

Forest Management Plan for Kingsley Area Schools

Hammer Road Parcel

c/o Josh Green – Forestry Commission

402 Fenton Street,

Kingsley, MI 49649

**Property Location: 480 Acres within W ¾ of Section 27, T25N R11W, Mayfield
Township, Grand Traverse County, Michigan**

Parcel ID#: 09-027-002-00

Plan Length: 20 years (2026-2046)



Plan Written By:

Zachary Jewison

Schillinger Forestry, LLC

1826 Perry's Loop

Traverse City MI, 49685

(231) 342-1792

zachary@michiganforester.net



Schillinger
FORESTRY, LLC

Forest Management Plan for Kingsley Area Schools

Hammer Road Parcel

402 Fenton Street,

Kingsley, MI 49649

**Property Location: 480 Acres within W ¾ of Section 27, T25N R11W, Paradise
Township, Grand Traverse County, Michigan**

<u>Page #</u>	<u>Description</u>
1	Title Page
2	Table of Contents
3	Introduction to Property
3	Landowner Goals
4-5	Management Timing & Forest Health Issues
6-25	Unit Descriptions and Recommended Management
26-27	Timeline for Management
28	Management Map
29-31	Soils Map & Information

APPENDIX –

Appendix A – Autumn Olive Management Extension Bulletin

Appendix B – Tree of Heaven Management Extension Bulletin

Appendix C – Beech Bark Disease Extension Bulletin

Appendix D – Emerald Ash Borer Fact Sheet

Appendix E – Wildflower & Grass Planting Handout – Dr. Josh Shields

Appendix F – Warm Season Grasses

Appendix G – Cool Season Grasses

Appendix H – Native Grass Identification

Appendix I – Prescribed Burning

Appendix J – Spotted Knapweed Info Bulletin

Signatures:

Landowner Signature: Joshua T. Rothwell Date: 5/11/26

Landowner Printed Name: Joshua T. Rothwell Date: 5/11/26

Forester Signature: Zachary Jewison Date: 2/11/2026

Forester Printed Name: Zachary Jewison Date: 2/11/2026

Introduction to the Kingsley Area Schools Hammer Road Parcel

The Kingsley Area Schools Hammer Road parcel is a 480 acre contiguous parcel located a few miles north east of Buckley, Michigan. There are several different forest community types on the property as well as non-forested meadows. Additionally, a portion of Anderson Creek bisects the property. There has also been somewhat recent timber harvesting on the property, specifically a high grade in Unit 3 (see unit descriptions in plan). There also appears to be at least one former oil well site on the property. The purpose of this plan is to evaluate the current forest resources and suggest sound management in accordance with landowner goals that maintains or enhances forest health, quality, resiliency, species diversity, and wildlife habitat features. Income from timber resources, though a part of the management, is not a primary goal. All management activities planned in this document will adhere to the State of Michigan's Best Management Practices for Soil and Water Quality.

Conservation Easement: This Property is protected by a conservation easement through the Grand Traverse Regional Land Conservancy (GTRLC). The easement requires written notice is sent to GTRLC prior to any harvesting operations.

Forest of Recognized Importance (FORI): This property is not considered a FORI. FORI are defined as forests with global, regional, or nationally significant landscape features with exceptional ecological, social, cultural or biological value. In Michigan, this includes forests adjacent to a National Wild and Scenic Rivers, forests within ½ mile of the Great Lakes, large tracts of forestland (500+ acres) in southern Michigan, or areas habituated by endangered species.

Threatened & Endangered Species: The Michigan Natural Features Inventory (MNFI) database check did not return any reported state or federal threatened & endangered species on this property.

Archeological Sites: A check of the State Historic Preservation Office Database (SHPO) did not return any recorded occurrences of archeological sites in the immediate area. Forest management activities should avoid disturbing the soil as much as possible, especially along rivers and waterways as these areas are more likely to contain archeological sites. If artifacts such as projectile points, stone flakes, ceramic pieces, or logging-era tools are found, they should be reported at michigan.gov/archaeology to ensure proper documentation of the site.

Landowner Goals & Objectives – Hammer Road Parcel

Goal 1 – Practice ecological forest management to maintain or enhance forest health, quality, resiliency, and tree species diversity.

- Periodic partial harvesting of timber with sound silvicultural methods.

Goal 2 – Maintain or improve structural diversity and wildlife habitat features.

Goal 3 – Aid in forest regeneration with tree planting, tree protection, and decreasing deer browse pressure.

Goal 4 – Earn periodic income from timber products sold to help achieve Goals 1-3.

Goal 5 – Involve Kingsley Area Schools students in activities and educational opportunities where applicable.

Management Timing and Forest Health Issues

High deer populations pose a significant challenge to tree regeneration and thus long term forest health. In the Grand Traverse County area, tree seedlings that are not consumed by deer are often poorly formed, threatening both the quality and quantity of trees able to reach maturity in a forest. Deer browse is an issue across the property, as it was noted at the vast majority of inventory plots. There are several options for reducing the impact deer have on the property: 1) Legally hunt/harvest more deer on the property. 2) Encourage hunting from other hunters (i.e. allow access if asked by trusted neighbors/friends). 3) Install fencing to exclude deer from a section of forest and allow regeneration to get above browse line. 4) Install tree tubes to exclude deer from individual trees (planted or natural seedlings) until they are above the browse line. 5) During any commercial harvests, construct slash walls with logging slash to act as natural fences and exclude deer from a section of forest, allowing regenerating trees to get above the browse line. Deer management activities such as fencing and tree tubes may be timed with good seed crop years from the overstory for the best results. Without addressing the deer population on this property, tree regeneration will continue to be negatively impacted in the future, even with sound management of the overstory trees. Note: At the time of this writing, Kingsley Area Schools has school policy that prohibits weapons on school property and



Image 1. Seedling killed by repeated deer browse



Image 2. Beech scale insects infesting an American beech tree

therefore hunting on this parcel is not allowed. The author recommends updating school policy to allow hunting in some form at the Hammer Road parcel, as this will greatly help the long term health of the forest.

Beech Bark Disease (BBD) was also found on the property. While American beech is not particularly common on the property, BBD will ultimately affect the forest dynamics. This disease is the combination of an invasive scale insect (similar to aphids) and a native fungus. The tiny insects form a white, waxy coating as they feed on tree trunks and branches. On heavily infested trees, it looks as if the bark is covered with white powder. The wounds created by the feeding insects allow the tree to eventually become infected by the *neonectria* fungus, which is fatal to the tree. The disease has already progressed in the area, so immediately removing the diseased trees is not necessary to slow the spread of the disease throughout the property. However, beech firewood or logs should not be removed from the property from mid-summer to late fall. In relevant harvests, beech trees that are most heavily infested, but with good form should be removed since their wood could be salvaged. All seemingly healthy beech trees in the forest should be left standing (since they may have natural resistance). Also, leave mature beech trees that are poorly formed and have no timber value (even if they are diseased) since they will produce beech nuts until they die which are excellent food for wildlife. Fortunately, cavities or dead trees that are created as the trees die off will be great wildlife habitat.

Unit 4 contains about 3% hemlock, and as such it should be monitored for Hemlock Woolly Adelgid (HWA). HWA is an aphid-like invasive insect pest that feeds on hemlock trees, causing mortality in 5-10 years. The insects feed at the base of the needles on the underside of the leaves. They are most visible in the winter (January to March), as they develop small, white, cottony ovisacs at the base of the foliage. HWA was not detected on the property and HWA has not been found in Grand Traverse County to date, nor has it been found as far inland from Lake Michigan as this property. Monitoring will allow for proactive management of the pest should the need arise.

Emerald ash borer (EAB), a non-native insect pest has also affected this property. As with the rest of the northwest Lower Peninsula, the infestation of EAB here is considered past its peak. However, it is likely the insects will continue to impact regenerating ash trees throughout the region and on the Hammer Road parcel. EAB is relevant to the Hammer Road parcel because the insect has killed virtually all mature black ash trees. Black ash are considered particularly susceptible to EAB, and as a result are the ash resource most imperiled by the beetle. The future of black ash remains in doubt, including on the hammer road parcel. However, there is a significant amount of black ash regeneration above the browse line throughout parts of Unit 4. The practicality of treating these trees against EAB is low, but it is a great opportunity to monitor for trees that are seemingly resistant to EAB as they mature. So called “lingering ash” are vital insights into the future of this ecologically and culturally significant species.



Image 3. Multiple black ash saplings are growing near this tip-up mound

Harvesting with mechanized equipment in or around hardwoods should be avoided between April 15th and June 15th. This period of time is known as “bark slip.” Trees are far more susceptible to mechanical damage during this time since the tree is growing quickly and moving sap up the trunk. The bark on the tree is rather loose as a result. Harvesting trees during this time is more likely to cause damage to residual standing trees, degrading the quality of stand for the future.

And finally, a broader, overarching health concern for the Hammer Road parcel is climate change. Forests are heavily influenced by—and also influence—climatic conditions at local, regional, and global scales. As the climate continues to change rapidly, it may affect the overall health of the forest directly or indirectly. This plan provides recommendations to help mitigate the impact climate change will have on this forest and its broader ecosystem impact. Management activities like assisted migration, increasing species diversity, increasing structural and habitat diversity are all included in the plan to help build resiliency for the future.

These forest health issues need to be addressed when management takes place on this property. The landowner is encouraged to keep in contact with Schillinger Forestry or a registered forester to keep up on any new treatment measures for these or other forest health issues.

Non-Timber Forest Products

Non-timber forest products (NTFP) are natural resources that can be harvest from forests—excluding commercially harvested timber—that have potential personal or commercial value.

