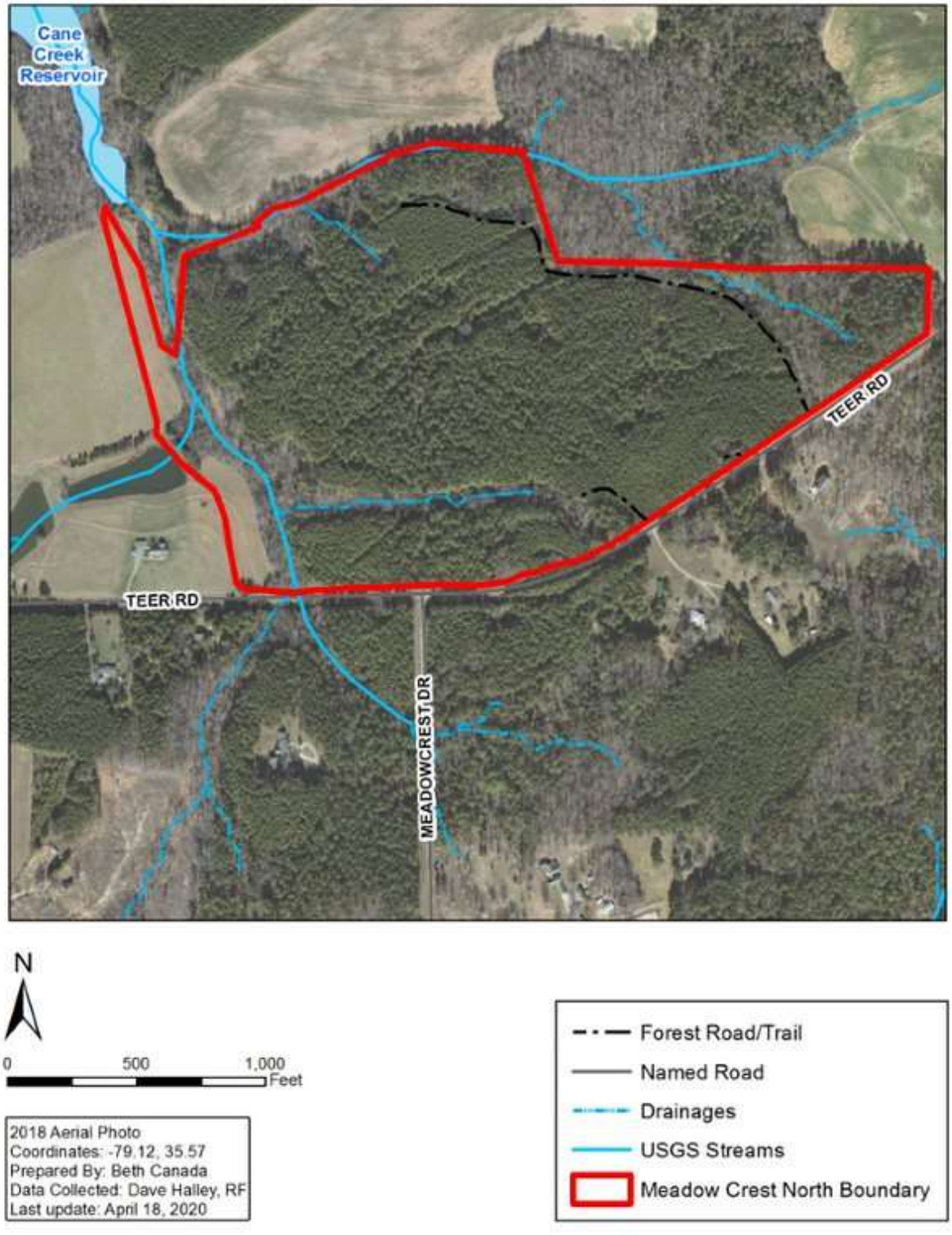
The OWASA Board of Directors approved a vision, guiding principles along with strategies for its Forest Management Program in September 2019. These can be found on their website at:

