
Tree Management Report

for

St. Thomas' Church

Prepared for:

St. Thomas Church
7020 Camp Hill Road
Fort Washington, PA 19034



Prepared by:



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TABLE OF CONTENTS

EXECUTIVE SUMMARY / MAJOR FINDINGS 3

INTRODUCTION..... 4

BACKGROUND, ASSIGNMENT & METHODS..... 5

GENERAL TREE MAINTENANCE PRIORITIES 7

FINDINGS, DISCUSSIONS, AND RECOMMENDATIONS..... 8

 A. *Tree Life Expectancy*.....8

 B. *Tree removal, In-Depth Inspection & Pruning needs*.....9

 Tree Removals:9

 In-Depth / Hazard Inspections:9

 Tree Pruning:10

 C. *Cabling and Bracing*12

 D. *Mower Damage*13

 E. *Tree Planting*14

 F. *Deer Issues and Fencing*16

 G. *Mulch Management*.....18

 H. *Emerald Ash Borer*.....19

 I. *Hemlock treatments:*.....19

 J. *Leaving Deadwood / Snags*20

 K. *Various Other Issues*.....21

ADMINISTRATIVE AND TREE MAINTENANCE TOPICS 23

 L. *Updating The Tree Inventory/Assessment & GIS Map*23

 M. *Establishing an Arboretum*24

 N. *Arbor Day*25

 O. *Tree Maintenance Budget Estimate*26

 P. *Tree Memorialization/Commemoration Policy*27

 Q. *Various Tree-related issues*27

 R. *Conceptual Tree Plans for Various Locations*30

RECOMMENDATIONS SUMMARY 34

ASSUMPTIONS AND LIMITING CONDITIONS..... 37

CERTIFICATION..... 37

APPENDIX 1: PROJECT AREA 38

APPENDIX 2: 10-YEAR ARBORICULTURAL BUDGET 39

APPENDIX 3: LANDSCAPE SUB-AREAS 40

EXECUTIVE SUMMARY / MAJOR FINDINGS

From June through August 2022, the Consultants conducted a tree inventory and assessment at the St. Thomas’ site. Detailed recommendations applicable to individual trees are made in the spreadsheet data submitted with this report. Major observations, findings and recommendations included the following:

Item (spreadsheet code)	Number	% of total
Total number of trees (no stumps, shrubs, etc.)	636	100.0%
Tree Life Expectancy		
>15 years	466	73.3%
5-15 years	104	16.4%
<5 years	48	7.5%
dead or nearly so	15	2.4%
need a more in-depth inspection ("?" in Life Exp column)	3	0.5%
Tree Removal (Re)		
	38	6.0%
Highest priority (a)	13	2.0%
Intermediate priority (b)	10	1.6%
Lower Priority (c)	15	2.4%
Trees that need a removal/retention decision (cr in Re column)	31	4.9%
Tree Pruning (G Pr) Total		
	300	47.2%
High priority (a1,2,3)	6	0.9%
Intermediate priority (b1,2,3)	24	3.8%
Low Priority (c1,2,3)	270	42.5%
Maintenance Score		
Mower root damage	164	25.8%
Mower trunk damage	40	6.3%
Mulched too deep	29	4.6%
Mulch needed	24	3.8%
Tree planted deep	11	1.7%

INTRODUCTION

Founded in 1698 soon after the first English settlements in Pennsylvania, **St. Thomas Episcopal Church** has survived for more than three centuries to become a flourishing congregation in Ft. Washington, PA. St. Thomas' Church campus includes 42 acres, nine separate buildings and more than a mile of roadway. The ~15-acre cemetery is managed by the Cemetery Commission; the Buildings and Hardscape Commission is responsible for the buildings, walkways and roads. The St. Thomas Landscape Commission ("STLC"), formed in 2010, has primary management responsibility on all acreage, other than that managed by the Cemetery and Hardscape Commissions.

The STLC's management responsibility includes the many large, mature trees that are the landscape's dominant element that help define space; screen and frame views and provide shade and other important benefits. Trees are an important green resource at the Church and their contributed and perceived value warrants efforts to manage and preserve them.

While trees are valuable assets, their great size and bulk make them potential safety hazards if not properly and routinely inspected and remedied of detected problems. As discussed, the maintenance of the mature trees in a safe condition remains a high priority at the St. Thomas. Acknowledging this, the STLC had contracted Morris Arboretum's Urban Forestry Consultants ("MAUF" or "the Consultants") in 2013 to propose tree-related services for the Church.

At that time, the MAUF completed a tree assessment that identified only trees with egregious, visually-apparent hazardous conditions, produced a map of these trees and a tree management report with recommendations about the 68 assessed trees. One of the report's recommendations was to "...plan for and complete a full tree inventory and assessment, which would provide baseline data for future tree management and planting."

In mid-2021, STLC met with MAUF and discussed fulfilling that 2013 recommendation and to address other tree-related issues. STLC requested that MAUF conduct a comprehensive tree inventory to include most trees on site. A proposal for those and other services, dated 01 July 2021, was offered and accepted, and this report details the findings and recommendations from the tree assessment.

The Morris Arboretum of the University of Pennsylvania is a multi-discipline non-profit institution featuring 165 acres of woody plant collections laid out in a garden setting. The Arboretum disseminates information to communities and institutions through its outreach programs such as its horticulture and arboriculture courses and workshops, which educate professional and amateur adult audiences regionally. The Arboretum' outreach activities also include contracted services from the Arboretum's Urban Forestry Consultants. Consulting revenue directly supports the Arboretum's educational programs and mission, which is to promote an understanding of the relationship between plants, people and place.

BACKGROUND, ASSIGNMENT & METHODS

In a proposal dated 01 July 2021, MAUF offered tree inventory, assessment, and mapping services at St. Thomas. The Scope of that proposed work included the following tasks:

1. **Spatial bounds of this project** (see map in [Appendix I](#)): Nearly all amenity trees within the Church's core area have been addressed under MAUF scope of service.
2. **Tree Tagging:** Trees in this scope were tagged with their unique inventory number. Round aluminum tags (1.25" diameter) stamped with the inventory number were attached using aluminum hardware on tree trunk's north side. These tags reference the information from the inventory spreadsheet with the tree's location. Tags from the initial 2013 assessment were removed.



NOTE: Installed tree tag numbers include #1-600; and #1600-1637

3. **Tree assessment approach and methods.** MAUF documented the attributes and prioritized the needs of 636 trees. Tree assessment was visual and ground based. Gathering arboricultural and spatial information was the primary goal and was the foundation upon which this report's recommendations are based. The assessment data were recorded directly into an iPad running GIS¹ spatial-database software². The variables recorded under this effort were as follows:
 - Tree identification number, as encountered or as assigned by MAUF
 - Tree species and, where feasible, cultivar
 - Tree size information (e.g. trunk circumference, trunk diameter³ or "DBH⁴, crown spread & estimated height)
 - Tree condition information
 - Pest/pathogen observations, if significant
 - Estimated useful tree-life expectancy (i.e. >15 years; 5-15 years; <5 years, or dead)
 - Recommended management actions as "High", "Intermediate" or "Low" priority
 - Comments and other data fields as needed.
4. **Produce a GIS-based Tree Map:** MAUF collected spatial data on each tree point during the conduct of the inventory. Each tree location was determined by GPS⁵ location usually within 3' accuracy. While not "survey accurate" this technology is acceptable and highly cost-effective for tree inventories. These spatial data are in standard ESRI/ArcGIS format and are supplied separately with this Report, and these data are incorporated here by reference.

¹ GIS: Geographic Information Systems-a category of mapping & database software programs.