Like timber, many of these NTFPs can have significant cultural, economic, and sustenance benefits. Common groups of NTFPs include edible items, medicinal and herbal items, floral and decorative pieces, and even wood for carving or other crafts. Common examples of NTFPs relevant to Northwest Lower Michigan include (but are not limited to): berries, seeds, and nuts (walnuts, acorns, etc...), edible mushrooms (morels, truffles), maple syrup, wild herbs, pine cones, and wood for walking sticks. The sustainable use of all non-timber forest products across any of the Kingsley Area Schools properties is permitted and encouraged for the landowner. Students are also welcome to be included in the education and use of these non-timber forest products.

Management Unit #1

Open Canopy Upland Mixed Species



Management Unit Information

Management Unit Number: 1 Number of Acres: 92(+/-)

=====Major Objectives of Unit=====

Maintain or improve quality and stocking of existing stand. Address invasive trees and other invasive plants as necessary. Monitor regeneration, and consider planting to improve species diversity, structural diversity, and overall tree/shrub regeneration.

=====Existing Conditions=====

Size Class: UM4 (Upland Mixed, Poorly stocked poletimber) **Soil Type(s):** MeB – Mancelona-East Lake loamy Sands (2-6% slopes), KaB, KaC Kalkaska loamy sand (2-18% slopes)

Site Quality: Fair **Stand Quality:** Fair **Stand Density:** 59ft²/acre

Site Index: 55 (Red Pine)

Desired Future Condition:

The Desired Future Condition (DFC) for this unit is a multi-age mixture of upland species dominated by white pine, but with a wide variety of associate species such as black cherry, red maple, red pine, red oak and other planted hardwoods. The desired regeneration harvest strategy is small group selection, and natural regeneration is the desired regeneration method. Intermediate treatments should not reduce the average basal area below 70-80ft²/acre.

Management Unit Description:

Unit 1 consists of a mix of upland conifer and hardwoods species, mainly white pine, black cherry, and sugar maple, with a minor component of red pine, red maple, ironwood and American beech. This unit is relatively poorly stocked with an average basal area of 59ft²/acre, and an open canopy structure. This type of stocking is to be expected in an area where forest was previously cleared and now recovering. Based on the diameter distribution below (**Figure 1**), it appears there is a roughly even-aged cohort of black cherry and white pine volunteers that dominate the unit. Larger maples, cherry and white pine are more scattered and were probably the seed source for many of the younger trees, considering their spatial distribution.

The soils in this unit are primarily Mancelona-East Lake loamy sands and Kalkaska loamy sand with a range of slopes from 2 to 18 percent. These soils are somewhat excessively drained with deep profiles, and as such are considered well suited for harvest equipment operability.

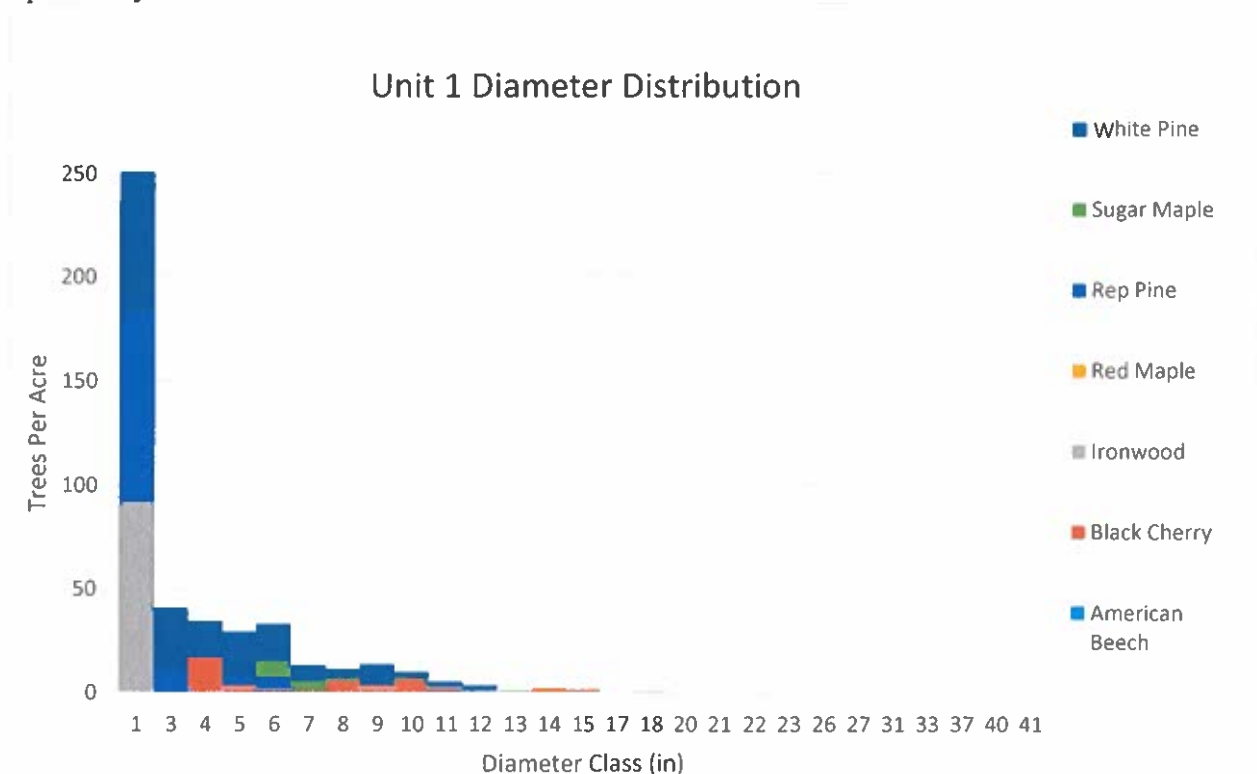


Figure 1. Diameter distribution of Unit 1.

A total of 7 species were tallied in this management unit with white pine making up the vast majority as indicated in **Figure 2**. Other tree/shrub species present in this unit that were not captured with the variable radius method include Scots pine (non-native state-listed invasive species), and autumn olive (non-native invasive shrub). The woody understory consists of pine,

cherry, and ironwood seedlings and saplings. The ground layer includes little blue stem, bracken fern, interrupted club moss, and fan club moss. Most of this inventory was completed in late fall/early winter and with deep snow cover, so not all plants were present or identifiable. According to USDA ecological site classification for this unit (Snowy Sandy Drift), other plants that may occur here include: Canada mayflower, wild sarsaparilla, teaberry, and northern lowbush blueberry.

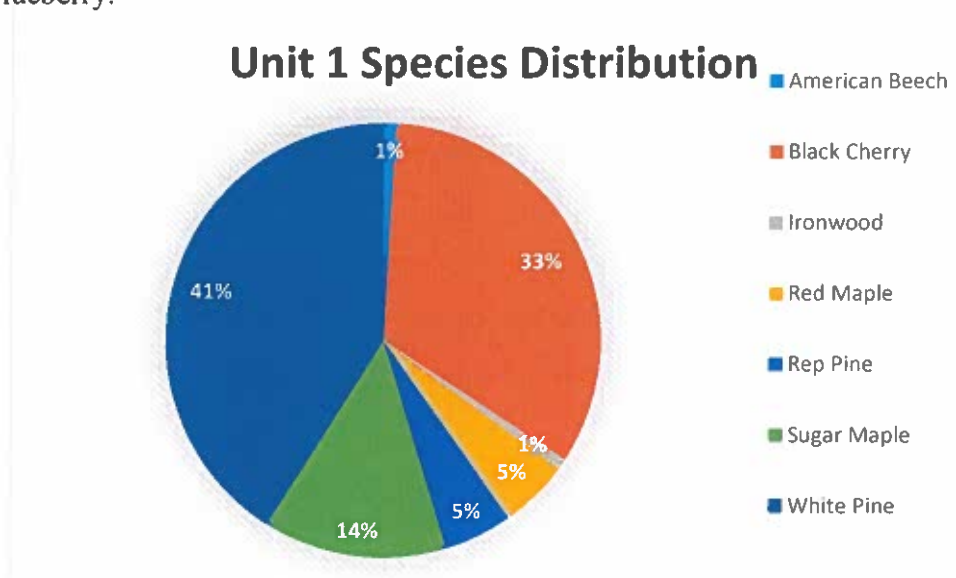


Figure 2. Displays the proportion of tree species tallied in Unit 1.

=====Planned Management Activities - Unit 1=====

Given the relatively open canopy nature of this unit, but the presence of species generally characteristic of closed canopy forest communities, it is recommended to allow Unit 1 to mature and develop a close canopy structure over time. As a result, commercial harvesting in Unit 1 is not recommended during the course of this plan. However, considering the current open canopy structure of Unit 1, there is opportunity to plant trees and shrubs to increase species and structural diversity. It is also a good opportunity to engage in assisted migration; that is, planting native trees in an area just north of where they occur naturally such that they are established where the climate will very soon suit those trees. Assisted migration is considered an important tool to help increase forest resilience in a rapidly changing climate.

Planting recommendations for Unit 1 are as follows: generally, select areas to plant that are relatively open (though each tree should be matched to its exact planting site). Plant trees and shrubs on an approximately 10ft x 10ft spacing. Locate planting areas somewhere accessible, such as near the former two track, as it will be important to water the newly planted trees. Make sure to protect each tree or shrub with a 5ft tree tube or small fence (conifers such as red pine and white pine may not require protection). Given the soil conditions and available planting space, a wide variety of trees and shrubs can be selected for this project including: white oak, northern red oak, paper birch, bigtooth aspen, quaking aspen, serviceberry, and witch hazel (shrub). Other trees/shrubs to select that would be in the “assisted migration” category include: bitternut hickory, shagbark hickory, blackgum, sassafras, tulip poplar, sycamore, and hackberry. Any of the species currently present in Unit 1 may also be planted. The landowner is encouraged to plant as many trees and shrubs as resources allow. But as a general guide, select 2-3 locations, planting

anywhere from 30-100 bare root seedlings each. It is recommended to plant each location either in the same year, or in successive years so that the maintenance schedule is roughly the same for each tree. Introduced trees must be watered at the time of planting, and should be watered consistently for the first three years after planting. Note: only water trees when the soil 6 inches below the surface is dry. Too much water can be problematic for trees. Currently, the planting effort in Unit 1 is planned for 2028.