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

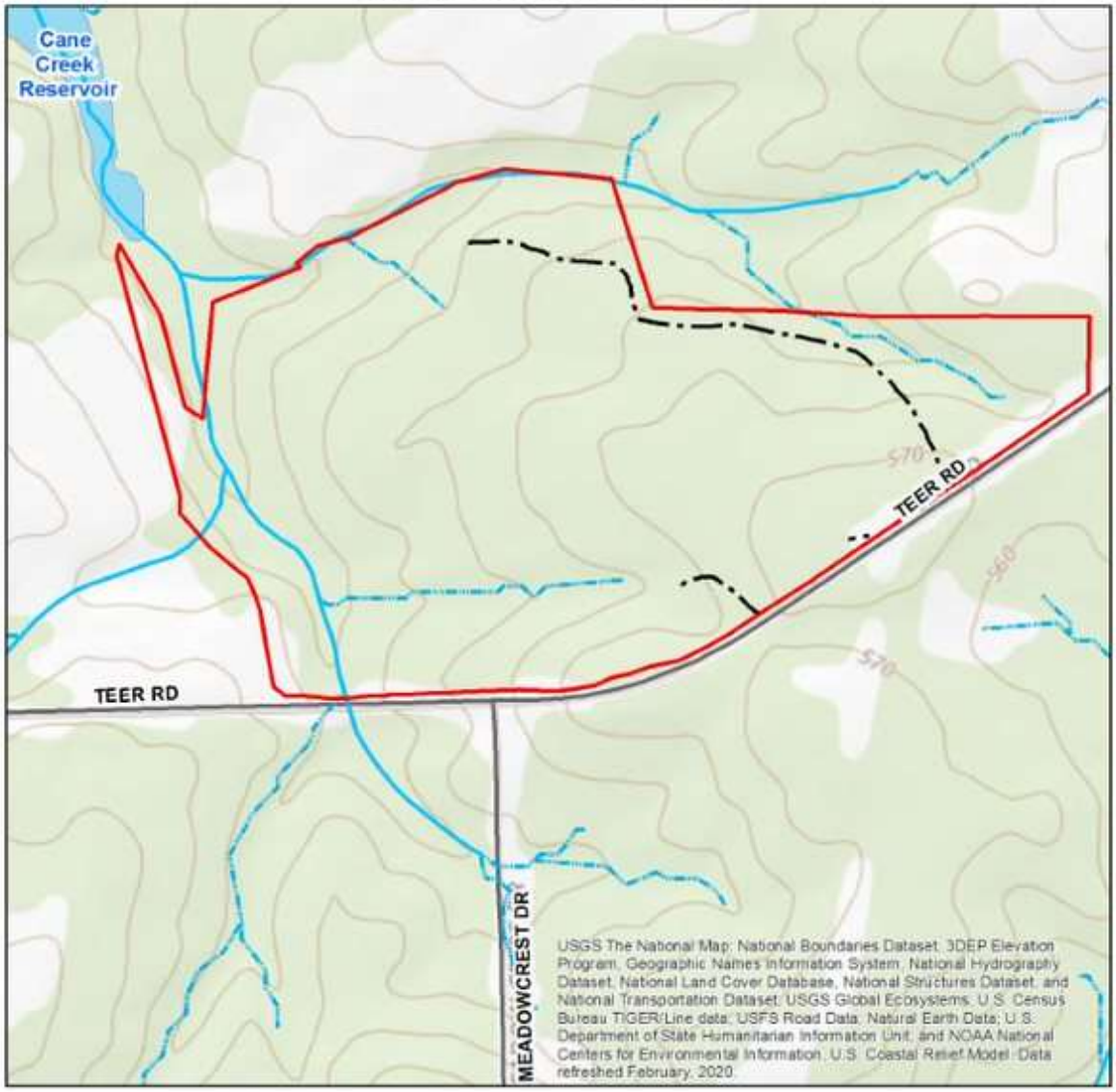
General Property Location



Meadow Crest North



Meadow Crest North



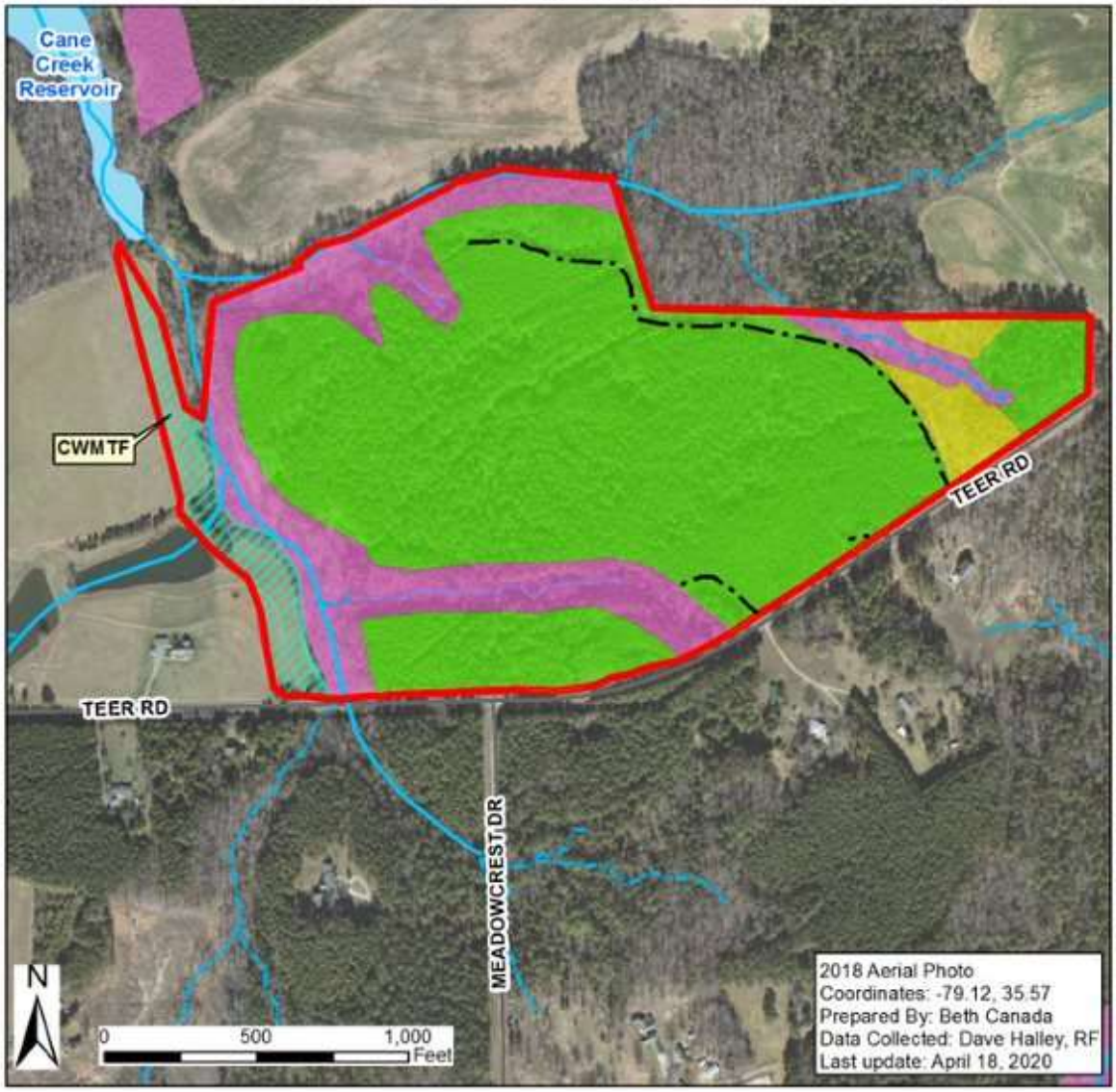
N

0 500 1,000 Feet

Toppgraphic Quad: White Cross
Coordinates: -79.12, 35.57
Prepared By: Beth Canada
Data Collected: Dave Halley, RF
Last update: April 18, 2020

- Forest Road/Trail
- Named Road
- Drainages
- USGS Streams
- Meadow Crest North Boundary