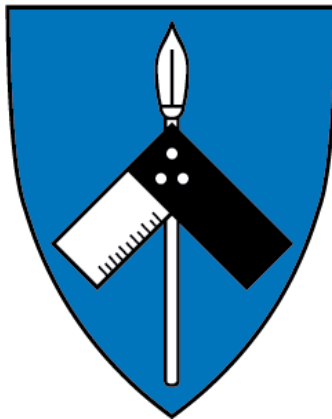
² ESRI ArcGIS Field Maps

³ Inferred from tree circumference, and measured at a standard height of 4.5' (54") above the uphill grade-side

⁴ DBH: Diameter-at-breast-height, see footnote 4.

⁵ GPS: Geographic positioning system, a locating technology based on reception of signals from orbiting satellites

5. **Produce and disseminate this Tree Management Report:** This report provides information, resources, and recommendations for identifying, planning, implementing, and maintaining The St. Thomas Cemetery landscape, to preserve and enhance tree health and aesthetics of the arboretum collection, and to identify potential tree-related risk so it can be ameliorated. This report includes an Excel-based tree spreadsheet containing the GIS tree data in spreadsheet form. This stand-alone document we provided with this report.
6. **Budget Estimation.** The information from the tree inventory and assessment spreadsheet was used to generate a 10-year tree related budget. Existing tree conditions were used to estimate budget figures for deferred and ongoing arboricultural maintenance tasks including pruning, removals, stump grinding, cabling, lightning protection, tree hazard / in-depth inspection, planting, contingencies, etc.
7. **Conceptual Tree Plan:** The MAUF consultants will work with STLC to define sub-areas within the landscape that will have specific tree lists and/or tree planting guidelines associated with them. Each sub-area will have tree planting goals and objectives.



GENERAL TREE MAINTENANCE PRIORITIES

Trees are a significant part of the St. Thomas' green infrastructure and are a dominant landscape element contributing to a sense of place by defining spaces; screening, softening and framing views; by providing shade, enhancing wildlife, and other important benefits. Therefore, the value provided by the trees warrants efforts to manage and preserve them, and reasonable tree management must plan for the care of existing trees while planting new ones because trees are perishable and transient. Also, stable mature landscapes are usually typified by mixed-age tree populations, and that this also means that new trees must be planted routinely.

Tree maintenance tasks should be fundamental to an overall tree management program for a landscape. While trees are valuable assets, their great size and bulk can create unacceptable risk if not properly and routinely inspected and remedied of detected problems. Thus, maintaining trees to reduce risk should remain a high priority at St. Thomas, and maintenance priorities must be established to use limited resources effectively. We therefore recommend the following prioritization of tree maintenance tasks:



- **First: Reduce tree-related risks to safety and property.**
- **Then: Maintain health of trees, especially mature individuals.**
- **Then: Provide special care and stewardship of young trees, as needed.**

We recommend that safety issues and risk reduction be addressed first in The St. Thomas' arboricultural management program. After all safety concerns have been addressed, resources should be allocated to maintaining the health of the existing large and highly valued trees to prevent conditions that would shorten their life expectancy, create safety hazards, or negatively impact gravesites/grave infrastructure. The last priority is to plant new trees and care for recently planted trees so that they can reach their full landscape potential and maturity. This latter task includes choosing quality trees at the nursery, planting and mulching them correctly, and providing structural pruning⁶, if needed. While it may be tempting to base management decisions on aesthetic concerns, such issues should only be addressed *after* the other priorities have been fully addressed and achieved.

Our assessment of required removals, pruning, and cabling categorized each tree as high-, intermediate- or low-priority thereby paralleling the logical scheme described above. Since the St. Thomas cemetery is used by the public and has potential targets⁷, intensive tree management is applicable to most of the grounds. To maintain the high quality of the St. Thomas' landscape and reduce tree-related risk, it is essential that the managers implement this tree management plan's recommendations and to plan and budget for periodic updates to the Plan and associated map data.

⁶ Pruning to establish a strong arrangement or system of scaffold branches.

⁷ People, property, or activities that could be injured, damaged, or disrupted by a tree failure.

FINDINGS, DISCUSSIONS, AND RECOMMENDATIONS

A. TREE LIFE EXPECTANCY

Tree life expectancy is our estimation of how long an individual tree will survive given its specific set of observed circumstances and “normal” environmental conditions. It is our subjective judgment, and incorporates our observations about tree vigor, damage, location, and many other factors influence the decision about life expectancy.

We estimated that most of the tree population (466 trees) has a useful life expectancy of longer than 15 years, while another 104 trees are likely to last 5-15 years before needing removal or similar intervention (see Figure 1). We also identified another 48 trees that seem unlikely to last more than 5 more years, while another 15 trees are dead or almost so.