Invasive Species Management

Unit 1 contains autumn olive, a non-native invasive shrub. Competition from this invading shrub jeopardizes the ability of native vegetation to naturally regenerate. It is recommended to control this shrub as soon as possible so that it does not continue to invade the stand. Fortunately, autumn olive is not very widespread throughout the unit.

A survey of autumn olive in this unit should be done prior to treatment to confirm the extent of the control efforts. There are two main options for controlling the plant, and both strategies may be used. The first strategy is manually hand-pulling seedlings (or with products like “weed wrench”) and removing/destroying them. For larger plants, chemical control will be necessary. This can be done by applying an appropriate herbicide with the cut-stump method. Late fall is one of the best times to use the cut-stump method, as the herbicide is more likely to kill the root system of the plant. Any treated areas should be monitored annually and re-treated if necessary. All herbicides must be used safely, applied by someone with appropriate credentials, and according to their label. See Appendix A for a bulletin regarding autumn olive management with more details. Controlling autumn olive in Unit 1 is scheduled for 2027.

Scots pine is also present in Unit 1. Scots pine is considered an invasive species in Michigan. Most Scots pine trees are non-merchantable (<4” DBH) and scattered. Once again, it is recommended to conduct a survey of Unit 1 for Scots pine trees to understand the full breadth of control efforts. Controlling Scots pine is straightforward: simply cut the trees down to the stump. The tops and roots will die without a need for herbicide, and the tops can simply be left to biodegrade in the unit while providing habitat for small animals. It is recommended to control all Scots pine trees throughout Unit 1 in the near future. Currently controlling Scots pine in Unit 1 is scheduled for 2027. Control efforts can occur at any time of year.

=====Monitoring and Additional Considerations – Unit 1=====

The significant deer browse on this property threatens the ability to regenerate a high quality stand. Monitor seedling regeneration in Unit 1 at least once every two years. Should deer browse continue to be an issue, consider implementing techniques described on pages 4-5. The method(s) selected may depend on the adequacy of the regeneration observed.

Follow-up treatments for the autumn olive and Scots pine control will be necessary to ensure all plants have been accounted for and to address plants that sprout from the seed bank. Monitor for these invasive plants at least once every two years, and control them as funds/resources allow.

It is also recommended to monitor any newly planted trees and shrubs once annually, checking for success versus mortality. Trees that have died may be replaced with new ones any time funds allow.

Retention of standing dead trees (snags) is of importance for this property. Snags create excellent cover for a variety of birds and animals offering protection from predation. Dead stems should remain standing to encourage activity from birds and small tree dwelling mammals.

Management Unit #2
Northern Hardwood Poletimber and Saplings



Management Unit Number: 2 Number of Acres: 23.7(+/-)

=====Major Objectives of Unit=====

Manage to promote quality hardwood regeneration and facilitate transition to mature northern hardwoods forest type.

=====Existing Conditions=====

Size Class: M5 (Northern Hardwood, Moderately stocked Poletimber) **Soil Type(s):** MeB – Mancelona-East Lake loamy sands (2-6% slopes), KaA – Kalkaska loamy sand (0-2% slopes)

Site Quality: Fair **Stand Quality:** Fair **Stand Density:** 80ft²/acre

Site Index: 58 (sugar maple)

Desired Future Condition:

The desired future condition (DFC) is a diverse northern hardwoods stand consisting of sugar maple, basswood, black cherry, residual American beech and other northern hardwoods associate species. A single tree and small group selection-style harvest is the desired regeneration harvest method. Natural regeneration is the desired regeneration method. Intermediate treatments should not reduce the average basal area below 80ft²/acre.

Management Unit Description:

Unit 2 consists of multiple sections of relatively young northern hardwood poletimber, as well as hardwood saplings. **Figure 3** shows that sugar maple dominates the species make up at

59% of trees tallied. The remaining trees are a fairly even mixture of other hardwoods and some white pine. Much like Unit 1, it appears most trees in Unit 2 are of a similar age, specifically the sugar maple. However, unlike Unit 1, Unit 2 has more of a closed canopy structure and fewer patches dominated by grasses. All size classes from 1" to 8" contain sugar maple, which is promising with respect to the goals for Unit 2 (**Figure 4**).

The soils in this unit are primarily Mancelona-East Lake loamy sands and Kalkaska loamy sand with a range of slopes from 2 to 6 percent. These soils are somewhat excessively drained with deep profiles, and as such are considered well suited for harvest equipment operability.

Similar to Unit 1, the ground layer includes little blue stem (but less common), bracken fern, interrupted club moss, fan club moss, as well as sedges such as long-stalked sedge. Again, most of this inventory was completed in late fall/early winter and with deep snow cover, so not all plants were present or identifiable. According to USDA ecological site classification for this unit (Snowy Sandy Drift), other plants that may occur here include: Canada mayflower, wild sarsaparilla, teaberry, and northern lowbush blueberry.

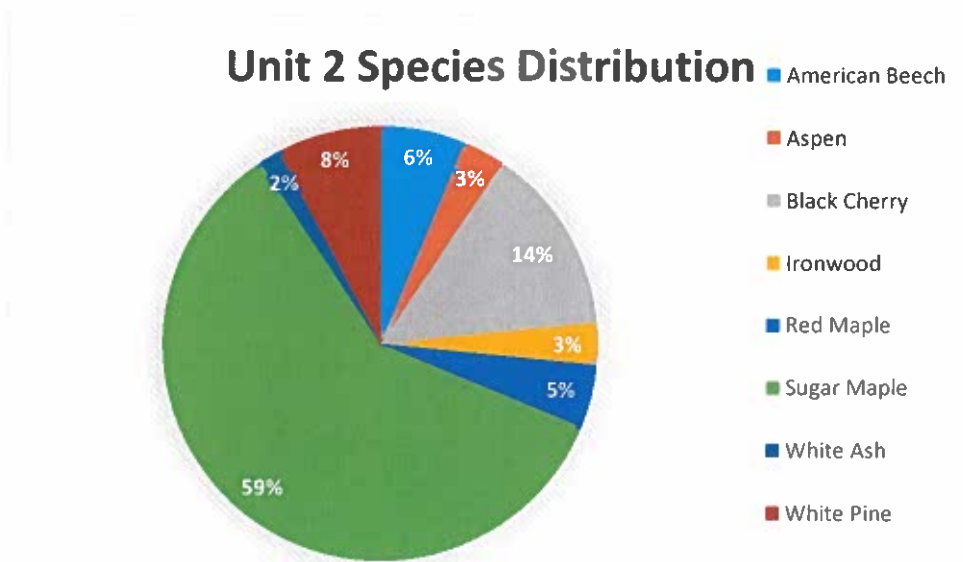


Figure 3. Proportion of trees tallied by species in Unit 2.

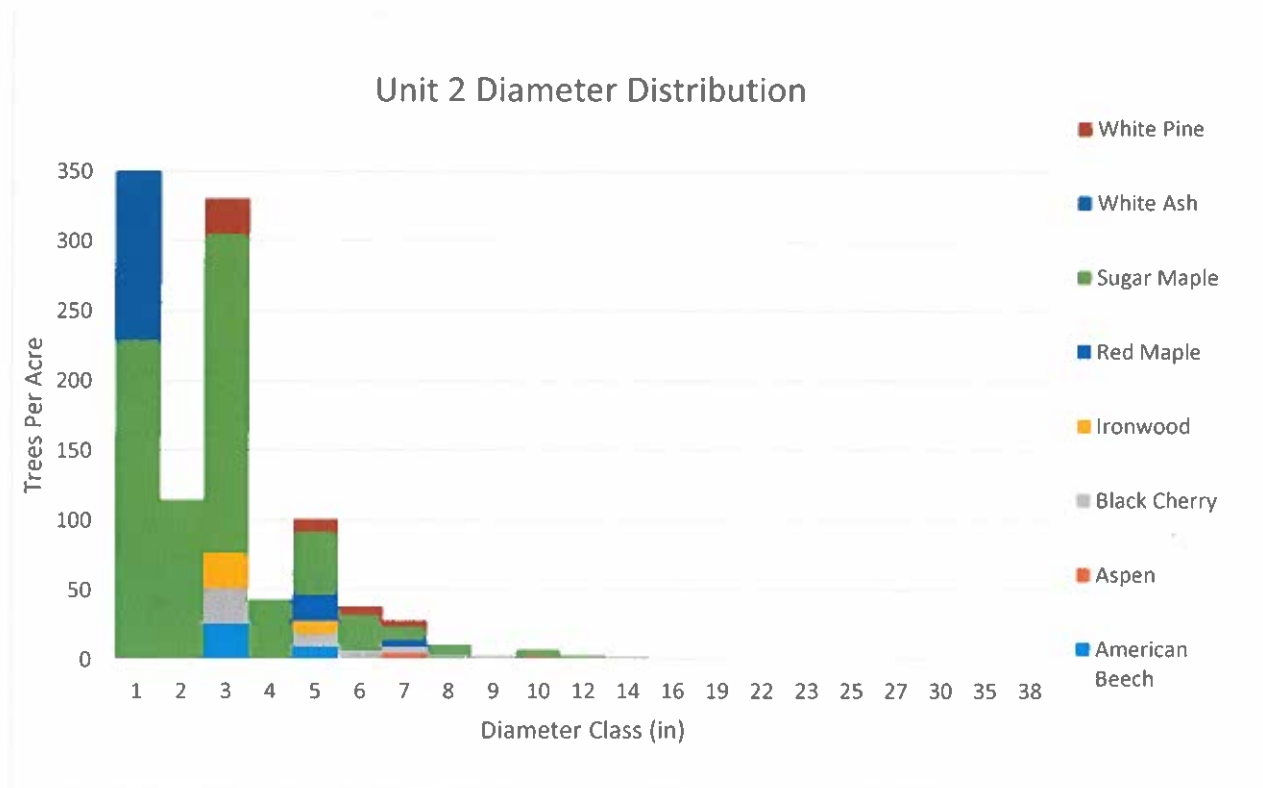


Figure 4. Diameter distribution of trees in Unit 2.