Meadow Crest North - Existing Forest Cover Type

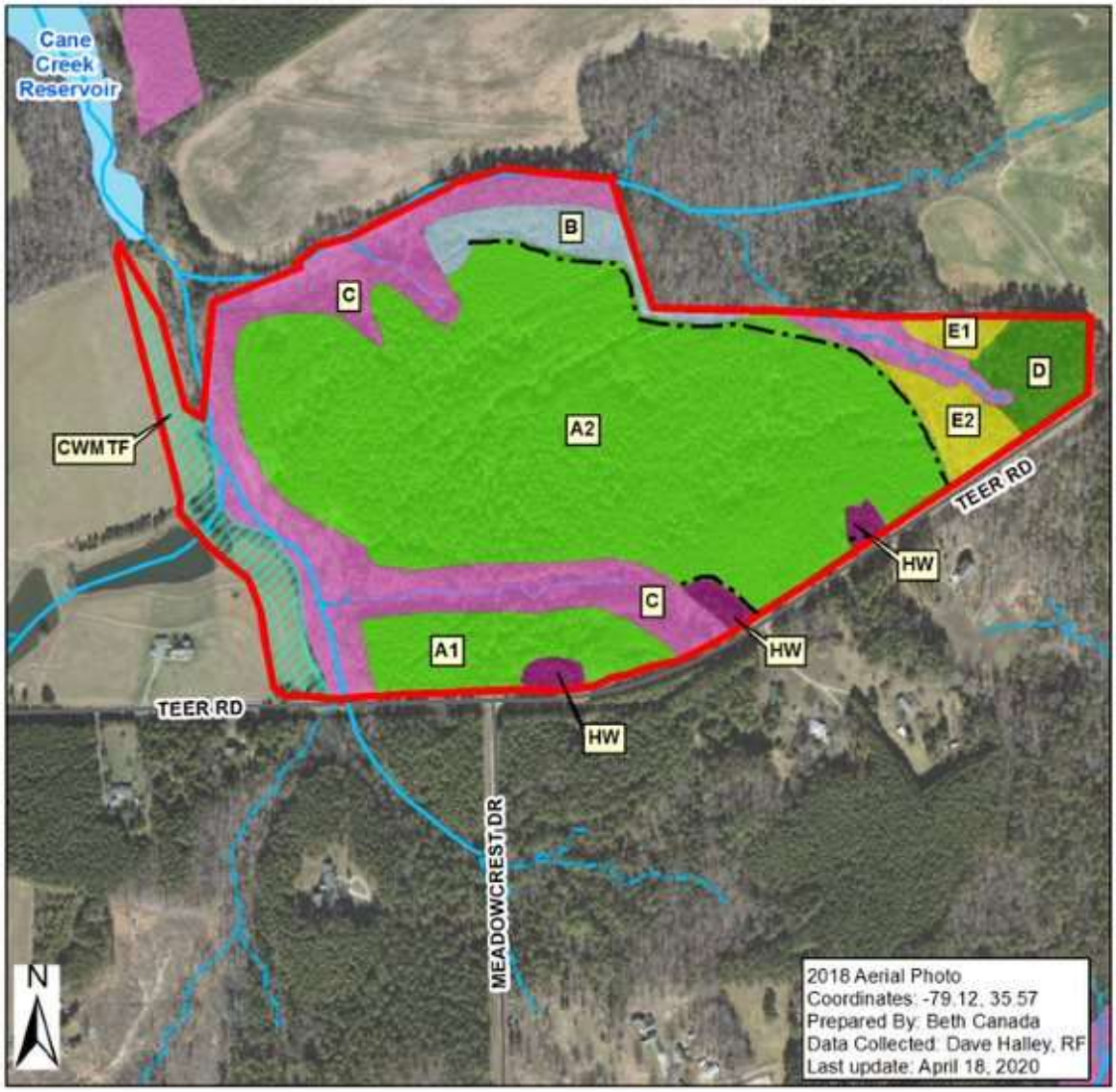


- Forest Road/Trail
- Named Road
- Drainages
- USGS Streams
- Meadow Crest North Boundary

Existing Forest Cover Type

- Natural Pine
- Hardwood
- Riparian Buffer
- CWMTF Buffer

Meadow Crest North - Forest Management Units



0 500 1,000 Feet

STAND	ACRES	COVER TYPE
A	50	NATURAL PINE
B	5	NATURAL PINE
C	15	RIPARIAN BUFFER
CWMTF	5	CWMTF EASEMENT
D	2.5	NATURAL PINE
E	2	UPLAND HARDWOOD
HW	<1	HISTORIC WOODLOT

- Forest Road/Trail
- Named Road
- Drainages
- USGS Streams
- Meadow Crest North Boundary

OWASA completed a prioritization of all their forest lands and Meadow Crest North 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 Meadow Crest North Property. Here are the descriptions and recommendations for each of the management units on Meadow Crest North property:

MANAGEMENT UNIT A

DESCRIPTION

Acres (Map Color):	50 (Light Green)
Landcover Type:	Natural Pine
Dominant Species Present:	Loblolly pine with some Virginia pine, sweetgum, and poplar.
Understory Species:	Not much understory vegetation. Some red maple, sweetgum, red cedar, and Autumn olive (invasive).
Age (Established):	25 years (1995)
Size:	9 to 14 inches in diameter (10-inch diameter average), 71 feet in height
Stocking:	Very overstocked (170 to 220 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:	Fair to good
Growth Rate:	Good, but slowing down
Soil/Water:	Mostly Herndon silt loam (HrB). Well drained. For detailed description and location of soil types see the Soils Section 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 were abandoned and allowed to reseed in pine around 1995. It was a working farm prior to OWASA's purchase in 1993, which corresponds with the age of the forest. Scattered throughout this management unit are large dirt piles. These may have been hedge rows that were pushed up and piled by the previous owners in preparation for a subdivision sale. There is some speculation that OWASA may have planted the open fields in loblolly pine, but if they did it is exceedingly difficult to delineate the planting rows. If it was planted, the natural loblolly and Virginia pine that seeded on top of it has made it difficult to discern. This is an extremely dense forest that is slowly thinning itself out through competition induced mortality. The forest floor is littered with smaller diameter pine trees that have died and fallen to the ground. Even with smaller trees dying this is still a very dense thicket of pines.