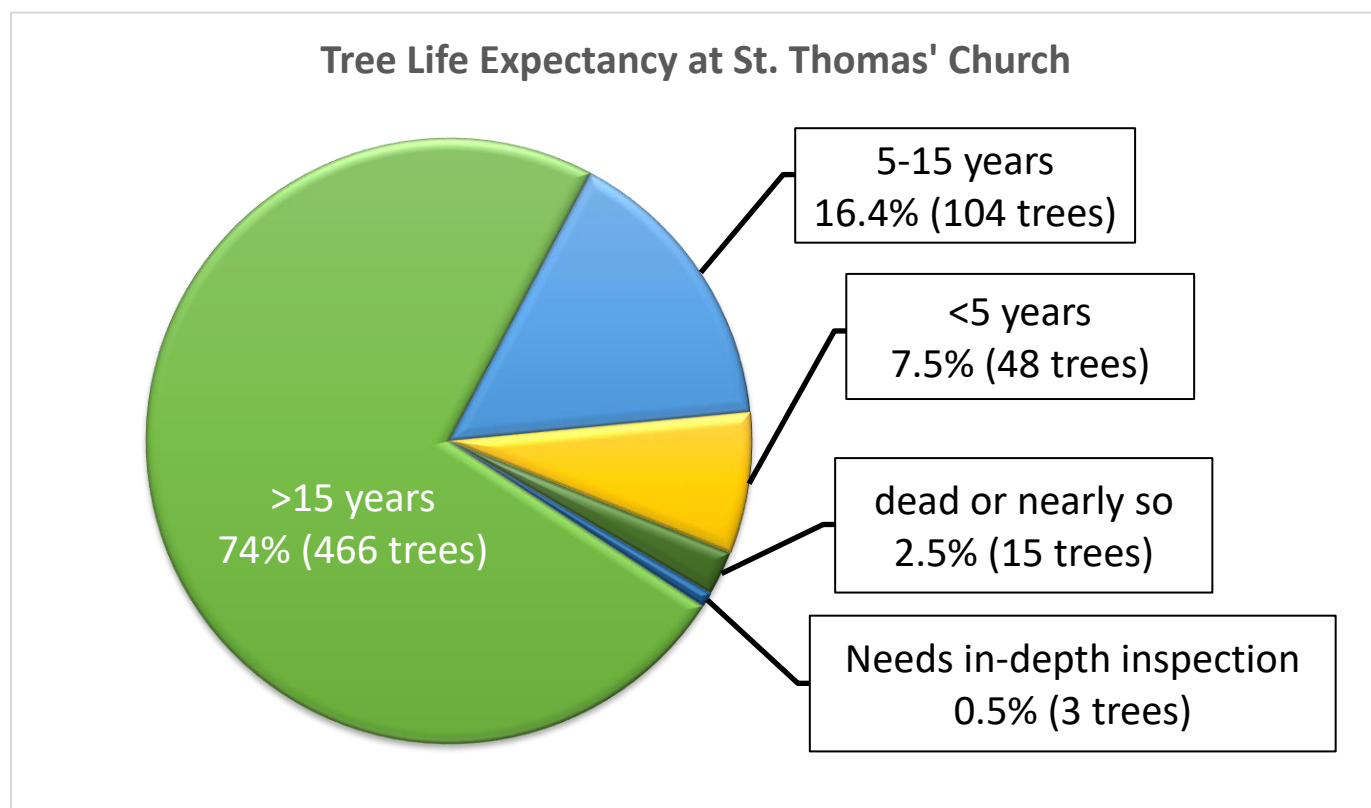


Figure 1. Tree life-expectancy summary, all assessed individuals

Overall, the distribution of expected mortality was typical of tree populations of this size, species mix and ages, and the landscape committee has made great strides in recent years at planting new trees to offset losses. The life expectancy of many of the trees within the ‘5 to 15 year’ category may be extended if health or structural problems are addressed. Trees assigned to the ‘>15 year’ category are worthy of routine preventative health care treatments as may be warranted. Note that all dead trees have been recommended for removal and assigned a priority under removal recommendations in the tree spreadsheet. A removal and replacement budget should be established to complete work on trees assigned to the ‘< 5 years’ category during a five-year period. A projected loss of ~167 trees within the next 15 years translates to a loss of approximately 11 trees per year. Maintaining the tree population at its current level should be

anticipated whenever plans and budgets for future tree plantings and construction projects are considered.

Tree Life Expectancy Recommendations:

- Anticipate the removal and replacement of approximately 11 trees per year to maintain St. Thomas’s canopy under reasonably normal biotic and abiotic influences.
- Anticipate budget requirements to remove and replant trees expected to live less than five years.

B. TREE REMOVAL, IN-DEPTH INSPECTION & PRUNING NEEDS

TREE REMOVALS:

Where we have recommended that a tree be removed, we also have made a good faith effort to prioritize the timing or sequence of that removal. These priorities are letter-coded as “A”, “B” and “C” in the “Removal” (removal priority) column of the tree assessment spreadsheets.

- *High-priority* (“A”) removals are those that pose an immediate and excessive risk due to their structural condition, location near high-traffic areas such as the walkways and roads or valuable structures. They should be addressed as soon as possible.
- *Intermediate-priority* (“B”) removals include trees with defects, such as dead or dying trees, that can fall onto less-used areas. These should be removed within one year and after the high-priority removals are completed.
- *Low-priority* (“C”) removals include dead and/or smaller trees or other trees likely to fall completely within presently infrequently used areas. These should be addressed last, if at all, because of their low risk potential.
- *Consider Removal* (“CR”) These trees are not optimally performing their landscape function but may be retained. St. Thomas’ decision-makers should make a retention/removal decision about these trees. It is often advantageous to decide about the fate of these trees before scheduling a tree contractor for other arboricultural-related activities such as tree pruning or removal.

Removals by Priority: Of the 636 assessed trees, we recommend that 38 trees be scheduled for removal. This group represents about 6% of the total trees and consists of 13 High-Priority removals (7 of which are ash (*Fraxinus*)), 10 Intermediate-Priority removals and 15 Low-Priority removals. Since some of these trees are hazardous and with obvious targets, the work should commence in sequence as soon as possible.

Consider Removal: A removal/retention decision needs to be made for 31 trees for which removal might be considered, but we have made pruning and other recommendations for them if they are to be retained. These trees typically have irresolvable conflicts, low vigor, better alternative uses for the planting space, high predisposition to novel pests, and so on. These are designated with “CR” under the removal column in the appended spreadsheets.

IN-DEPTH / HAZARD INSPECTIONS:

Three (3) trees displayed exterior symptoms that warrant additional or invasive investigation to determine their safety and risk potential. In-depth inspections are a progressive process of

gathering visual clues, identifying and measuring defects, and diagnosing problematic conditions. Some trees may require climbing or drilling. For example, when assessing wood decay, MAUF can use a Resistance drill⁸, a machine that measures the resistance of wood to a narrow drill bit as it bores into a trunk or limb. This specialized diagnostic tool can help quantify the extent of decayed wood. MAUF can provide a cost estimate for inspecting trees needing an in-depth inspection if requested.

We recommend that these In-depth inspections be conducted as soon as possible since the potential safety risks are undetermined for these trees. Although some such hazardous conditions may be remedied by pruning or other prescriptive care, we expect that a portion of these trees will be recommended for removal following the in-depth inspection. Because tree-care contractors usually quote lower prices (per-tree) for bulk projects, in-depth inspections should be completed soon to achieve greater economy of scale if additional removals are needed.

Tree Removal and In-Depth Inspection Recommendations:

- Address all high-priority removals as soon as possible and intermediate removals within one year. Low priority removals can be done as budgets and conditions warrant.
- Decide which, if any, of the 31 trees coded as “consider removal” will be removed and schedule the others for appropriate maintenance work.
- Hire a knowledgeable and experienced arborist, such as MAUF, to do the in-depth inspections for the three trees indicated by “HI” in the “Re” (removal) column of the appended spreadsheet.

TREE PRUNING:

After high-priority removals, pruning is the most important tree-maintenance task. The techniques used in pruning and the position of pruning cuts can greatly affect a tree's long-term structural integrity and risk. For this reason, only use qualified, properly trained tree-care contractors who know how to prune to industry standards⁹ and understand a tree's physiological responses to pruning.

Our pruning recommendations include both the priority¹⁰ and amount¹¹ of pruning that we estimate should be implemented. We have based these on a variety of factors such as size and location of trunk and branch parts, the severity of observed defects, probability of damage or injury, and long-term structural development and aesthetics of a given tree. Please refer to the “G Pr” (General Pruning) column on the appended tree inventory and assessment spreadsheets for these data.

Overall, about 49% of the trees need or would benefit from some form of pruning; however, most of this (about 44%) recommended pruning work is low priority (see spreadsheet). The three pruning needs categories are as follows:

- *High-priority pruning* (codes A1, A2 or A3) is recommended for conditions such as a large, dead branch showing fungal conks located over roads, buildings and walkways.

⁸ E.g., IML Resi F-400 Resistance Drill (see <https://www.iml-na.com/product/iml-resi-f-series/>)

⁹ ANSI A300 Part 1 – Standard Practices – Pruning

¹⁰ Priority: A= high, B=intermediate & C=low

¹¹ Amount: 1=heavy pruning & debris, 2=moderate pruning & debris, 3=light pruning & debris

High priority pruning work to mitigate risk should be done soon, within weeks rather than months. Seven (7) trees were identified as having high-priority pruning needs.

- *Intermediate-priority pruning* (codes B1, B2 or B3) is needed for situations like a 3-inch diameter dead branch that could fall on an interior walking path. Trees with these “B” priority recommendations should be addressed only after all high-priority removals and pruning is completed; however, it may be financially advantageous to schedule B-priority pruning activities with the A-priority pruning needs if feasible. If not, B-priority pruning should be completed done within one year. We assigned 24 trees to this pruning category.
- *Low-priority pruning* (codes C1, C2 and C3) refers to trees that have pruning needs but are located within infrequently used areas or cases the size of the defective part is relatively small. These trees should only be addressed after the more urgent removals and pruning is complete if at all. In most cases, “C” priority tree care is not recommended unless it is being done to structurally prune new trees or it is convenient, i.e., a tree worker climbs the tree for another purpose and is near the pruning work. 279 trees were assigned “C” category pruning recommendations.

In summary, of the 636 trees assessed within the project area, 31 of them (~5%) have high- or intermediate-priority pruning needs that should be addressed as soon as possible. The specific recommendations for each tree can be found in the tree spreadsheet.

Tree Pruning Recommendations:

- Schedule all high-priority pruning needs as soon as possible, and schedule intermediate-priority pruning soon.
- All pruning should be consistent with ANSI A300 Part 1 standards.
- It may be fiscally prudent to bid out the tree pruning and removal work under the same contract.
- The pruning recommendations in the tree spreadsheet should be used to guide pruning activities; however, anticipate that the working arborist may find other issues once they are working in the tree.