=====Planned Management Activities - Unit 2=====

In order to accomplish objectives for this unit, it is recommended to thin Unit 2 when the average basal area reaches 120ft² per acre, or in approximately 10 years. By this time, most of the trees in the stand will be of commercial size and thus can be commercially thinned. This first harvest entry to Unit 2 will follow these specifications: the harvest strategy is a low thinning. Trees selected for harvest will include poorly formed suppressed, or intermediate trees. Poorly formed codominant trees may also be selected in cases where it will release higher quality crop trees, or groups of well-formed saplings. This harvest should retain 80ft² of residual basal area per acre, and care should be taken to encourage species diversity wherever possible.

Successive harvests in Unit 2 will occur outside of this planning period (beyond 2046). The second entry to this unit should likewise occur when the basal area again reaches about 120ft² per acre, or about 10-15 years after the first harvest entry, and should likewise be a low thinning. Subsequent harvests after the second entry will most likely be single tree or small group selection style harvests as is typical of northern hardwood forest management.

=====Monitoring and Additional Considerations – Unit 2=====

Although heavy deer browse was noted in the seedling layer of this unit, there is a relatively high amount of sugar maple saplings already above the browse line, which can be promoted by following the recommended management. However, deer browse should still be monitored in this unit since the impact to the seedling layer has implications for long term forest regeneration. See Monitoring and Additional Considerations for Unit 1 for options regarding deer browse (pages 9-10). Deer browse should be monitored each year post harvest for at least 5 years to assess the impact on regenerating trees.

As with all units on the property, retain snags in Unit 2 to provide wildlife habitat.

Management Unit #3
Northern Hardwoods



Management Unit Number: 3 Number of Acres: 140.5(+/-)

=====Major Objectives of Unit=====

Improve stand quality during harvests. Maintain or improve species diversity with harvests and/or supplemental tree planting. Promote quality sapling regeneration by thinning undesirable saplings.

=====Existing Conditions=====

Size Class: M8 (Northern Hardwood, Moderately stocked sawtimber) **Soil Type(s):** KaA, KaB, KaC, KaD Kalkaska loamy sand (0-18% slopes)

Site Quality: Good **Stand Quality:** Poor **Stand Density:** 80ft²/acre

Site Index: 64 (Sugar Maple)

Desired Future Condition:

The desired future condition (DFC) is a diverse northern hardwoods stand consisting of sugar maple, basswood, yellow birch, black cherry, residual American beech and other northern

hardwoods associate species. A single tree or small group selection-style harvest is the desired regeneration harvest method. Intermediate treatments should not reduce the average basal area below 80ft²/acre. Natural and artificial regeneration is the desired regeneration method.

Management Unit Description:

Unit 3 is composed of typical northern hardwood species such as sugar maple, black cherry, red maple, American beech and others. As evidenced by some stumps, there has been a somewhat recent harvest in this unit, leaving the stand moderately stocked. Unfortunately, the most recent harvest was a “high grade” harvest. High grade harvests often look similar to typical northern hardwood selection style harvests to the untrained eye. However, a high grade removes *only* the most vigorous and most valuable trees, often the largest, leaving the forest with poorly formed or suppressed trees that are less able to regenerate the next cohort, produce quality



Image 4. Removing only half of a double-stem tree is a classic indication of a high grade.

timber, and/or handle pest or disease issues. While a high grade maximizes income in the short term, stand health, quality and resilience are reduced significantly in the long term.

Sugar maple is overwhelmingly dominant in Unit 3, with species like red maple, black cherry, American beech and ironwood making up a much smaller proportion (**Figure 5**). Musclewood (also known as American hornbeam) was found in two different locations in Unit 3. Musclewood is a native understory tree that is very uncommon in the general region. Care should be taken to promote and protect this relatively unique species in Unit 3 during all planned activities.

The soils in this unit are composed of Kalkaska loamy sands with little to moderate slopes. These soils are considered somewhat excessively drained and therefore well suited for harvest equipment operability.

Unit 3 Species Distribution

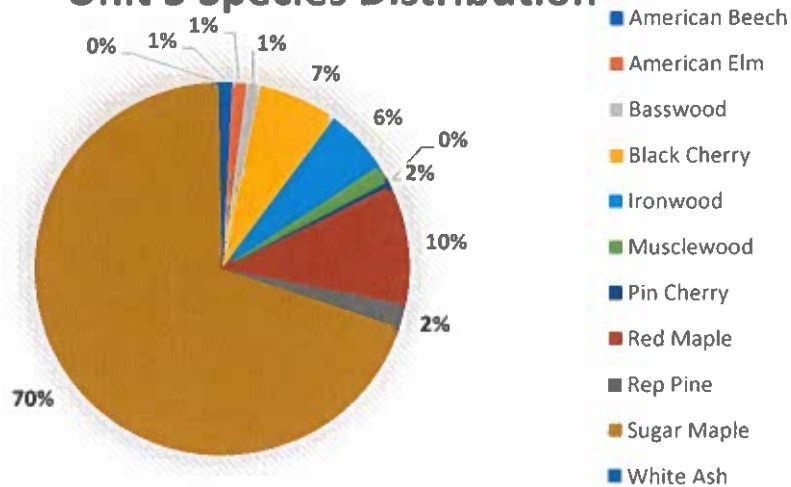


Figure 5. Proportion of species tallied in Unit 3.

Unit 3 Diameter Distribution (Scaled)

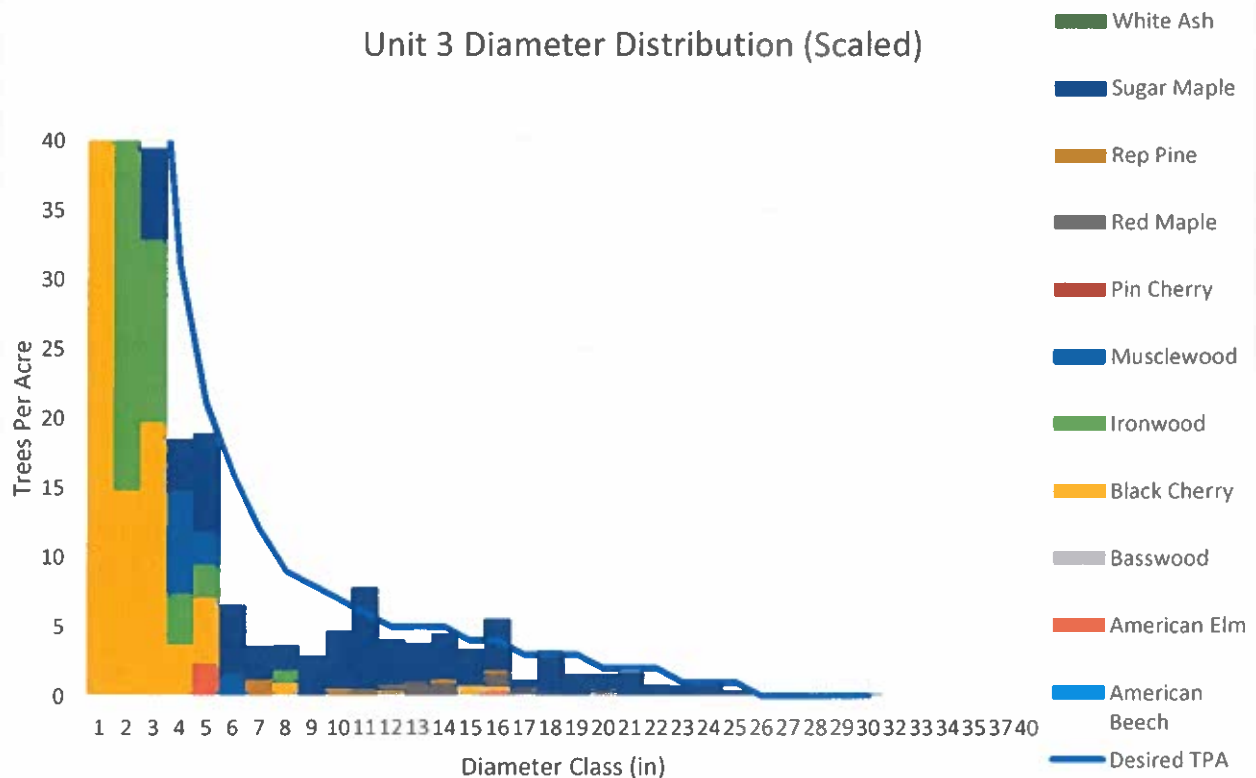


Figure 6. Diameter distribution of Unit 3. Many poletimber and sawtimber size classes are understocked. The y-axis is scaled to 40 TPA to better show the discrepancies.

=====Planned Management Activities - Unit 3=====

Currently, the number and spatial distribution of saplings (trees <4" DBH) in Unit 3 taller than 4.5ft would normally be considered adequate regeneration. However, quite a large number

of these saplings are ironwood (**Figure 6**, note that when scaled, the total amount of ironwood trees present in 1-2" diameter classes are not visible). While ironwood is a native and important northern hardwood associate species, it is an understory tree and does not produce large, high quality timber products at maturity. As such, the current abundance of ironwood in the understory jeopardizes the ability of the forest to not only regenerate a diverse suite of species, but produce forest products in the long term. It is therefore recommended to thin the understory ironwood trees, particularly around other more desirable saplings. For example, there is a clear cohort of young black cherry in similar size classes as the ironwood. Thinning ironwood saplings around black cherry saplings reduces competition and will help recruit the black cherry to the canopy. It is recommended to choose at least 3-5 areas of about 1 acre in size throughout Unit 3 within which to thin the ironwood saplings. Select areas dense in ironwood but also with other desirable saplings like sugar maple, black cherry, and red maple. Use loppers and or chainsaws to simply cut/remove a number of ironwood trees around the desirable trees. As many as 1/3 to 1/2 of the ironwood saplings in a given unit area may be removed as a part of this effort. Even this intensity of thinning will not eliminate or reduce ironwood's ecological significance to the forest. Rather it will help ensure other species will be able to reach maturity in the canopy and one day produce valuable wood products. This management action will be non-commercial since the trees being cut are too small to be sold as wood products. As such, it will be a good opportunity for volunteers or outdoor education students from Kingsley High School to help complete the work. It is recommended to complete the thinning within the next 3 years (2026-2029), and it may be completed all at once or in multiple phases. If outdoor education students are involved, thinning one, one-acre plot per semester over 3 years would result in 6 acres of treatment over 3 years thus exceeding the current recommendation. Optionally, one of the selected management areas can be placed near Hammer road such that future outdoor education classes can easily access and learn about the past management actions and their impact on the forest.