Management Unit A

RECOMMENDATIONS (Management Unit A)

This management unit is past due for its first thinning. Normally pine forests are 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-five years old and its average diameter

is 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. In natural pine stands, with no defined rows, the logger cuts a row of trees out every fifty to sixty feet to provide access into the stand. Then they remove small diameter, poor quality trees along the 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

To improve light conditions along interior forest roads we recommend removing a row of pine trees along the main forest roads, or thin the pines heavier along a 30-foot wide path adjacent to the forest roads. This will allow more sunlight to reach the forest floor and stimulate the growth of more forbs, native grasses, and herbaceous plants. This extra sunlight along the road will help improve road conditions by drying the road out quicker following rain events. The heavier thinning along roads will help to stimulate and create

some additional early successional habitat on the property. This will provide better escape cover for wildlife and songbirds.

Approximately eight to ten years following the first thinning (2028-30), 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. In some areas we may go as low as 50-60 square feet of basal area per acre for the added wildlife habitat benefit, especially along the Management Unit borders and along forest roads. When you conduct this second thinning, I recommend that you have us mark the 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 you have 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)

During the second thinning of these pine stands I am recommending that you consider creating several **small clearings** within the larger blocks of pines. These small clearings will create some early successional habitat within these older pine forests. These small clearings (< 2 acre in size) would be irregular in shape to maximize the amount of edge,

and these clearings can be in areas that have the lowest stocking of residual pine. The increased sunlight that will reach the forest floor in these small clearings will stimulate a lush growth of herbaceous species. When preparing for thinning we can look out for weak areas to create these small openings. Replanting may not be necessary in these openings because the adjacent mature pines may reseed these smaller openings. We will also need to design the location of small group openings so we can easily put fire lines around them to protect them during their early development. As the pine trees in these small group openings get older and taller, they will be more tolerant of understory burns and can be incorporated into the burning plan again.

We should avoid extremely narrow openings because nearby tree cover will create too much shade and will not allow enough direct sunlight to stimulate herbaceous vegetation. The small clearings will increase the age diversity within this pine stand and provide additional nesting areas for quail and turkey and areas to better find, capture and eat insects.

If they exist, we should try to locate and leave any hardwood species in these openings like white oak and northern red oak to increase the tree species diversity within these openings and provide some hard mast (acorns) for wildlife. I would like to see OWASA harvest two or three small openings in this management unit during the second thinning.

Seldom are pine thinnings done as a lump sum sale. Therefore, we will have to negotiate with a timber company to pay you on a per-ton-per-product-class of wood removed. In this type of payment method, they will pay you as the wood is cut. For each thinning True North can assist you finding a reputable thinning crew, negotiating an acceptable per unit timber price, and assist you in writing a timber sale contract. We can also assist in monitoring the thinning operation to ensure the proper extraction and protection of your 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 and aesthetic forest buffers we deem necessary to protect water quality and aesthetics. 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. This 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 you 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 A: 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 of 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 encouraging 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 additional trails and firebreaks throughout the stand, which are normally developed just prior to commencing the burn. You already have an extensive system of trails that can double as firebreaks.

Understory pine burn next to firebreak

All controlled burns on your 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 2020 rate for development of fire lines (bladed line) is $105/hour and their rate for 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 areas should be analyzed to determine the desired timing and reforestation plan. Loblolly and shortleaf pine can certainly be grown for 60 to 80 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 high percentage of this property, so it will be important to maintain the current hardwoods 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
50	2020-23	2022-24 2026-27	2028-30	2030-31 2033-34

MANAGEMENT UNIT B

DESCRIPTION

Acres (Map Color): 5 (Light Blue)

Landcover Type: Natural Pine

Dominant Species Present: Mostly loblolly pine and Virginia pine, with some shortleaf pine.

Understory Species: Red maple, sweetgum, red cedar, Christmas fern, and hickory.

Age (Established): 42 years (1978)

Size: 12" to 16" DBH (DBH: Diameter at breast height. Breast height is 4.5 feet above ground)

Stocking: Overstocked

Quality: Good

Growth Rate: Fair to slow

Soil/Water: Herndon silt loam (HrB), and Georgeville silt loam (GeC). Well drained. For detailed description and location of soil types see the Soils Section at the end of the plan.

Topography: 2 to 10 percent slopes

Management Unit History: This Management Unit represents a natural pine forest on the north end of the property. No treatments have been made on this forest in the past. There has been some recent mortality from competition and several trees have blown down in recent storms.

RECOMMENDATIONS (Management Unit B)

I am recommending a light to medium marked thinning on this stand in the next three years in conjunction with the thinning of Management Unit A. Approximately 80 to 100 pine trees per acre should be marked and left standing following the thinning. The thinning should concentrate on removing all the Virginia pine and low-grade hardwood in favor of mature loblolly pine and shortleaf pine.

This management unit is adjacent to a riparian forest buffer so this water quality buffer should be flagged out and painted prior to the marking and thinning.

We would like to see you start a periodic **prescribed burning** beneath this thinned pine stand with the goal of promoting herbaceous ground-level vegetation to improve browse and concealment for forest animals. This management unit could be added to the planned prescribed burning of Management Unit A.

Management Unit B

Although this stand is of sufficient age to justify a harvest, we are not recommending a **final harvest** of this older pine stand until Management Unit A is thinned a second time in eight to ten years. The pines will be 50+ years of age by that time. Following harvest and stabilization, this harvest area should be analyzed to determine site preparation needs and to schedule the site for reforestation. Options for reforestation include replanting with shortleaf pine seedlings, instead of loblolly pine or managing for a more mixed pine/hardwood stand. If we replant in shortleaf pine, we recommend an 8-foot by 10-foot spacing or 544 trees per acre. We should also use containerized shortleaf pine

seedlings to improve survival. Shortleaf pine is a species of concern in North Carolina due to its population declines.

Forest Management Schedule (Management Unit B)

Acres	Marked Thinning	Understory Burning	Final Harvest	Reforest
5	2020-23	2022-24 2026-27	TBD	TBD

Management Unit B

MANAGEMENT UNIT C

DESCRIPTION

Acres (Map Color): 15 (Pink)

Landcover Type: Riparian Forest Buffer

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

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

Age: 25 to 60 years

Size: 8 to 18 inches in diameter (DBH)

Stocking: Adequate

Quality: Fair to good

Growth Rate: Excellent

Soil/Water: Mostly Georgeville silt loam (GeC), Chewacla (Ch), and 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 10 percent slopes

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

RECOMMENDATIONS (Management Unit C)

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. If any riparian buffer area poses a risk for a major wildfire, endangerment, or damage to structures, we may consider working within the boundaries of these riparian forests to improve their overall quality. 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, your 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.