C. CABLING AND BRACING

Flexible wire cables and threaded rods are often used to provide supplementary support for trees with acute angled and embedded bark type trunk junctions. These techniques are recognized to reduce, but not eliminate, the risk of limb/trunk failures. Reasons to provide supplemental support include safety of people and property and preserving important landscape trees.

Cabling is “the installation of a steel wire rope, steel strand, or synthetic-fiber system within a tree between limbs or leaders to limit movement and provide supplemental support,” according to the American National Standards Institute’s ANSI A300 (Part 3: Cabling, Bracing, and Guying). Cabling should only be designed and installed by an experienced arborist following the ANSI A300 standards. Once installed, it is required that the cable system be periodically inspected; adjustments and repairs are necessary when problems are discovered.

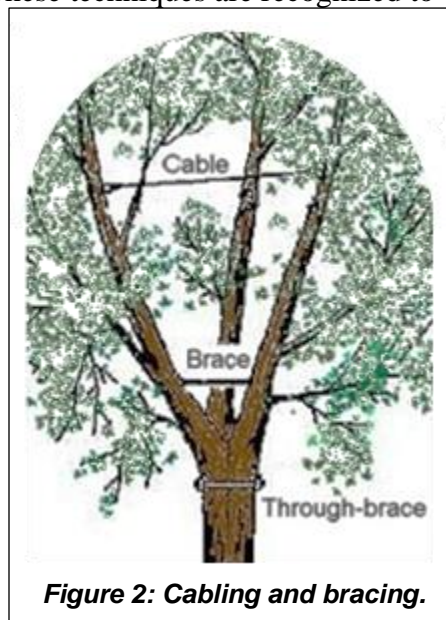


Figure 2: Cabling and bracing.

During the assessment, 3 trees were identified that could benefit from cable or brace installations, and 1 tree already has existing cables installed that need to be checked. Like with pruning and removals, we recommend cabling at 3 different priority levels: low (C), medium (B), and high (A). This information can be found in the “**Cabling Priority**” column on the spreadsheet. In addition, we also recommend the number of cables to be installed (“**Number of Cables Needed**” column), and we recorded any comments regarding cabling in the “**Cabling Comments**” column.

Tree number 40 (large American sweetgum) has an existing cable that was installed in the tree between large leaders. If this cable has not been checked by a knowledgeable arborist in the last 3 years, we recommend that it is checked for frayed cables, worn down hardware, and cable tightness.

<i>Inv #</i>	<i>Common Name</i>	<i>Cabling Priority</i>	<i>Number of Existing Cables</i>	<i>Number of Cables Needed</i>	<i>Cabling Comments</i>
484	Eastern hemlock	C	0	1	Co-dom, crack between.
424	Weeping higan Cherry	C	0	1	Sharp-forked crotch. We should note that this tree has a life expectancy of 5-15 years.
74	Shagbark hickory	B	0	2	One cable for lower V for the main trunk with lowest lead, 1 cable for upper V, 2 large leaders. Adjust and back out hardware Box, light in tree.

Cabling and Bracing Recommendations:

- Schedule cabling within 1 year for the hickory, and within 2-3 years for the others.
- Cabling should only be designed and installed by an experienced arborist following the ANSI A300 standards.
- These systems should be periodically inspected.

D. MOWER DAMAGE

About 1/3 of the trees were found to show signs of mower damage including damage to the trunk flare (base) and/or surface roots. Such damage is most often caused by lawn maintenance equipment. Wounds caused by mowers and string-trimmers provide an entry point for disease and compromise the tree’s anchorage. As a result, the tree’s longevity can be affected.

This damage to the trunk flare (base) and surface roots is presently occurring and as indicated by the condition of existing wounds, has been occurring over a long period of time.

Mower and string trimmer-induced wounds will have a subtle but cumulatively negative effect on tree health because the cell layer where new growth occurs is compromised. This damage **must** stop to help assure that trees are long-lived and remain vigorous. The best way to alleviate mower/string trimmer damage immediately is to inform and enforce that mower/string trimmer operators understand that contacting trees with mower decks or string trimmers is an unacceptable maintenance practice that produces undesirable results. Mower decks should be set at a minimum of 3” and, if possible, should be set at a 4” height. This will minimize striking above-ground roots with the mower and turf grass performs better when cut at a minimum of 3” height.

In the future, MAUF recommends to maintain a proper mulch ring around new trees and to protect existing trees by removing as large an area of turf as possible around the tree’s base and replacing it with good quality mulch. Removing the grass around the tree’s trunk will make turf managers’ jobs easier and will remove their reason to get close to the tree’s trunk. Also, since grass competes with tree roots for resources, turf removal will have the added benefit of promoting tree growth and health.



To remove turf around trees, spray the area with an organic grass-specific herbicide around the base of trees so that it is unnecessary for mowing equipment to get close to the tree's trunk flare. Larger areas are recommended around trees with surface (exposed and above ground) roots that are susceptible to damage from mowers. If herbicides are used to suppress grass, **never spray the trunk of thin-barked trees**, or the trunk, roots, or any suckers arising from the trunk or roots.

If the area around the tree's base is to be mulched, mulch as much of the tree's surrounding area as is possible or practical, using no more than three inches of organic material. Mulch should not contact the tree's trunk and should be placed at least 6" away from the trunk. Leaves can be mulched with mowers using mulching blades and blown into the mulch rings, so their nutrients remain onsite and benefit existing trees. However, the mulched leaves should not be piled against tree trunks.

Mower Damage Recommendations:

- All mower decks should be set at a minimum of 3" and, if possible, should be set at a 4" height.
- Educate the mower/string trimmer operators that contacting trees with mower decks or string trimmers is an unacceptable maintenance practice that produces undesirable results.
- Decide which trees to protect with mulch and which areas to treat with grass-killing herbicide. If desirable, in lieu of turf around tree trunks, replace with up to two inches of mulch to protect trunk flare. Larger mulched areas are recommended around trees with surface roots that are susceptible to damage from mowers. Mulch should not be placed in direct contact with the trunk.
- Care should be taken to avoid spraying thin-barked trees or the trunk, roots, or any suckers arising from the trunk or roots.
- Where possible, remove turf grass and replace with two inches of mulch so that it is unnecessary for mowing equipment to get close to the tree's trunk flare. Larger mulched areas are recommended around trees with surface roots that are susceptible to damage from mowers.

E. TREE PLANTING

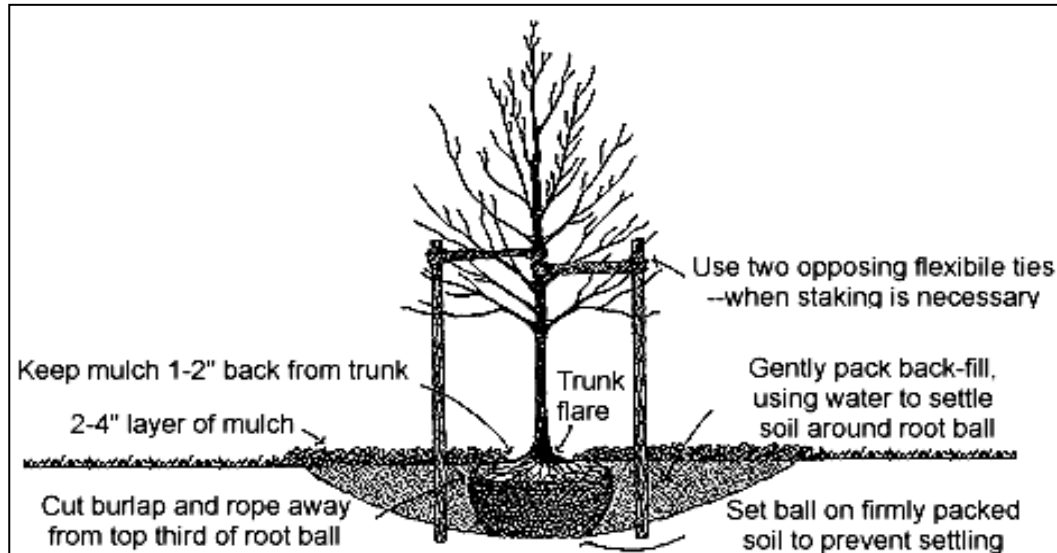
New trees are an infrastructure investment. Unlike hardscapes and hard infrastructure that depreciate over time, well-cared-for trees *increase* in value as they age. How well the tree "investment" grows depends on the species and quality of tree selected, its planting location, planting method and the follow-up care provided after planting.