Additionally, it is recommended to commercially thin Unit 3 when the average basal area reaches 120ft² per acre, or in approximately 10-15 years. This first commercial harvest entry to Unit 3 is currently scheduled for fall/winter of 2036 and follow these specifications: the harvest strategy is a low thinning. Trees selected for harvest will include poorly formed suppressed, or intermediate trees in a variety of size classes. Poorly formed codominant trees may also be selected in cases where it will release higher quality crop trees or groups of well-formed saplings. Given the current diameter distribution, trees in the 11" class as well as 16" and 18" size classes should be preferentially harvested to an appropriate stocking level while other size classes will see less harvesting. This harvest should retain 80ft² of residual basal area per acre, and care should be taken to encourage species diversity wherever possible.

In order to increase species diversity, it is recommended to plant new species or species of low abundance in Unit 3 after the 1st commercial thinning (2037). Select areas that have been released or have canopy gaps due to the commercial thinning. Plant bare root seedling stock in selected locations and protect each tree from deer browse with a tree tube. Aim to plant trees on an approximately 10'x10' spacing within the area. As few as just 1 tree can be planted in a select location or up to as many as the space will allow. Generally, plant seedlings within newly formed canopy gaps, but consult your forester for more specific plant/site relation questions. Species that can be considered to add diversity include: yellow birch, eastern hemlock, and northern red oak. Trees that can be planted to increase abundance of current species include: red maple, basswood, and American elm (if resistant varieties available). Introduced trees must be watered at the time of planting, and should be watered consistently for the first three years after planting. Note: only

water trees when the soil 6 inches below the surface is dry. Too much water can be problematic for trees. Bare root stock is recommended.

Successive commercial harvests in Unit 3 will occur outside of this planning period (beyond 2046). The second entry to this unit should likewise occur when the basal area again reaches about 120ft² per acre, or about 10-15 years after the first harvest entry, and should likewise be a low thinning. Subsequent harvests after the second entry will most likely be single tree or small group selection style harvests as is typical of northern hardwood forest management. Thinning saplings and/or supplemental planting of tree seedlings/saplings throughout the unit is encouraged beyond the duration of this plan as well.

=====Monitoring and Additional Considerations – Unit 3=====

The extensive deer browse on this property threatens the ability to regenerate a high quality stand. As noted above (see pages 4-5), there are a number of considerations for addressing deer browse, and methods may depend on the adequacy of the regeneration observed after scheduled harvests.

Remember to water introduced tree seedlings as indicated above. Also, naturally regenerating tree seedlings may be protected with tree tubes. In addition to the introduced seedlings, consider selecting a number of well-formed natural seedlings to protect in canopy gaps. Monitor the introduced seedlings for survival at least once annually.

Retention of standing dead trees (snags) is of importance for this property. Snags create excellent habitat for a variety of birds and animals, offering protection from predation. Dead or dying stems with large cavities and low timber value should be retained to encourage activity from birds, small mammals and other wildlife.

Management Unit #4

Lowland Mixed Conifers and Hardwoods



Management Unit Number: 4 Number of Acres: 159(+/-)

=====Major Objectives of Unit=====

Maintain or improve tree diversity. Maintain features for wildlife and overall forest aesthetics. Monitor for lingering ash trees. Maintain or improve tree regeneration. Monitor for invasive pests.

=====Existing Conditions=====

Size Class: LM9 (Lowland Mixed, Well-stocked sawtimber) **Soil Type(s):** Rs – Rifle peat, CpA – Croswell loamy sands (0-2% slopes), Gladwin-Richter gravelly sandy loams (2-6% slopes).

Site Quality: Fair **Stand Quality:** Good **Stand Density:** 126ft²/acre

Site Index: 40 (Balsam Fir)

Desired Future Condition:

The desired future condition (DFC) is a diverse lowland mixed stand consisting of conifers like balsam fir, white cedar, and eastern hemlock, as well as hardwoods like red maple, basswood, yellow birch, and paper birch. No commercial silvicultural treatments are recommended for this unit at this time. Natural regeneration is the desired regeneration method. Protecting natural regeneration and artificial regeneration is encouraged.

Management Unit Description:

Unit 4 hosts a diverse mix of lowland tree species and part of Anderson Creek. In most of Unit 4 during the late fall when the inventory occurred, the soils were saturated. Unit 4 also contains the transitional areas between lowlands and uplands where lowland tree species dominate or are common, but the soils were no longer saturated. With 15 tallied tree species, Unit 4 is by far the most diverse unit on the property. Red maple, white cedar, and balsam fir make up 72% of trees tallied, with the other species filling the remainder in a somewhat even split (**Figure 7**). Black ash, balsam fir, and red maple in particular are commonly found above the browse line in Unit 4. That being said, many seedlings below the browse line were heavily browsed, so there is “mixed evidence” in terms of how significantly deer browse is affecting regeneration in Unit 4. However, given the broad regional trends with respect to deer browse and tree regeneration, it is reasonable to assume tree protection measures will be necessary to perpetuate a healthy forest (see Planned Management Activities for Unit 4 for more).

Looking at the diameter distribution below (**Figure 8**), it appears there are relatively even-aged cohorts of red maple and white cedar making up the larger size classes (the canopy). Balsam fir dominates the understory size classes, but it is also worth noting that black ash has fair representation in the seedling to sapling size classes, particularly the 1-inch size class.

Figure 8 is scaled in order to have the best overall picture of the diameter distribution, however, black ash has nearly 3 times the representation in the 1-inch diameter class than balsam fir (166 trees per acre vs. 55 trees per acre). Black ash is highly preferable to emerald ash borer, and considering the substantial regeneration in Unit 4, it is worth monitoring for lingering/resistant black ash (see Monitoring and Additional Considerations – Unit 4).

Lowland and wetland areas like Unit 4 are often operationally restricted for commercial timber management, but they play an important role in the local and broader ecosystem. They are diverse forests that are critical for flood control, water filtration, wildlife habitat, carbon sequestration and storage, and other ecosystem services. The dense pockets of cedar in parts of this unit, for example, are excellent winter thermal cover white-tailed deer.

The soils in this unit are primarily rifle peat. Rifle peat soils are deep organic soils that are very poorly drained with very low runoff. They are poorly suited for harvest equipment operability. Rifle peat soils are considered a Snowy Mucky Depression site according to USDA ecological site classification, meaning it will support such herbaceous plants as skunk cabbage, bulblet fern, and yellow marsh marigold. Again, not all plants were visible or easily identifiable as inventory was completed in the late fall/early winter. The other soils that are included in Unit 4 are generally on the edges of the unit and these soils are not saturated.

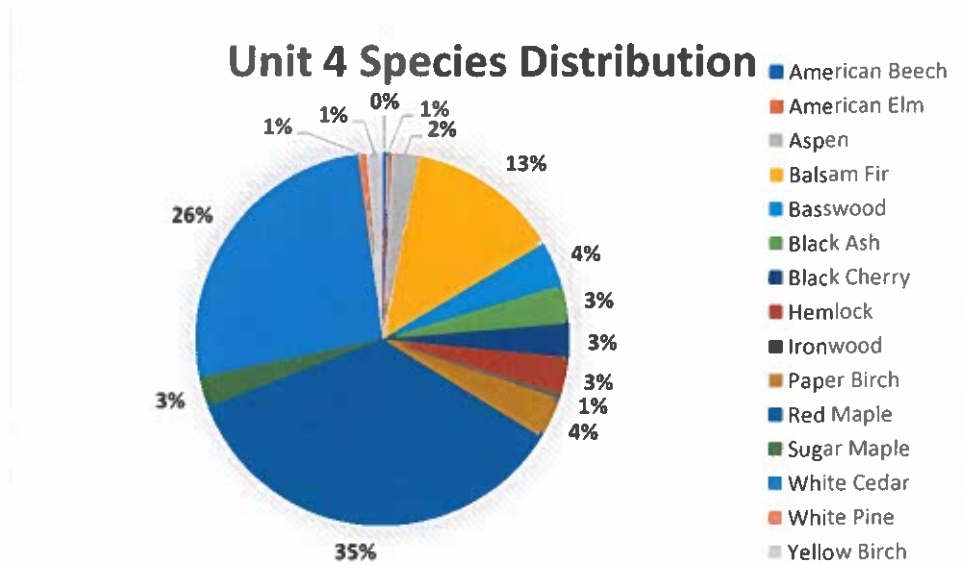


Figure 7. Showing the proportion of tree species tallied in Unit 4. Unit 4 is the most diverse unit on the property.