Creek on north side of property

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.

Riparian forest buffer

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 access the thinning work from Management Unit A2 to A1. The location of this drainage crossing will be designated, restricted to one crossing, and its design and construction will comply with Best Management Practice Guidelines.

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. 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.

3. 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.

Intermittent stream/drainage

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

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

10. 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 Practice Guidelines 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.

11. 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 and compliance

of Forestry Best Management Practices and NC Forest Practices Guidelines Related to Water Quality.

12. 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, we expect to keep erosion to natural rates to prevent sediment build up in streams and protect water quality.

Creek running down the west side of property

MANAGEMENT UNIT CWMTF

DESCRIPTION

Acres (Map Color):	5 (Blue and White Striped)
Landcover Type:	Clean Water Management Trust Fund (CWMTF) Buffer
Dominant Species Present:	Yellow poplar, sweetgum, loblolly pine, hickory, black walnut, green ash, hackberry, willow oak, and white and red oak.
Understory Species:	Sweetgum, red maple, boxelder, dogwood, green ash, eastern hophornbeam, and American hornbeam.
Age:	25 to 60 years
Size:	8 to 18 inches in diameter (DBH)
Stocking:	Adequate
Quality:	Fair to good
Growth Rate:	Excellent
Soil/Water:	Mostly Georgeville silt loam (GeC & GeB), with some Chewacla (Ch). Well drained to somewhat poorly drained. See Custom Soils Report for detailed location and description of soil types.
Topography:	0 to 10 percent slopes

Management Unit History: This Management Unit represents the area protected under a Clean Water Management Trust Fund (CWMTF) conservation easement.

RECOMMENDATIONS (Management Unit CWMTF)

Leave to grow. This Management Unit has a restrictive conservation easement on it held by the Clean Water Management Trust Fund. 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 “CWMTF 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 CWMTF 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 located 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 riparian buffer improvement activities within the non-easement area adjacent to it.

Example of CWMTF signage

MANAGEMENT UNIT D

DESCRIPTION

Acres (Map Color): 2.5 (Dark Green)

Landcover Type: Natural Pine

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

Understory Species: Red maple, blackgum, sourwood, American beech, sweetgum, white oak, hickory, wild grape, blackberry, and flowering dogwood.

Age (Established): 60 years old (1960)

Size: 14-22" in diameter

Stocking: Overstocked

Quality: Good

Growth Rate: Slow

Soil/Water: Mostly Orange silt loam (Or). Moderately well drained. For detailed description and location of soil types see the Soils Section at the end of the plan.

Topography: 0 to 3 percent slopes

Management Unit History: This Management Unit represents a natural pine forest.

RECOMMENDATIONS (Management Unit D)

This is an older pine forest that is starting to show signs of slow growth, low vigor and is starting to senesce. We are recommending a final harvest, but not to conduct a clearcut of this small mature pine stand near the road. We are recommending a more aesthetically pleasing **Seed Tree Harvest** within the next three years in conjunction with the thinning of Management Unit A. Approximately 8 to 15 pine trees per acre should be marked and left standing for natural reseeding purposes. The seed trees marked should be a combination of shortleaf pine and loblolly pine, with a strong preference to shortleaf pine.

Another strategy for this Management Unit is to remove all the overstory loblolly, and leave just shortleaf pine seed trees, and any overstory oaks or hickories to regenerate the stand. This would help produce a more mixed stand, and if we introduced fire to this regenerated stand early (within three years) we could help tip the scales in favor of oak and shortleaf pine regeneration over loblolly pine. Loblolly pine regeneration will most likely occur anyway, but this treatment would increase the proportion of other species in the regeneration, especially if we utilized fire in the early development of this stand. With lack of shortleaf pine seed trees, we may also choose to supplement regeneration by planting shortleaf pine seedlings following the harvest. Shortleaf pine is a less frequent seed producer than loblolly, so planting will ensure shortleaf will at least have a chance from the start.

We need to pick the best quality pine trees to leave as seed trees because they will supply the best quality seeds for the next stand. They should be from the dominant crown class, of good quality (straight, clean bole, small limbs, and appear to be disease resistant), have dense, full crowns, and show indications that they can produce a good crop of pinecones. Seed trees are particularly vulnerable to wind, lightning, insects, and disease; so probable losses from these causes should be considered when we determine the number of trees to leave.

Example of a Seed Tree Cut at the Cane Creek Mitigation Property

The main disadvantage of seed tree method over tree planting is that the natural reseeding of loblolly pine can be usually quite high, and Mother Nature does not seed pines with optimal spacing. Successful natural reseeding from the seed tree method is usually in the 800 to 3,000 trees per acre range. Mechanical hand thinning (to about 300-400 trees per acre) when these naturally regenerated stands are six to eight years old will greatly improve the quality of the stand and create optimal growing conditions for this newly regenerated forest Pine, particularly shortleaf pine, will be the target species for release, but we should also look for opportunities to release oak and poplar to create a more mixed stand.

Seed trees can be harvested once a new stand has been re-established in three to five years, but we will probably just keep them in place and remove them during the second thinning of Management Unit A. There will be so few that they will not shade out the understory or restrict regrowth.

Prescribed burning through this stand following the seed tree harvest is an option to consider. If done early in the development of the stand it will favor the development of more fire tolerant species such as shortleaf pine and oak. It may be utilized to help thin out an overstocked naturally regenerated loblolly pine stand.

Forest Management Schedule (Management Unit D)

Acres	Marked Seed Tree Harvest	Hand Thinning to Reduce Stocking
2.5	2020-23	2028-31

Management Unit D

MANAGEMENT UNIT E

Acres (Map Color):	2 (Yellow)
Landcover Type:	Upland Hardwood
Dominant Species Present:	White oak, red oak, hickory, southern red oak, with scattered loblolly pine.
Understory Species:	Red maple, sweetgum, sourwood, American beech, and eastern red cedar.
Age (Established):	60 years (1960)
Size:	12 to 20 inches in diameter (DBH)
Stocking:	Adequate to overstocked
Quality:	Fair to very good
Growth Rate:	Good
Soil/Water:	Mostly Herndon silt loam (HrB) and Orange silt loam (Or). See Custom Soil Report for detailed description and location of soil types.
Topography:	2 to 10 percent slopes

Mgt. Unit History: This is a small upland hardwood Management Unit and represents a critical portion of the property for species diversity. Except for the hardwoods in the riparian forest buffer (20 acres) this management unit represents the only upland hardwood on the property.