Planting new trees correctly assures a tree's longevity and landscape value. The most major consideration when planting new trees is to plant them at the correct height - planting too deep is the number one planting mistake. Trees have evolved to have their trunks above ground and their roots below ground. When the tree's bark is buried, it can decay and kill the tree. Also, deep planting can cause stem-girdling roots.

Trees have evolved to have their trunks above ground and their roots below ground. When the tree's bark is buried, it can decay and kill the tree.

To plant a tree at the proper height, the trunk flare (the part of the tree that evolved just above ground) must be at or slightly above the ground level, so it does not get buried by soil or mulch. The trunk flare is where the trunk expands at the base of the tree. This point should be at least partially visible after the tree has been planted (see Figure 3). Usually, the top of the root ball needs to be excavated/removed before planting to locate the trunk flare.

Figure 3. Tree planting specifications, "typical", for general guidance.



Time to Plant: Digging a tree for transplanting can remove as much as 95% of absorbing roots. Therefore, trees that are difficult to transplant should be moved when conditions are optimal. In general, the best time to move most trees is in the early spring or late fall. If soil is warm enough, roots have a chance to grow and begin to establish before the ground freezes. Some trees are “fall planting hazards” and are likely to survive if acquired and transplanted in the spring before bud break. Transplanting dormant trees reduces the demand for moisture. Evergreens are more readily transplanted while dormant.

Tree root balls should be irrigated so that they remain moist, and never allowed to dry. Newly acquired trees should be planted as soon as possible after they arrive. If new trees cannot be planted within a few days, they should be “healed in”, e.g., their root balls covered with mulch or soil, and irrigated frequently so the root balls do not dry out. It is much preferable, however, to plant the trees directly than to stockpile them and such timing be addressed in the tree planting bid package.

Tree Species Choice Considerations: The most common species of trees on the property are:

- **Flowering dogwood (78)** – If more are to be planted, we recommend opting for the more disease-resistant varieties such as the ‘Celestial’ hybrid (*Cornus × rutgersensis*) series, and to plant them in locations that are shady for at least part of the day.

- **White pine (42)** – White pine is still a recommended species for planting in our area, and most of them have grown quite well at St. Thomas. Since most of the existing pines are of older age, consider planting a few new ones.
- **Hemlock (42)** – Hemlocks are not recommended for planting in our area any longer because of issues with the hemlock woolly adelgid and elongate hemlock scale.
- **White oak (33)** – Most of the white oaks on the property are young trees, probably 20 years old or less. This species is perhaps the best wildlife tree in our area, and is more disease-resistant than red oaks, which makes this a great overall choice.

It is beneficial to have a diversity of tree species collection, especially natives. Generally, the landscape committee should consider planting species that are not commonly found on the property already.

Tree Planting Recommendations:

- When planting new trees in St. Thomas' cemetery, follow industry standards¹² and include reference standards in contract specifications.
- Make sure trees are planted at the right height,
- Do not plant fall planting hazards until the spring,
- Remove stakes and ties after one full growth year unless the tree is planted in a high wind area, then remove after two growing seasons. Use a flexible tie material installed correctly.
- Plan for a plant a diversity of desirable tree species.
- Consider planting only a limited number of tree species that are common in the landscape.

F. DEER ISSUES AND FENCING

While charming and likable, white-tailed deer (*Odocoileus virginianus*) are vastly overpopulated in southeastern Pennsylvania and throughout much of the mid-Atlantic. This is because humans have virtually eliminated their natural predators in large parts of their native range, and have created more deer habitat by clearing wooded areas and replacing them with lawn or edge habitats. Deer hunting is often outlawed in our areas because of dense residential dwellings and the possibility of collateral damage.

Deer populations decimate virtually any natural regeneration of native plants and trees, while mostly ignoring invasive or non-native species. Any oak, maple, hickory, sassafras, or other native sapling that naturally germinates is quickly eaten by hungry deer if they can access it.

Additionally, male deer will look for young trees or saplings to rub off the velvet on their antlers in the fall. During rut, these bucks will girdle, snap or severely damage many unprotected trees, further complicating efforts to plant trees or restore natural areas.

All new trees planted on St. Thomas' grounds **must** be adequately protected from deer to ensure their establishment and survival. Deer typically can browse on leaves and twigs that are lower

¹² ANSI A300 Standards for Tree Care Operations, Part 6 Transplanting



than 6 feet off the ground. This means that if the

Photo 2: A young black gum (*Nyssa sylvatica*) is fenced in with a 5' tall welded-wire fence and is secured by 3 stakes. This set up prevents deer browse and damage.

majority of the leaves on a newly planted tree are below the deer browse height, the entire tree must be fenced. If most leaves are above 6 feet and cannot be reached by deer, then the tree's trunk should at least be protected with a sturdy bark-guard to deter buck rub.

Tree Fencing: Smaller trees with most of their crown within deer-browse range should be

protected by a sturdy fence. We recommend using a galvanized steel welded-wire garden fence similar to the fence in **Photo 2**. The fence should be at least 5' tall and should be supported with at least 3 sturdy stakes driven firmly into the ground that prevent the fence from moving when contacted. The fence should remain in place until the majority of the tree's leaves have grown out of the deer browse height (usually 5-8 years). At that time, it should be replaced with a bark guard if the lower branches are pruned.

Bark Guards

Larger trees with most or all their leaves above the deer browse height require a bark guard at the very least. Guards can be made with the same fencing materials but can be cut in smaller pieces to fit around just the bark (**Photo 3**).

Bark guards can also be made from a sturdy plastic mesh. These are generally more expensive but may be easier to handle as they come pre-cut. Bark guards should remain on the trees until the trunk is at least 4" in diameter.



Photo 3: Bark guards can be made from a welded-wire metal fencing, or from strong plastic mesh guards.

Deer-Related Recommendation:

- When planting new trees, always plan for and install robust deer protection.

G. MULCH MANAGEMENT

Proper use of mulch is very beneficial, but improperly applied and excessive use of mulch can adversely affect tree health and increase mortality.

The consultants found some newly-planted trees to have excessive mulch and/or mulch in direct contact with the tree trunks. A two-inch layer of shredded leaves, shredded hardwood bark, or aged (composted) woodchips are appropriate mulch types and depths for most applications.

Whatever mulching material is used, it should be **placed at least 6” away from the tree’s trunk** and should not be mounded up against the trunk, which is known as a mulch “volcano.”



Photo 4: Mulch volcano. Dotted line indicates the tree’s trunk. Photo not at St. Thomas.

Some of the overmulched trees are planted at the correct height, with the trunk flare at or slightly above the level of the surrounding soil (**Photo 5**). Excessive mulch can stress stem tissues and may lead to the development of insect and disease problems or stem-girdling roots, resulting in tree decline and death. Furthermore, mulch mounds shed rainwater away from a young tree’s roots, which may exacerbate drought conditions.