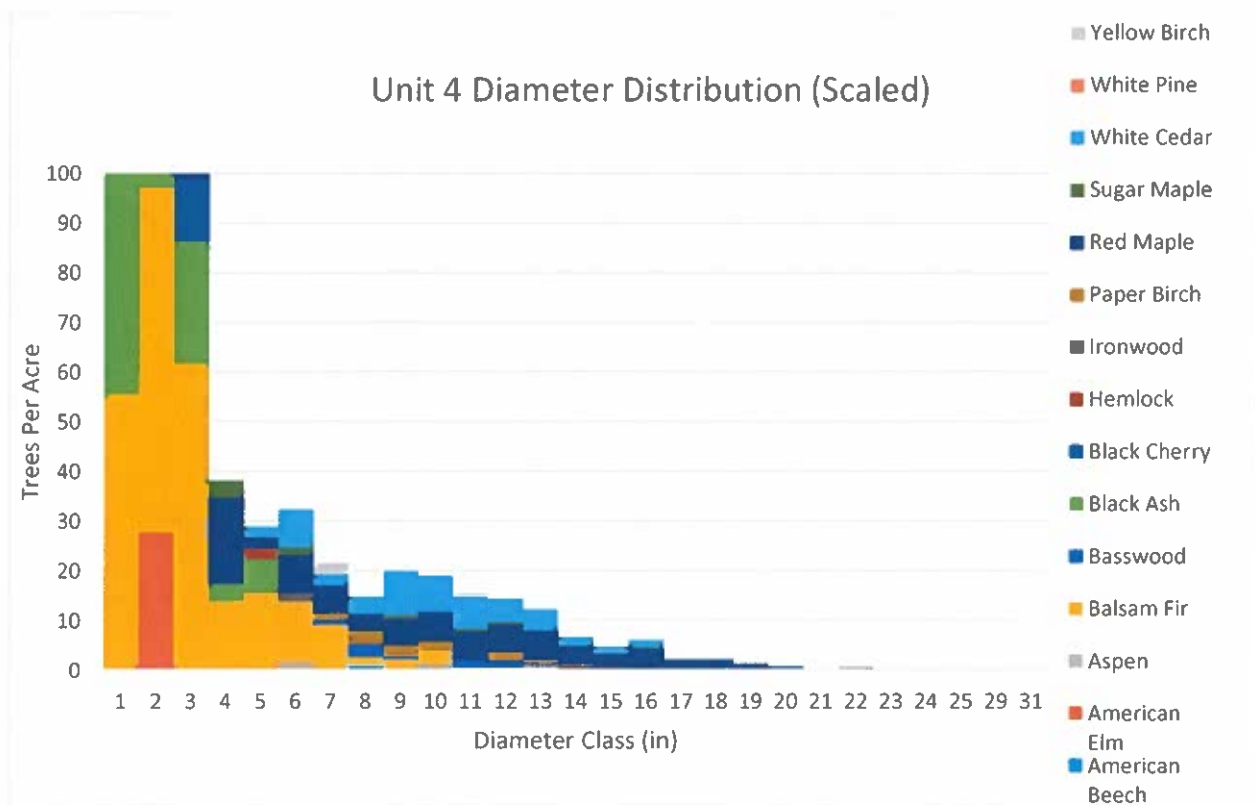


Figure 8. Diameter distribution of Unit 4.

=====Planned Management Activities - Unit 4=====

Given the current forest dynamics in Unit 4, commercial harvesting is not recommended at this time. The soils in the area will prohibit access from machinery—potentially year-round in the wettest spots, and the main objectives for this unit can be accomplished without commercial harvesting.

In order to enhance natural regeneration, it is recommended to protect natural seedlings with tree tubes. Select naturally growing seedlings with good form below the browse line to protect with a 5ft-tall tube. Seedlings growing in natural canopy openings are good candidates for protection. It is recommended to select at least 3-5 canopy gaps/areas to install protection tubes, though as much protection as funds allow is encouraged. If possible, protect trees with approximately 10ft x 10ft spacing. (Note: fencing is also a great alternative for protecting seedlings from browse, though considering the characteristics of Unit 4 tree tubes are likely easier to install and provide maximum flexibility for protecting individual trees).

Artificial regeneration is encouraged though not strictly necessary in Unit 4. The landowner may improve regeneration quality by planting trees and protecting trees in addition to protecting natural seedlings. If the landowner pursues this option, select the same or similar areas as those for protecting natural regeneration, and make sure that the species selected is a good match for the planting site.

Optionally, both methods of protecting and planting trees above may be completed in tandem with purposely created canopy gaps. In other words, the landowner may purposely fell single trees, or small groups of trees and subsequently plant and/or protecting regenerating trees. For example, the landowner may choose to fell a large hemlock tree in a group of mature hemlocks, and then protect naturally regenerating hemlock seedlings that sprout in the canopy

gap, or on the newly created “nurse log.” (Hemlock are perhaps the most common example of trees in Michigan that are heavily reliant on nurse logs for regeneration. Nurse logs are trees that have died and fallen to the forest floor on which regenerating seedlings grow. The decaying log provides a micro-site for establishing hemlocks that can help them gain an edge over competing seedlings. Balsam fir, yellow birch, and other trees will benefit from nurse logs as well.) Such canopy gaps can be created as resources allow during the course of this plan. As a guide, about 10 gaps/planting areas can be created during the plan length, though it is best if only as many gaps as the landowner can reasonably monitor and maintain during the course of the plan are created. About 15 canopy gaps is a recommended upper limit to the number of gaps created during the plan timeline. As noted above, leave any trees that are felled when creating canopy gaps, the coarse woody debris is not only good as a nurse log but also as wildlife habitat.

In regards to species selection for planting, the landowner may select any of the trees that currently occur in Unit 4. To increase diversity, the landowner may also select from the following: tamarack, black spruce, slippery elm, or green ash (though pest/disease issues may be problematic for these latter two species). Planting and protecting seedlings in Unit 4 is scheduled to begin in 2029. Creating canopy gaps and additional planting/protection efforts can occur in any year resources allow.



Image 5. A small hemlock tree growing on a decaying tree. An excellent example of a natural seedling that is worthy of protection from deer browse.

=====Monitoring and Additional Considerations – Unit 4=====

Monitor regeneration in Unit 4 once every two years by walking transects and noting any damage done to seedlings: identify priority areas for protection from deer and install tree tubes or other protections as necessary and as funds allow. It is suggested to monitor the impact of deer browse in this unit every other year for the duration of the plan.

Unit 4 contains hemlock trees which are vulnerable to an emerging non-native invasive insect pest called hemlock woolly adelgid (HWA). Unit 4 should be monitored for HWA once annually in the winter when the pest is easiest to spot (January through March). See Management Timing and Forest Health Issues (page 5) for more information on the pest. If found, create a plan with your forester to manage and/or treat mature specimens or priority areas.

As mentioned before, black ash is highly preferred by emerald ash borer (EAB), and as a result there are no live, mature black ash throughout the unit—they were killed by the initial EAB infestation. However, the seedling class, particularly in the south of Unit 4 is abundant in black ash regeneration from the former canopy trees. It is possible, though unlikely, that some of these regenerating trees have a natural resistance to EAB. It is recommended to monitor Unit 4 at least every 2-3 years, watching and identifying any ash trees that may be resistant to EAB infestation, especially those greater than 4” DBH.

Management Unit #5

Aspen Stands
Management Unit Number: 5 Number of Acres: 10.4(+/-)

=====Major Objectives of Unit=====

Maintain young, even-aged stands of aspen on the property for wildlife use and general ecological diversity. Diversify age classes among the aspen subunits.

=====Existing Conditions=====

Size Class: **Soil Type:** GrA, GrB – Gladwin-Richter gravelly sandy loams (0-6% slopes), RWD – Rubicon sand (6-18% slopes)

Site Quality: Fair **Stand Quality:** Fair **Stand Density:** 117ft² /acre

Site Index: 55 (bigtooth aspen)

Desired Future Condition:

The desired future condition in Unit 5 is even-aged aspen stands. The desired regeneration harvest strategy is a clear cut, and natural regeneration is the desired regeneration method. Intermediate treatments will likely not be necessary. The various subunits of aspen will be of different ages to each other to ensure early successional aspen habitat is consistently present on the property.

Management Unit Description:

As expected, Unit 5 is overwhelmingly dominated by aspen, with minor presence of other species like cherry, red maple, and balsam fir. The property contains four areas, or subunits, of aspen trees. All four subunits contain mostly non-merchantable trees (i.e. less than 4" DBH), or small poletimber trees, suggesting the trees are of a similar age or part of a clone.

=====Planned Management Activities - Unit 5=====

In order to accomplish the objective for this unit, it is recommended to complete a commercial harvest on the southern two subunits within the next 5 years (2026-2031). This harvest will consist of the following strategy: clear cut the aspen trees. All merchantable, well-formed non-aspen trees should be left standing for species and structural diversity (suppressed or poorly formed non-aspen trees may be removed as part of this harvest). As many snags as can safely be maintained should also remain. The harvest should be completed in winter with frozen ground as the soil surrounding the subunit is generally more poorly drained; a clear path of dry ground to this subunit during the growing season may be difficult. (Note that the purpose of this harvest strategy is to regenerate the aspen, harvesting in the winter also encourages a better response from the regenerating aspen). This harvest is currently set for 2030.

The two northern most subunits contain mostly non-merchantable aspen trees in 2026. Therefore, to accomplish objectives for this unit, it is recommended to commercially harvest the two northern most subunits in about 10-15 years when the vast majority of trees will be of commercial size. The strategy for this harvest is the same as above: clear cut the aspen trees. All merchantable, well-formed non-aspen trees should be left standing for species and structural diversity (suppressed or poorly formed non-aspen trees may be removed as part of this harvest). As many snags as can safely be maintained should also remain. The harvest should occur in the winter. This harvest is currently set for 2038. This harvest schedule will also create two different age classes among the aspen groups, which increases structural and habitat diversity.

Future harvests in Unit 5 should follow a similar strategy as the above so long as the goal of the landowner is to maintain the aspen component on the property. A typical aspen stand rotation length in Michigan is about 40-70 years. Since the main purpose of harvesting aspen is to create early successional habitat (encouraging use from species like ruffed grouse or woodcock), a shorter rotation length of 30-35 years may be used, depending on tree size and markets.