RECOMMENDATIONS (Management Unit E)

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 red and white oak trees in its main canopy. Loblolly pine, hickory 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 of food for wild turkeys, squirrels, and deer. During the late fall and winter, this is where we would expect you all to find a lot of turkey sign (scratching) because they are looking for acorns.

Management Unit E

The only forest management we might consider for this management unit at this time is **a light Hardwood Improvement Cut**. This could be accomplished during the thinnings of the adjacent pine stands. Low value, poor quality trees could be marked and removed to make room for more wildlife and timber valued trees such as oak, poplar and hickory. With the abundance of pine on most of the other units, I would recommend that you remove the merchantable pine from this area. I would recommend that you have me mark the trees that should be retained during the improvement cut.

An Improvement Cut is best regarded as one whose primary emphasis is placed on the removal of upper-crown-class trees of undesirable species or form. The primary objective of an improvement cut is to promote growth, improve stand structure and regulate species composition. Improvement cuts are generally hard to market because the wood removed from the improvement cut is not high grade or high value. However, completing the hardwood improvement cut in conjunction with the adjacent pine thinnings should provide an opportunity to implement this portion of the forest stewardship plan.

The types of vegetation that would be removed in an improvement cut would be:

- Crooked, limby or poorly formed trees
- Trees damaged by fungi, insects, or storms
- Inferior or short-lived species
- Trees growing too close to each other
- Offsite species, such as American beech
- All the pine

But we would leave tree with hollows and dead snags for wildlife den and bugging trees.

Type of low value trees marked and harvested during an Improvement Cut

I would recommend that only about 15 - 20 % of the overstory trees be removed in the improvement cut done on this management unit. The target will be to maintain 70 square feet of basal area and no less than 50 square feet of basal to maintain quality stems. Too heavy an improvement cut will cause excessive branching on the remaining oaks, poplar, and hickories. An improvement cut that removes more than 30% of the stand may do more harm than good. To be done correctly I recommend that you have me mark the trees to leave. The trees I marked in paint are trees that should be retained in an improvement cut. The long-term goal of the improvement cut will be to remove inferior trees in order to increase the overall quality, genetics, and vigor of the residual hardwood stand. Trees with good form, good vigor, and well-developed crowns would be left. With your multiple objectives, trees will be favored that have good timber, wildlife, and aesthetic value. A mixture of species will also be favored due to its greater potential for producing multiple benefits.

Example of a Hardwood Improvement Cut

The other advantage of this type of improvement cut is that the filtered light to the understory will help to improve the advanced regeneration of desirable trees such as oak, hickory, and yellow poplar. These species do not do well in full shade and require full or filtered sunlight to establish successfully in the understory. So, in addition to mature canopy trees removed during the improvement cut, some mid-story species such as sweetgum, red maple, sourwood, and beech should also be harvested to improve the understory growing conditions (increased sunlight) to promote the advanced regeneration of more desirable timber and wildlife trees. The removal of the mid-story is also one of the initial phases of what is call an oak Shelterwood system.

Regeneration of oak a year following an Improvement Cut

Prescribed burning at low to moderate intensity and moderate frequency is recommended for this management unit. Fire will help promote regeneration of oaks and shortleaf pine in the canopy gaps we create or are created by natural causes (storms, ice, or mortality of large trees). Future burns on adjacent management units should be allowed to carry through this unit.

Forest Management Schedule (Mgt. Unit E)

Acreage	Marked Hardwood Improvement Thinning
2	2020-23

MANAGEMENT UNIT HW

Acres (Map Color): <1 (Purple)

Landcover Type: Historic Woodlots

Management Unit History: This Management Unit represents the three historic woodlots on the property. On these three sites there are no buildings or structures, just older woodlot trees that were maintained when the property was farm. These could have been sites where agricultural crops were processed, or farm equipment stored. We did find some scrap metal on one site. There is one exceptionally large post oak tree (42" DBH) on one these historic woodlots.

Large post oak

RECOMMENDATIONS (Management Unit HW)

No active management will occur within these three small areas. Some minor clearing and pruning may be acceptable to keep the appearance of the site. Prescribed burning could be conducted through these sites.

One of the small historical woodlots has a grove a very large loblolly pine. These serve as a nice "legacy forest". We may consider some light marked thinning of this pine grove to improve health and vigor of the existing stand.

Meadow Crest North 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 actually 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. This will cause the dislocation of soil particles (sediment) and their movement by running water. The initial soil removed will be the most fertile topsoil causing a loss in the productivity of the site. The movement of soil particles (erosion) by running water will flow to low areas, usually a small stream or drainage, eventually impacting water quality to streams and rivers they drain into. 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) Guidelines to

insure we comply with North Carolina's Forest Practices Guidelines Related to Water Quality.

Maintenance of these BMP's will also be important. For example, turn outs on logging roads will need to be periodically rebuilt or cleaned out to allow proper stormwater drainage off the road and into vegetative areas. 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 Practice 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 loss of the forestry exemption and referral to the appropriate enforcement agency. As your 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's are a collection of practices recommended to minimize soil erosion and stream sedimentation to help met the performance standards of FPG's. The manual's purpose is to inform and educate forest harvesters on proper BMP use and the technical specifications for use. The BMP Manual is available on the NC Forest Service website at:

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

The manual is a comprehensive source of water quality related issues as they affect forestry management practices in North Carolina. Using 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. Maintaining 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 that healthy forests are 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 permanent and efficient access throughout the property without damaging the watershed value of the forest. Unfortunately, there are no inexpensive “shortcuts” when building roads. It will require enough funds, especially during active logging, to build and keep a good road.

The following are a set of recommendations for control of erosion on your 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. 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.
7. 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.
8. Inspect the roads frequently during logging to ensure drainage structures are maintained.
9. Upon completion of logging, stabilize and seed all roads, main skid trails, and deck sites.