Therefore, trees having too much mulch require that some mulch is removed to where the trunk flare is clearly visible and that the mulch level not be higher than the surrounding ground level.

Photo 5: Tree #75 – note that the mulch has been piled up against the trunk at its base. This mulch should be removed or spread out to reveal the tree’s trunk flare

For overmulched trees, break up any matted layers and spread the old mulch into lawn areas being careful to spread it thinly as to not smother the grass, or spread the mulch intentionally to increase the mulched area around the tree. Raking the old mulch away is beneficial because this prevents mulch buildup



and the partially decomposed mulch feeds soil micro- and macro-organisms which increases soil and tree health.

Mulch Management Recommendations:

- Mulch as much of the tree’s surrounding area as possible or practical, using no more than two inches of material with mulch at least 6” away from the trunk.
- Trees labeled in the tree inventory spreadsheets as having too much mulch require that some mulch is removed.
- When mulch builds up, excessive mulch should be removed were necessary and spread out around the tree.
- Appropriate specifications regarding mulch management should be included in landscaping and tree planting contracts; work should be checked after landscapers are finished.

H. EMERALD ASH BORER

Emerald ash borer (*Agrilus planipennis*) (“EAB”) is an introduced bark-boring beetle and is one of the most significant challenges that ash (*Fraxinus spp.*) trees face in our region. Since 2002, when it was first discovered in Detroit, this invasive exotic beetle has steadily spread, and has killed hundreds of million ash trees in North America and threatens to kill most of the ash trees. EAB is in the Philadelphia area. There is no way of eradicating this pest, but eighteen trees at St. Thomas are being treated with systemic pesticide to preserve them.



Photo 6: Emerald Ash Borer (not to scale)

A decision should be made about whether to treat the remaining untreated ash that are in good condition. Many of the untreated ash in the inventory have declined to a point where treatment will not be efficacious. Ash trees that are not to be treated and can fail and strike targets such as paths, buildings, or gravesites should be proactively removed or their height should be reduced to the extent where, when they fail, they will not hit targets.

Emerald Ash Borer Recommendations:

- Decide what, if any, untreated ash trees are worthy of treatment. You will have to wait until after full leaf-out to see if the trees are still good candidates for treatment.
- For untreated ash, proactively remove the trees or reduce their height to reduce tree-related risk of failing onto targets.
- Anticipate budget requirements for trees to be treated over time.

I. HEMLOCK TREATMENTS:

Our state tree, Eastern hemlock (*Tsuga canadensis*) is being attacked across our region and on the Church property by Hemlock Woolly Adelgid (“HWA” under the **Pest** column in the tree spreadsheet). Native to Asia, it is an invasive, aphid-like insect that is very small (1.5 mm) and often hard to see. They can be identified by the white woolly masses they form on the underside of hemlock branches at the base of the needles. The feeding activity of this insect injures the host plant by withdrawing plant sap. In addition, it is believed that the

adelgid introduces a toxin into the plant that eventually damages the vascular system, thus incurring plant death.

Many, if not all, of the hemlocks are also suffering from Elongate Hemlock Scale (“HES” under the *Pest* column in the tree spreadsheet). Scales injure host plants by inserting their threadlike, piercing-sucking mouthparts into needles and withdraw vital nutrients necessary for plant growth. Excessive loss of plant fluid reduces the growth and health of the plant. Feeding injury causes needles to develop yellow banding on the top of infested needles. This injury causes needles to drop prematurely giving the crown of an infested tree a thin appearance. Many of the church’s 42 hemlocks were planted along Camp Hill Road as a screen but have grown so their canopies do not effectively screen the road. Of the 42 hemlocks, 2 are recommended for removal, three others have a life expectancy of <5 years, and one other should be considered for removal. This leaves 36 trees that are candidates for treatment. Most of these trees are indicated by “Treat” in the Pest Comments or Comments column in the tree spreadsheet.

All hemlock will probably decline and eventually die without treatment. Their decline will be exacerbated by continued warming temperatures, which stress this species even more. Therefore, a decision needs to be made by the Church to treat the trees that are in good biological health or, over time, have them removed as they decline.

Hemlock Treatment Recommendations:

- Consider treating any or all the 36 hemlocks deemed to be in good enough shape for treatment.
- Remove any untreated hemlocks as they decline and die.

J. LEAVING DEADWOOD / SNAGS

For trees that are to be removed in more remote areas, consider leaving a snag. Snags are dead tree trunks that are left standing. Leaving a snag, where safe, is very beneficial for insects, birds, woodpeckers, bats, and other wildlife. When we were using a mallet to strike and inspect tree #393, a flying squirrel jumped out of the hollow trunk. Smaller organisms will use the decaying wood until it breaks down completely and is returned to the soil. Consider leaving 20’ or 30’ snags, or adjust the height based on nearby targets. Additionally, it is less expensive when compared to a full removal.

Leaving Deadwood / Snags Recommendations:

- Consider retaining part of the tree’s trunk if it is being removed.

K. VARIOUS OTHER ISSUES

The following is an assortment of other issues/recommendation from our fieldwork:

Recommendations:

1. **Clearance pruning:** Trees can grow into infrastructure and alter their function. For example, branches can grow into and block lights, cameras, sidewalks, roadways, and buildings. When this happens, tree may be to be pruned to restore function or make more space for that infrastructure. These trees are marked as “Clearance Pruning” under the “Specific Pruning” categories, with more specific information listed in the comments for that point. Overall, 30 trees are marked for “Clearance Pruning” or CP.
2. **Vine removal:** Similarly, trees marked with “Remove Vines” under the “Specific Pruning” categories have vines growing on them. Vines are typically undesired and can seriously damage or alter the growth of a tree or shrub. Vines are typically more vigorous and can grow much quicker than trees, often shading them out and adding a lot of weight for the tree to support. If left unmanaged, these vines often kill the tree eventually. The most common vines include English ivy (*Hedera helix*) and other *Hedera* species, oriental bittersweet (*Celastrus orbiculatus*), grapevines (*Vitis* species), and Japanese honeysuckle (*Lonicera japonica*). To remove, cut the vines in two places: one as low to the ground as possible, and the other as high as you can reach. Pull out the roots of the vine to the greatest extent that is possible. This will prevent resprouting. For larger vines that are too big to pull out, consider painting the stump with an organic herbicide like triclopyr. Leave the rest of the vine on the trunk or in the tree – do not attempt to pull it out. The dead parts will decay and fall off the tree quickly.
3. **Managing storm-damaged trees/crowns:** Many of the trees on the property have been damaged by severe storms in recent years. Often, this resulted in trees losing many large scaffold branches that previously held a lot of leaves. When this happens, the tree scrambles to produce as many new leaves as possible, so it can start making more energy again. As a result, a vigorous tree grows many shoots off the broken branch or along the trunk. It is best to leave these in place for at least 3 years, until the tree has had a chance to begin restoring its depleted energy reserves. However, after 3 years, these sprouts should be managed by an experienced arborist. Over time, some of the sprouts should be selective pruned off to reshape the tree’s crown and to form branches that are strongly connected.
4. **Irrigation:** Irrigation is very important for establishing new trees successfully. During the tree assessment in the summer, some new trees were severely stressed because of the lack of rain and supplemental irrigation. Irrigation should be planned for and implemented for all new trees for at least one year after they are planted. Proper irrigation should include about 10-15 gallons per week for each tree, assuming we did not get any rain. During heatwaves, periods of extreme heat, and drought, it is a good idea to provide supplemental irrigation to new trees. Lastly, during prolonged drought and heat (similar to the summer of 2022), consider watering mature trees as well. Even though they are well established, they can certainly become very stressed from drought.