=====Monitoring and Additional Considerations – Unit 5=====

Even with overpopulated deer herds, vigorously regenerating aspen can often “win the race” against deer browse. Clear cutting the aspen subunits in winter should encourage such aggressive regeneration. That said, it is still worth monitoring Unit 5 at least every year or two after harvesting for the first 5 years to ensure regeneration is adequate.

Management Unit #6

Meadows



Management Unit Number: 6 Number of Acres: 38.5(+/-)

=====Major Objectives of Unit=====

Create and maintain a meadow of native grasses and herbaceous plants for wildlife use and ecological diversity. Maintain or improve diversity of native plants in the unit.

=====Existing Conditions=====

Size Class: N/A **Soil Type(s):** GrA – Gladwin-Richter gravelly sandy loams (0-2% slopes), KaB, KaF – Kalkaska loamy sand (2-25% slopes)

Site Quality: Fair **Stand Quality:** N/A **Stand Density:** N/A

Site Index: N/A

Desired Future Condition:

The desired future condition in Unit 6 is a meadow consisting of a mix of native grasses and other native herbaceous plants. Open grown individual trees or small clumps of trees may also occur in the unit.

Management Unit Description:

Unit 6 primarily consists of herbaceous plants. Volunteer trees are also present, most of which are black cherry, white pine, and occasionally Scots pine. Grasses and herbaceous plants present in Unit 6 include: little bluestem, timothy grass, smooth brome, and spotted knapweed. With the exception of little blue stem, all of the other plants listed are not native to North America. Not all plants were easily identifiable in the winter and/or due to snow cover. That said, Unit 6 is generally dominated by little bluestem, and as a result it is worth a proactive approach: the habitat is not so overrun with invasive plants such that maintenance efforts made in the near term will save larger efforts later. Without active management, it is possible non-native invasive plants start to outcompete native species.

=====Planned Management Activities - Unit 6=====

The best way to maintain the meadow habitat is to incorporate the use of prescribed fire. Historically, fire played a very important role for these ecosystems. Today, prescribed fire can help control spotted knapweed and other weeds, and promote growth of desirable species. The use of prescribed fire may pose a logistical challenge but is highly recommended as a maintenance tool in the context of grasslands/meadows. It is recommended to consult with prescribed fire professionals when considering using fire as a management tool. Also, notifying local law enforcement and fire departments prior to a burn is essential, especially because burn permits are often required. Prescribed fire recommendations for Unit 6 are as follows: Over the course of this plan, it is recommended to complete two burns in the near future, each occurring in a relatively short period of time, and a third burn later. Currently, it is recommended to burn in 2028, 2030, and 2040. Each burn should be completed in the mid to late spring. This is likely to provide a good balance of controlling spotted knapweed, and promoting native grasses to outcompete non-natives. The burn should be of moderate to low severity, which shouldn't kill root stock for native grasses. Seeding native grasses or other desirable native plants after a burn is also recommended if recourses allow. More general information on native grasses and prescribed fire can be found in appendices E-I. Ideally, all of Unit 6 should be treated, but again this will be logistically difficult. Selecting a priority area to burn instead (e.g. a 10ac subsection) is probably more realistic (landowner and forester can select together). Burns should be repeated on the same section in order to achieve the desired effect.

Another optional (but highly encouraged) management activity for Unit 6 includes installing birdhouses/nesting boxes along the edge of the unit. Birdhouses can be purchased from local crafters, or handmade. This is a great project for Kingsley High School students if resources allow. Students could make and install birdhouse for Unit 6 as a part of a school project for the outdoor education class. Each student or groups of students could be assigned to build (or find for purchase) a birdhouse that will suit a given species of bird.

Invasive plants in Unit 6 may be address with mechanical or chemical control methods in addition to prescribed fire. However, given the size of Unit 6, it will probably not be as cost-effective as using fire. That being said, if time, labor and resources allow, mechanical and chemical control of invasive plants is welcomed and encouraged at any time during the plan. Establishing priority areas for these treatments, should they occur, will help direct control efforts.

=====Monitoring and Additional Considerations – Unit 6=====

When timed correctly, prescribed fire can help control non-native spotted knapweed. However, best results usually come from burning annually, which may not be as beneficial to native plants, or logistically feasible. Follow-up treatments will likely be necessary with respect to controlling spotted knapweed. Other options for spotted knapweed control included hand pulling or herbicides (see Appendix J for more information). Controlling spotted knapweed or other invasive species in Unit 6 is encouraged at any time resources allow.

Management Unit #7

Non-forested wetlands and water features

Management Unit Number: 7 Number of Acres: 19.1(+/-)

=====Major Objectives of Unit=====

Maintain quality wetland habitat and ensure any management activities in Unit 7 or adjacent units maintain or enhance water quality.

=====Existing Conditions=====

Size Class: Soil Type: Rs – Rifle peat, Rv – Roscommon sand

Site Quality: Good **Stand Quality:** N/A **Stand Density:** N/A

Site Index: N/A

Desired Future Condition:

The desired future condition in Unit 7 is high quality wetland habitat.

Management Unit Description:

Unit 7 consists of the non-forested wetland areas around Anderson Creek, and an area more recently ponded due to beaver activity in the south eastern section of the property.

=====Planned Management Activities - Unit 7=====

No forest management activities are planned for Unit 7. All forest management activities in adjacent units should follow the State of Michigan's Forestry Best Management Practices for Soil and Water Quality to ensure water resources are conserved in Unit 7. Currently, there were no invasive plants recorded in this unit. If any are found, the landowner is encouraged to control the plants as resources allow.

=====Monitoring and Additional Considerations – Unit 7=====

Monitor for invasive wetland plants once every two years. Control invasive plants as necessary and as funds allow.

Forest Management Plan for Kingsley Area Schools

Hammer Road Parcel

402 Fenton Street,

Kingsley, MI 49649

Property Location: 480 Acres within W ¼ of Section 27, T25N R11W, Paradise Township, Grand Traverse County, Michigan

Plan Start Year: 2026

Plan End Year: 2046

Tabular Timeline*:

Unit #	Unit Size (ac)	Management Activity	Year(s) Planned	Year(s) Complete
All	480	Consider Hunting Program to Control Deer Populations	2026-2046	
1	92	Tree & Shrub Planting (Spring)	2028	
		Autumn Olive Survey & Control (Fall, monitor bi-annually)	2027	
		Scots Pine Survey & Control (monitor bi-annually)	2027	
		Monitor Deer Browse (bi-annually)	2026-2046	
		Monitor Planted Trees (annually)	2029-2046	
2	23.7	Commercial Thinning	2036	
		Monitor Deer Browse (annually/bi-annually)	2038-2046	
3	140.5	Non-Commercial Thinning Understory Saplings	2026-2029	
		Commercial Thinning	2036	
		Tree Planting in Canopy Gaps (Spring)	2037	
		Monitor Planted Trees (annually)	2038-2046	
4	159	Protect/Plant Seedlings (Spring)	2029	
		Create Canopy Gaps/Protect Seedlings	Variable (2026-2046)	
		Monitor for Hemlock Woolly Adelgid (HWA) (Winter, annually)	2026-2046	
		Monitor Tree Regeneration & Protected Trees (bi-annually)	2026-2046	
		Monitor for Lingering Ash (bi-annually)	2026-2046	
5	10.4	Commercial Regeneration Harvest – Clearcut Southern Subunits (Winter)	2030	
		Commercial Regeneration Harvest – Clearcut Northern Subunits (Winter)	2038	
6	38.5	Prescribed Burn (Spring)	2028	
		Prescribed Burn (Spring)	2030	
		Install birdhouses (optional, anytime)	2026-2046	

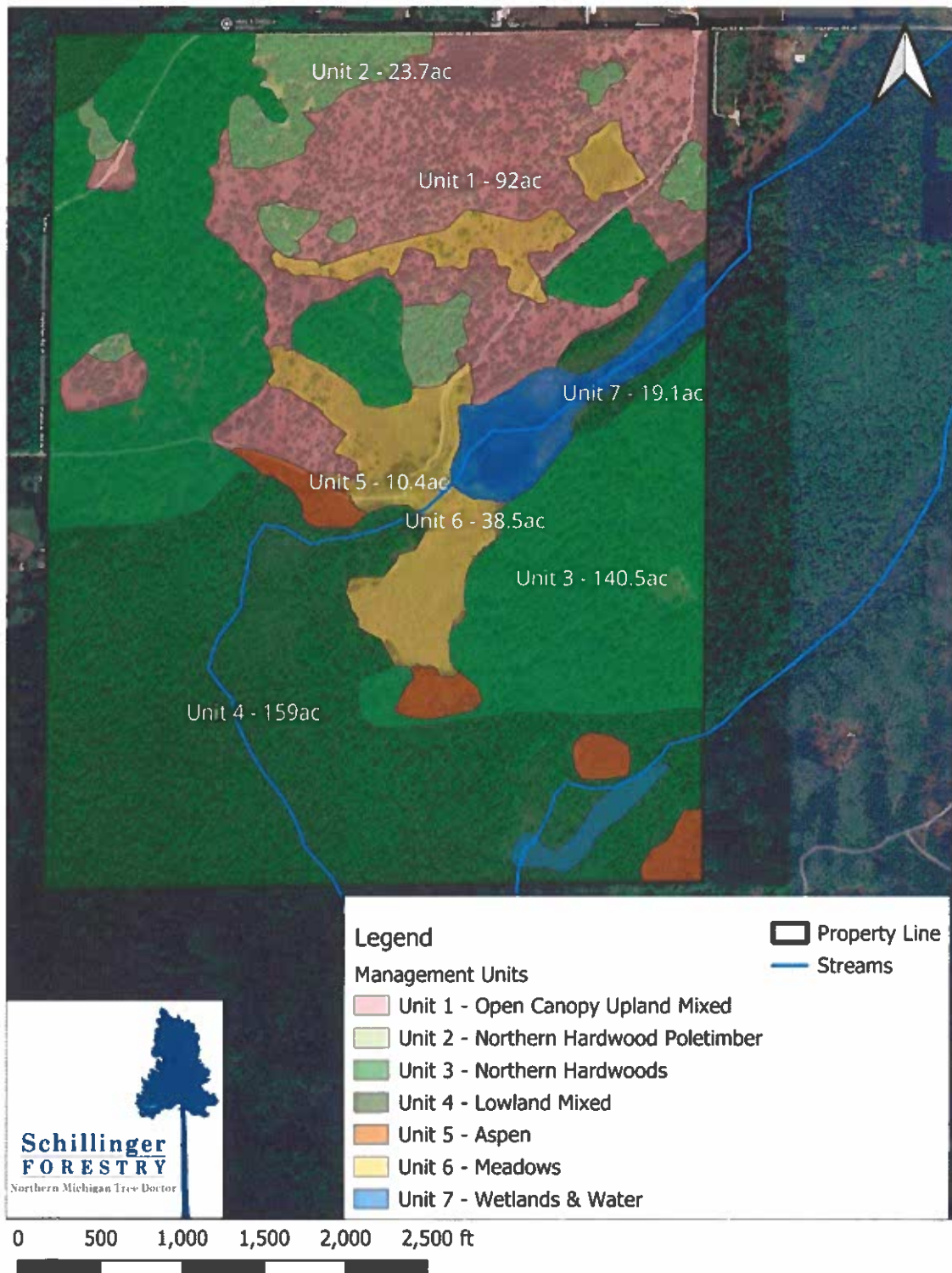
7	19.1	Prescribed Burn (Spring)	2040	
		Spotted Knapweed Control (As Resources Allow)	2026-2046	
		Monitor for Invasive Plants (bi-annually)	2026-2046	