Possible Adverse Impacts to Neighbors:

Another one of OWASA land objectives is to mitigate any adverse impacts to neighbors or surrounding communities. Most of the occupied residents near the property are along Teer Road on the south side of the property. There appears to be at least six occupied homes on the south side of Teer Road across from the property. There is also an entrance to Meadow Crest Subdivision across from the property (Meadow Crest Drive) which has at least three homes in it. OWASA owns property directly across Teer Road from Meadow Crest North, which they call Meadow Crest South. This property occupies much of the Meadow Crest Community and land along Teer Road.

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 Teer Road. There is a small final harvest area (2 acres) in the far southeast corner, but it will not be clearcut. We are proposing a seed tree harvest that will maintain 8-15 mature trees per acre.

No access is required through other properties, so no formal access agreement is necessary. The property has direct access from Teer Road, via existing entrances. We

recommend that the entrances used to the property be improved and that at least one load of gravel be put down at the main entrance to Teer Road to avoid tracking dirt onto the highway.

One negative impact to neighbors may be logging equipment noise and the temporary added traffic on Teer Road. Based on an estimate of volume to remove during thinning operation the logging operation should not last more than three to four weeks 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 also plans to meet with neighbors to share the draft of this plan and listen to concerns, and where applicable, develop measures or conditions to mitigate those concerns.

Improving Wildlife Habitat and Species Diversity:

Your 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 will promote more age diversity and provide more diverse habitat types and conditions.

- Promoting the development of mature oak/hickory forests that provide acorns/nuts which is 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 vernal ponds 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.

- Daylighting roads will improve understory light conditions for development of understory vegetation and grasses planted in roadways. This added light will promote a thicker layer of understory vegetation for escape cover, nesting habitat and source of food for wildlife and songbirds.

- 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.

A helpful wildlife reference are the newsletters called the *Upland Gazette* published by the North Carolina Wildlife Resources Commission. This newsletter is an excellent reference for improving wildlife habitat and summarizing how different forestry practices can benefit piedmont wildlife species. The library of publications can be found at:

https://www.ncwildlife.org/Conserving/Upland-Gazette

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 your 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 hardwood improvement harvests we will help to maintain and restore a 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 invited partner agencies to review an earlier draft of this forest stewardship plan and have incorporated 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 general 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 your 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:

David P. Halley

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SUGGESTED SCHEDULE OF MANAGEMENT ACTIVITIES

MEADOW CREST NORTH PROPERTY
Orange County
(As of April 2020)