5. **Bacterial Leaf Scorch (BLS):** Throughout our assessment, we observed several oak trees that likely have Bacterial Leaf Scorch (BLS). This is a chronic infectious disease that causes premature defoliation, dieback and eventual death of trees. It is primarily seen in trees of the red oak group but is known to infect 28 other trees as well. It is caused by the bacterium *Xylella fastidiosa* which is spread by xylem-sap feeding insects such as spittlebugs, leafhoppers and treehoppers.

The bacterium will colonize and clog up the water conducting tissues in the xylem. Leaf scorch results from moisture stress due to the plugging of the vascular tissues in leaves, twigs and branches. Symptoms are first seen as a premature browning of the leaf margins in discrete areas of the crown in mid-summer when water needs are greatest.

On young trees, death may result in one or two seasons while a large shade tree may take five years or more. Symptoms can be suppressed somewhat through trunk injection of the antibiotic oxytetracycline in June, but this appears to simply delay symptoms for a few weeks. Maintaining tree vigor, pruning out dead and diseased portions, proper mulching and good irrigation during drought periods are the most effective cultural techniques towards managing BLS.

6. **Reset flagstones in St. Francis Garden:** The root growth from river birch in the center of the St. Francis Garden is raising the stepping stones to the point where they are a tripping hazard. Therefore, these stones should be lifted and the area around the roots be filled with modified stone or coarse sand, and then the flagstones can be replaced. The edges of the higher new path can be backfilled with soil to “feather” the raised walkway it into the surrounding landscape.

Tree size attributes: Tree circumferences were measured at standard height (54” above grade) and then converted into diameters. With this approach, the global mean diameter of tallied trees was 17.6”. The largest living tree encountered was tree #404 American sycamore (*Platanus occidentalis*) that measured 60.2”, while the smallest were newly planted trees of negligible trunk diameter.

The 3 tallest trees on the property were white oaks (*Quercus alba*) estimated to be about 100’ tall. Other notable trees include tall white pines (*Pinus strobus*), sugar maples (*Acer saccharum*) and northern red oaks (*Quercus rubra*), which measured about 80’ or taller. The smallest trees were the newly planted American chestnuts, which measured about 1’ tall. The average tree height across the entire assessed population was about 41’. Similarly, the width of the crown spreads averaged 32’ for all individuals, but because this attribute is greatly influenced by a tree’s species and specific location, it varied widely even for trees of similar trunk diameter.

ADMINISTRATIVE AND TREE MAINTENANCE TOPICS

L. UPDATING THE TREE INVENTORY/ASSESSMENT & GIS MAP

Tree Assessment Discussion: Information recorded during our tree inventory and assessment represented tree conditions at the time of inspection. Since tree conditions change, sometimes rapidly, over time, we recommend that the Landscape Committee plan and budget for periodic updates to the tree inventory/assessment, and for the associated arboricultural tasks such as remediating hazardous conditions and maintaining tree health and longevity.

There is no absolute rule governing the amount of time between tree assessment updates. Considering this, some courts have set a “reasonable person” standard, which represents a reasoned outlook on how often tree assessments should be updated. Since tree conditions can change overnight due to a severe storm event, or may change slowly, it is reasonable to presume that the frequency for tree assessment updates be evaluated as conditions warrant. St. Thomas’ decision makers must interpret the amount of time between “periodic updates” of the tree assessment in light of the “reasonable person” standard and change update frequencies based on potential risk.

Potential risk can be thought of as the likelihood that an adverse event will occur and the likely consequence of the adverse event. In areas of higher potential risk, such as trees over the parking areas, tree assessments should be done at least annually. In other areas, tree assessments can be done every two to four years. Please note that these are guidelines only. It is also prudent to inspect trees just after conditions have changed in a relatively short period of time such as after an extreme storm event. The tree assessment updates should be performed by an appropriately qualified person who possesses sufficient education, training, and experience in inspection techniques and tree hazard detection.

Updating the GIS map/data: The consultants have provided the GIS-based map and supporting information to the Landscape Committee. The GIS information should be periodically updated. The extent and depth of the updated information should include, at a minimum, trees removed and date of removal, and trees planted and planting date. The data can be updated by a volunteer, staff, or anyone else knowledgeable about GIS and having the relevant GIS software.

There are many options available to St. Thomas about how best to use and update the maps, as shown in Figure 4.

Tree Assessment Update Recommendations:

- The Landscape Committee should determine how best to proceed with updating and using the provided GIS data
- St. Thomas should plan and budget for periodic updates of the tree inventory/assessment and GIS map, which was delivered with this report in electronic format.
- Tree assessment updates should be performed by an appropriately qualified person who possesses sufficient education, training, and experience in inspection techniques and tree hazard detection.

Figure 4: Options for managing and using GIS data

Requirement	Platform/Software	Approach
Lower Cost - More Time	Printed map and Adobe .pdf file	Morris Arboretum Urban Forestry Consultants will provide a plotted map and .pdf file.
	ESRI ArcGIS Explorer	Receive GIS Data with Instructions for installing free software and using it.
	QGIS (Quantum)	Receive GIS Data with Instructions for installing free software and using it.
Moderate Cost - Medium Time	ESRI Non-Profit Program (Partial MA-UF GIS Support)	<p>St. Thomas Landscape Committee applies for ESRI Non-Profit Program and is accepted</p> <p>St. Thomas Landscape Committee receives and installs GIS software and sets up Online Web mapping account</p> <p>Receive GIS Data files with Instructions for using it with GIS software</p> <p>Request that Morris Arboretum Urban Forestry Consultants assist with setting up Online GIS webmap services (or additional options)</p>
Moderate Cost - Medium Time	Custom Web/Mobile GIS App	Request that Morris Arboretum Urban Forestry Consultants develop and host a customized web/mobile app via Esri ArcGIS Online
Higher Cost - Less Time	ESRI Non-Profit Program (Full MA-UF GIS Support)	Request that Morris Arboretum Urban Forestry Consultants assist with joining ESRI Non-profit Program , Software acquisition and set up, along with installation, development and support for web and mobile applications to assist tree and facilities management.

M. ESTABLISHING AN ARBORETUM

St. Thomas’ Landscape Committee has expressed interest in applying to become a Level 1 Arboretum through the ArbNET accreditation program. The information is available at the following link:

<http://www.arbnet.org/arboretum-accreditation-program>

The following is ArbNET’s Level I Criteria

The most basic level of accreditation requires achievement of the following standards:

An arboretum plan documentation of some sort, such as an organizational plan, strategic plan, master plan, or other, that defines the purpose of the arboretum, its audience(s), the types of plants that are to be grown to achieve that purpose and serve those audiences, provisions for the maintenance and care of the plants, and provisions for the continuing operation of the organization through time with a clear succession plan.

An arboretum organizational group of people or governing board or authority that is dedicated to the arboretum plan and its continuation beyond the efforts of a single individual. Such an organizational group can affirm fulfillment of standards and authorize participation as an accredited arboretum.

An arboretum collection with a minimum number of 25 species, varieties or cultivars of trees or woody plants that have been planted and are growing in accordance with the arboretum plan. Plants in the arboretum collection must be labeled in some way as to identify them taxonomically, including scientific name and cultivar if applicable, and documented in some way so that information on their acquisition (source or origin, date of acquisition, etc.) is available for access.

Arboretum staff or volunteers who ensure fulfillment of the arboretum plan and provide for the basic needs of the arboretum collection and functions of the arboretum.

An arboretum public dimension that includes some level of public access, and at least one public event or educational program each year focused on trees or arboretum purposes (for example, an Arbor Day observance).