*Note on Management Timing: Management activities are not required to be completed in the year listed on the timeline. There is room for flexibility. However, the timeline is currently designed to be compatible with other Kingsley Area Schools property timelines. Regardless of the date listed/when management occurs, all management activities should follow best practices with respect to forest health, pest and disease issues listed on pages 4-5.

Kingsley Area Schools

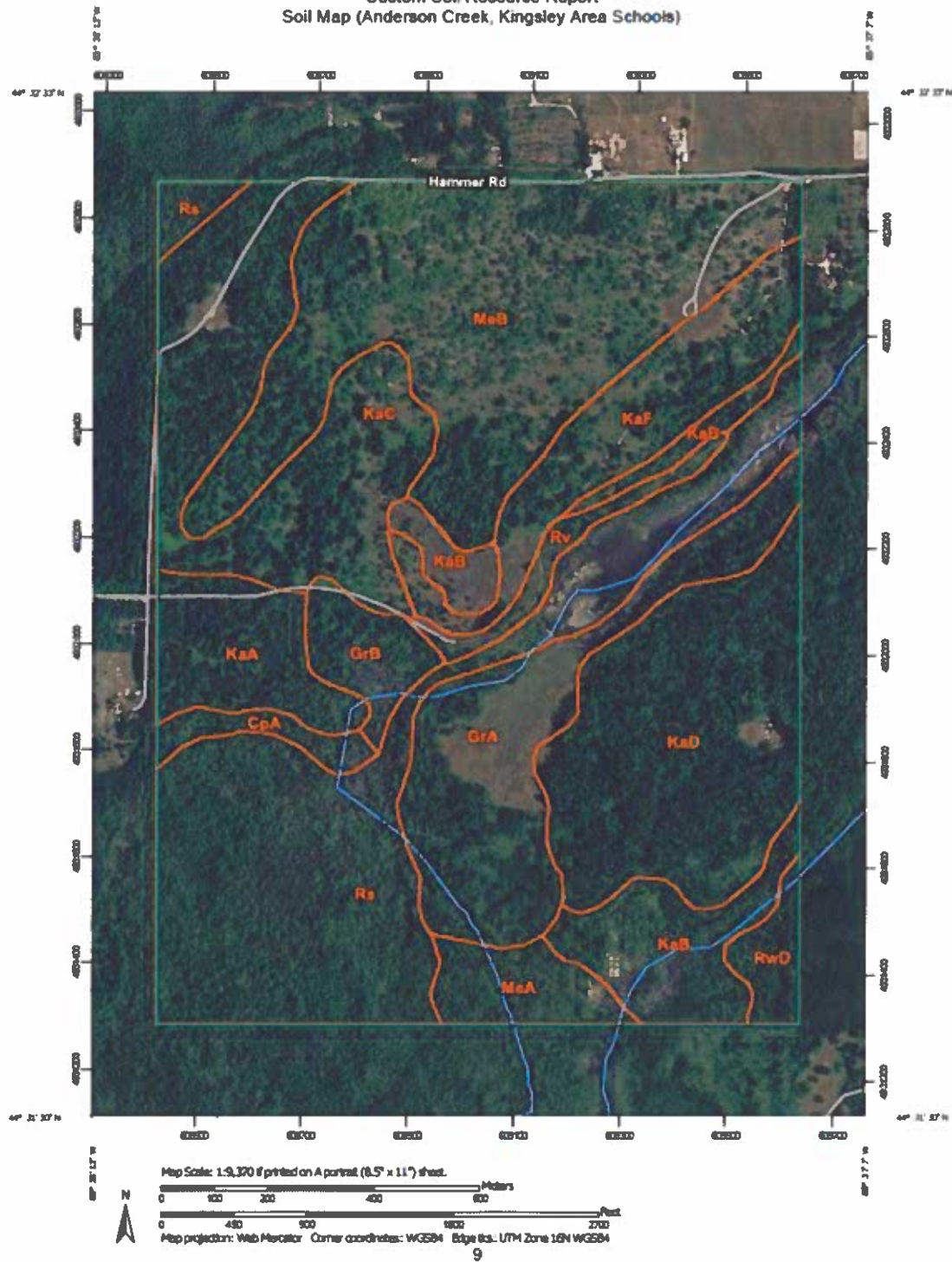
Hammer Road Parcel - Management Map

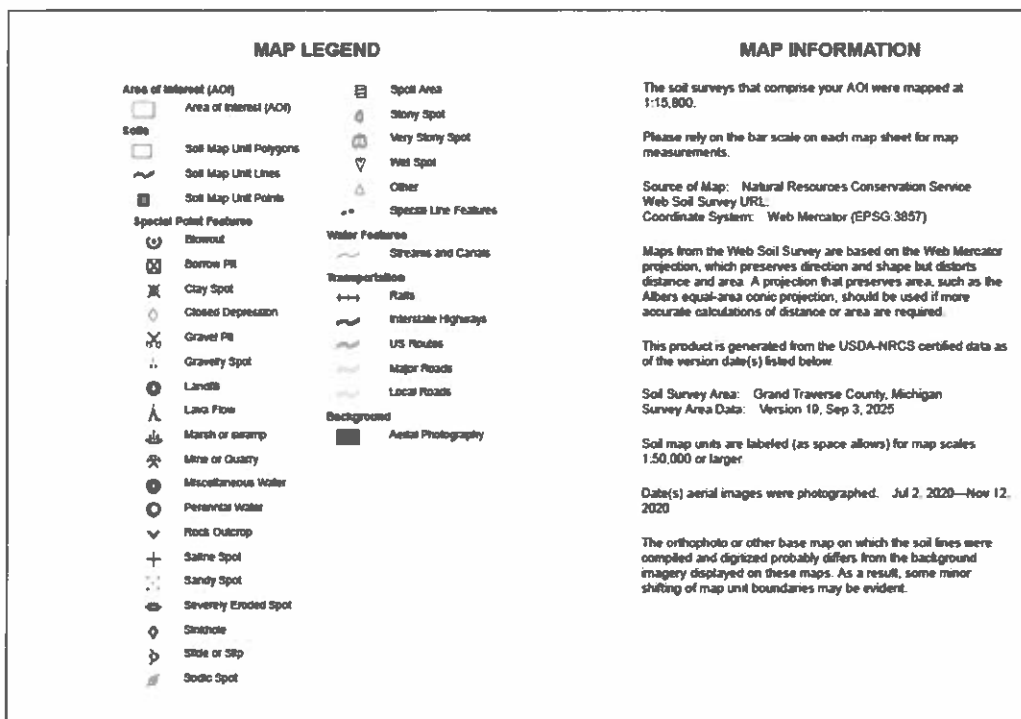
Property Location: 480 Acres within W ¾ of Section 27, T25N
R11W, Paradise Township, Grand Traverse County, Michigan



Soils Map

Custom Soil Resource Report
Soil Map (Anderson Creek, Kingsley Area Schools)





Map Unit Legend (Anderson Creek, Kingsley Area Schools)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CpA	Croswell loamy sands, 0 to 2 percent slopes	5.7	1.2%
GrA	Gladwin-Richter gravelly sandy loams, 0 to 2 percent slopes	44.4	9.4%
GrB	Gladwin-Richter gravelly sandy loams, 2 to 6 percent slopes	10.4	2.2%
KaA	Kalkaska loamy sand, 0 to 2 percent slopes	19.9	4.2%
KaB	Kalkaska loamy sand, 2 to 6 percent slopes	29.9	6.3%
KaC	Kalkaska loamy sand, 6 to 12 percent slopes	59.4	12.5%
KaD	Kalkaska loamy sand, 12 to 18 percent slopes	61.1	12.9%
KaF	Kalkaska loamy sand, 25 to 45 percent slopes	30.9	6.5%
MeA	Mancelona-East Lake loamy sands, 0 to 2 percent slopes	11.7	2.5%
MeB	Mancelona-East Lake loamy sands, 2 to 6 percent slopes	99.5	21.0%
Rs	Rifle peat	88.7	18.7%
Rv	Roscommon sand	6.9	1.4%
RwD	Rubicon sand, 6 to 18 percent slopes	6.2	1.3%
Totals for Area of Interest		474.8	100.0%

Map Unit Descriptions (Anderson Creek, Kingsley Area Schools)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class.