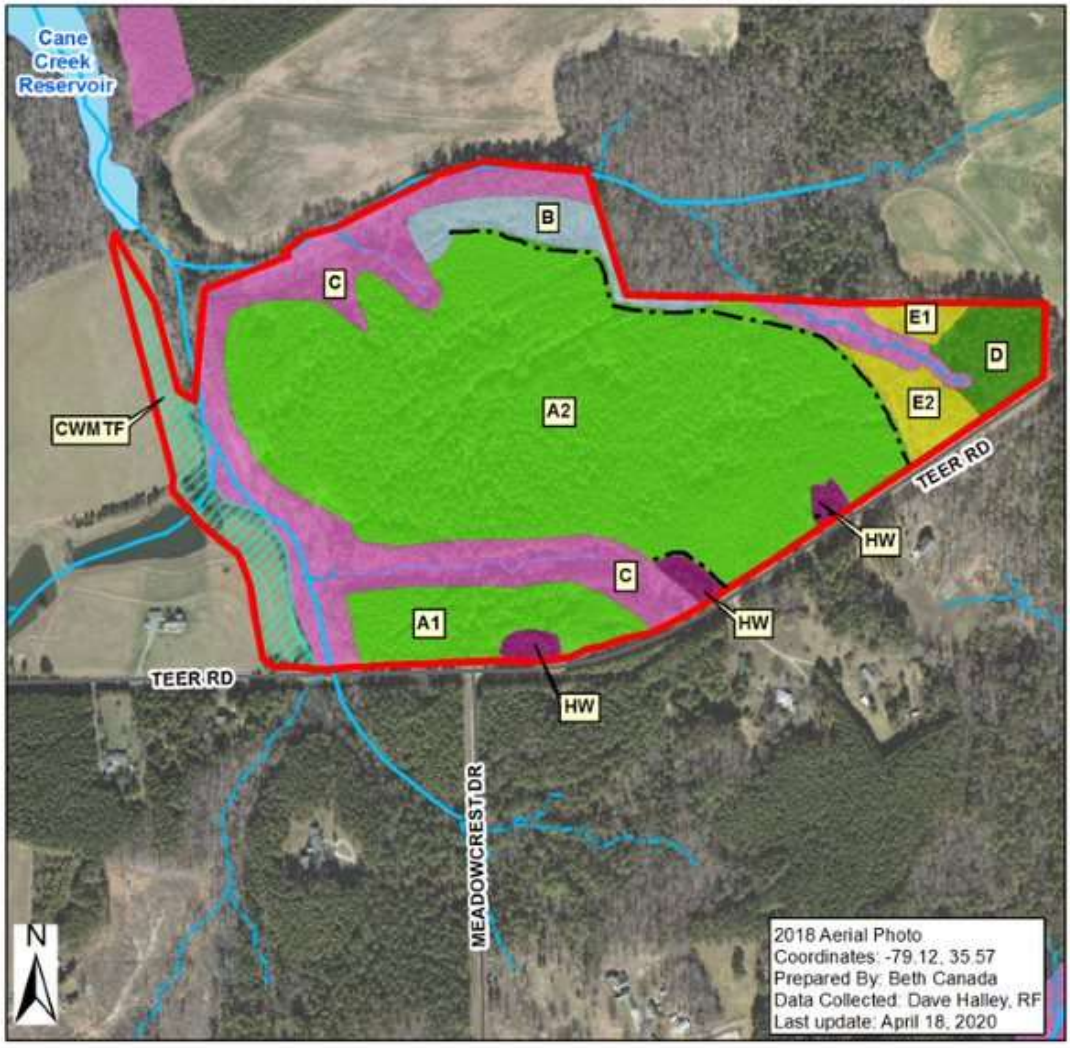
W: Winter S: Spring U: Summer F: Fall

Year	Season	Acres	Mgt Unit	Activity*
2020-21	U-F			Make road improvements, gravel entrances
2020-21		83		Repaint property lines and install CWMTF signs
2020-23	S-F	50	A	Conduct First Thin
2020-23	S-F	3	B	Mark and conduct thinning
2020-23	S-F	2.5	D	Mark and conduct Seed Tree Harvest
2020-23	S-F	2	E	Mark and conduct Hardwood Improvement Cut
2020-25				Invasive species control*
2028-30	S-F	50	A	Mark and conduct second thin
2028-30	S-F	3	A	Flag out and create small group openings
2028-30	S-F	3	B	Final harvest
2028-30	S-F	2.5	A	Hand thinning to reduce stocking*
2029-30	S - U	3	B	Site prepare and reforest in shortleaf pine*
2030	U-W	83		Update Forest Stewardship Plan

***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.

Meadow Crest North - Forest Management Units



0 500 1,000 Feet

STAND	ACRES	COVER TYPE
A	50	NATURAL PINE
B	5	NATURAL PINE
C	15	RIPARIAN BUFFER
CWMTF	5	CWMTF EASEMENT
D	2.5	NATURAL PINE
E	2	UPLAND HARDWOOD
HW	<1	HISTORIC WOODLOT

- Forest Road/Trail
- Named Road
- Drainages
- USGS Streams
- Meadow Crest North Boundary

Understory Burning Schedule
(As of April 2020)

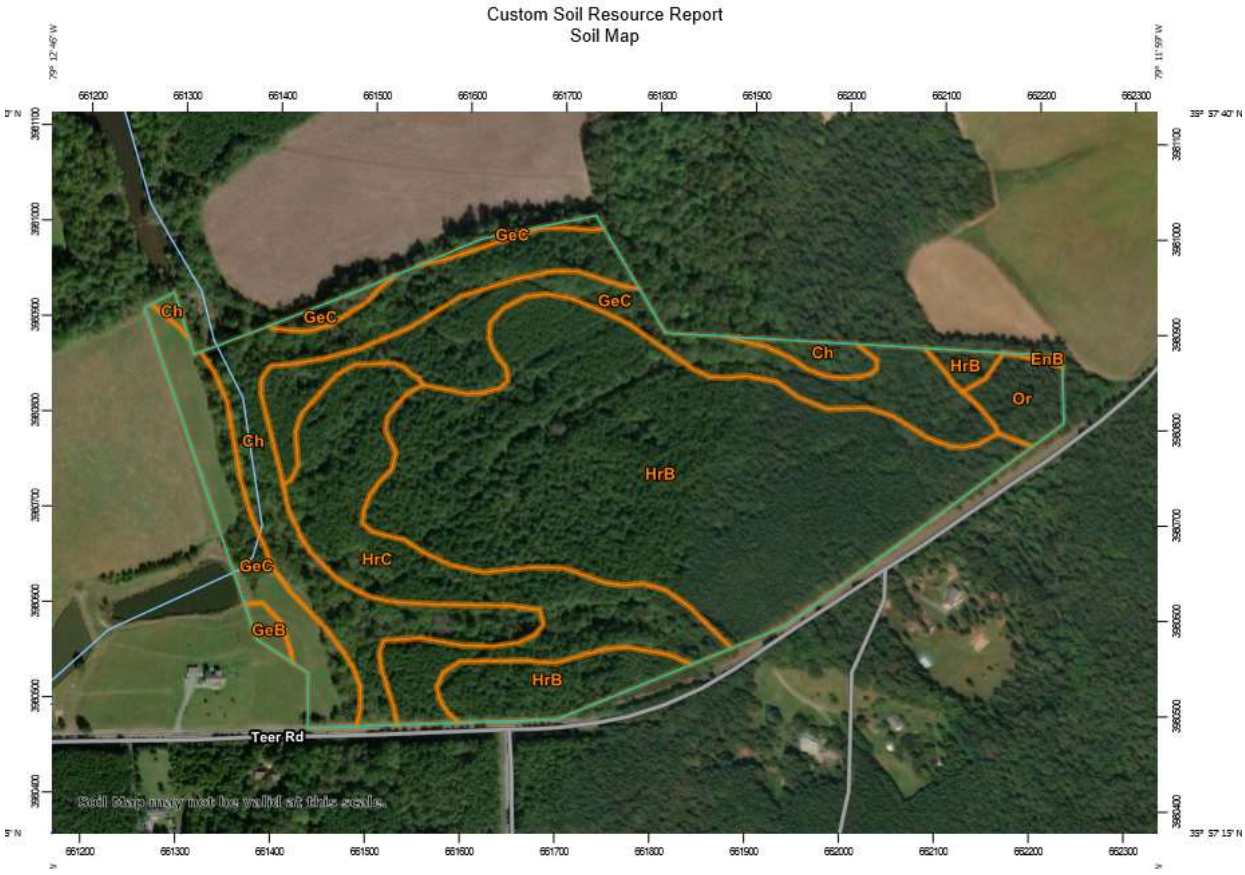
W: Winter S: Spring U: Summer F: Fall

Year	Season	Acres	Mgt. Unit	Activity*
2022-24	F-W	50	A	Cool season burn*
2022-24	F-W	3	B	Cool season burn*
2022-24	F-W	25	E	Cool season burn*
2026-27	F-W	50	A	Cool season burn*
2026-27	F-W	3	B	Cool season burn*
2026-27	F-W	25	E	Cool season burn*
2031-32	F-W	50	A	Cool season burn*
2031-32	F-W	25	E	Cool 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	11.6	15.0%
EnB	Enon loam, 2 to 6 percent slopes	0.1	0.1%
GeB	Georgeville silt loam, 2 to 6 percent slopes	0.4	0.5%
GeC	Georgeville silt loam, 6 to 10 percent slopes	14.9	19.1%
HrB	Herndon silt loam, 2 to 6 percent slopes	37.1	47.7%
HrC	Herndon silt loam, 6 to 10 percent slopes	12.0	15.4%
Or	Orange silt loam, 0 to 3 percent slopes	1.7	2.2%
Totals for Area of Interest		**77.8**	**100.0%**