Our assessment totaled at least 84 unique species of woody trees or large shrubs. Notable or uncommon species include:

- *Emmenopterys henryi*
- Butternut (*Juglans cinerea*)
- Chinese Chestnut (*Castanea mollissima*)
- Larch (*Larix* spp)
- Persian Ironwood (*Parrotia persica*)



Establishing an Arboretum Recommendation:

- The Landscape Committee should review and fulfill the requirements for, and then apply to become a Level 1 Arboretum through the ArbNET accreditation program.

N. ARBOR DAY

The ArbNET accreditation program’s application requires at least “at least one public event or educational program each year”. A good start would be to host an Arbor Day each year. The first Arbor Day took place in Nebraska on April 10, 1872. The idea was created by Julius Sterling Morton, a Nebraska journalist and politician originally from Michigan. In 1970, President Richard Nixon proclaimed the last Friday in April as National Arbor Day. Today, all 50 states celebrate Arbor Day, which is an excellent opportunity for the Church to promote trees on the grounds by involving the members, students and perhaps the wider community.

Activities for Arbor Day may include:

- Creating an Internal/external press release detailing the event
- Coordinating student recruitment/involvement/volunteers
- Selecting a planting site(s)

- Selecting a high-quality tree(s) to be planted
- Coordinating tree delivery to the planting site
- Gathering the needed tools and supplies such as shovels, water, mulch, wire cutters, etc.
- Supervising the tree being planted correctly
- Purchasing and installing a tree plaque
- Updating the GIS database with the new tree information
- Documenting the event for reports, newsletters, website, or other outreach channels

Arbor Day Recommendation:

- If an Arbor Day tree planting event is adopted by the Church, an area of campus could be set aside for an “Arbor Day Grove” or “Arbor Day Allée”.

O. TREE MAINTENANCE BUDGET ESTIMATE

Preserving, protecting, and enhancing the Church’s trees requires proactive management and budgeting support. It is important to plan for and plant the next generation of trees, remedy tree-related safety hazards, manage trees (such as injecting ash, if necessary, every two years to combat EAB), and to anticipate losses and impacts from periodic severe storm events.

Since tree care contractors are often reluctant to invest large amounts of time to price work that might not be funded, our scope included providing a budget for managing the Church’s tree resource. Using cost estimate methods based on studies from tree inventories in other urban areas, we have generated a 10-year tree maintenance budget for arboricultural tasks such as tree planting, pruning, removals, pest and disease treatment, and other tree-related activities ([Appendix 2](#)). This budget recognizes the needs outlined in this report (deferred maintenance) and reasonably anticipated ongoing maintenance, all based upon the following assumptions:

- This is an estimated budget only. Our price/cost assumptions for tree pruning, removals, stump grinding, and other tree-related activities are based upon current tree crew prices. Therefore, the only true price is that provided by a qualified contractor who is willing to perform the work.
- Budget based on the inventoried trees only.
- All deferred items are accomplished by 2026.
- Inflation rates are anticipated in selected re-occurring line items.
- Periodic storm events may impact the budget in unanticipated ways.
- Number of trees planted roughly equals the number to be removed.
- Emerald Ash Borer treatments every two years for the two ash on the tree assessment spreadsheet.

General Arboricultural Budget Recommendation:

- Keep records of all arboriculturally-related expenditures at the Church to guide future budgets, it would be beneficial to record expenses over time using the budget headings

- This budget can be used to inform the ArbNET Arboretum application and recertification

P. TREE MEMORIALIZATION/COMMEMORATION POLICY

The Consultants recorded information about the trees having tags or plaques indicating they are memorial trees. These tags and plaques are a hodge-podge of designs and formats.

A Tree Memorialization/Commemoration Policy provides donors with an opportunity to facilitate planting new memorial trees or to commemorate existing trees, as overseen by the Landscape Committee and the Project Review Subcommittee, and to enhance the landscape’s aesthetic and educational value while fulfilling the donor’s desire to commemorate or honor a friend or loved one. It also describes a mechanism for St. Thomas to acquire, label, plant, and provide ongoing care for new trees, or to label and provide ongoing care for existing landscape trees.



Photo 7: Memorial Tree Tag on tree #62. Tree growth enveloped the top attachment screw causing the tag tun upside down on the tree.

St. Thomas’ tree memorialization program, including plaques and installation, should be standardized. Therefore, a Memorial Tree Policy specific to trees should be crafted and approved. The Morris Consultants have experience developing this type of policy and can, if requested, submit a proposal for working with the Landscape Committee and the Project Review Subcommittee to do so.

Memorial Tree Recommendations:

- Consider developing a Tree Memorialization/Commemoration Policy.
- Update the STLC Policies and Procedures Manual with the ratified Tree Memorialization/Commemoration policy.

Q. VARIOUS TREE-RELATED ISSUES

Problematic Tree Species/Issues:

There are some problematic species present on the property. Some are problematic because of severally damaging or lethal pests, including:

<i>Species</i>	<i>Pest</i>
<i>Tsuga canadensis</i> (eastern hemlock)	<i>Adelges tsugae</i> (Hemlock woolly adelgid) <i>Fiorinia externa</i> (elongate hemlock scale)
<i>Fraxinus</i> spp. (Ash species)	<i>Agilus planipennis</i> (emerald ash borer)
<i>Picea glauca</i> (dwarf Alberta spruce)	<i>Oligonychus ununguis</i> (spruce spider mite)
<i>Cornus florida</i> (flowering dogwood)	Powdery mildew, anthracnose
<i>Pinus nigra</i> (Austrian pine)	<i>Sphaeropsis sapinea</i> (Diplodia Tip Blight)

Other problematic species include those listed in the “Plant Material Not Permitted” Section of the STLC Policies and Procedures Manual. Most of these are invasive exotic plants that spread to wild places and outcompete native plants. We recommend considering the removal of Norway maple (*Acer platanoides*) and female (fruit-bearing) amur corktree (*Phellodendron amurense*) wherever possible or practical.

Also, some tree species have not been performing as well in our area due to climate change (warmer temperatures, more dramatic precipitation extremes, humidity). These are no longer recommended for planting, but existing trees are fine to remain unless otherwise noted:

- **Douglas-fir (13)** – this species has not been performing well in our area recently due to climate change (warmer temperatures, precipitation extremes, humidity), and is therefore no longer recommended for planting.
- **Hemlock (42)** – this species is not recommended for planting in our area any longer because of issues with the hemlock woolly adelgid and elongate hemlock scale.

Lastly, some problematic trees are more easily addressed. *Cercis canadensis* (eastern redbud) from the nursery usually have poor structure and are prone to breakage. This can be ameliorated with proper structural pruning over the years.

Parking Lot Sycamore:

There is an American sycamore (tree #77) in the middle of one of the parking lots. It is currently surrounded entirely by concrete, which is limiting its root space and, thus, its ability to obtain water and nutrients.

Since the tree is of significant size (121” in circumference, ~50’ wide and ~70’ tall) and is a native species that provides valuable ecosystem services, its long-term preservation is worth considering.

We suggest that the two adjacent parking spaces (one on each side of the tree) and the associated hardscape be removed. The underlying soil can be carefully decompacted, new topsoil added if necessary, and organic wood chip mulch can be installed on the surface. Bollards with connecting chains could be installed at the edges of the mulched area to prevent vehicles from driving over the tree and its roots (**Photo 8**).

Expanding the tree pit surface area would likely improve the tree’s biological health. A bonus is that the additional space would intercept more stormwater during rain events. The tree pit could be planted with flowering plants, which would make this tree a nicer and improved centerpiece for the parking lot.



Photo 8: Consider expanding the tree's root space, laying down some mulch, and adding bollards.

Oak Wilt and Beech Leaf Diseases:

While not yet widespread, two rather concerning diseases are emerging in our area. Oak Wilt (*Ceratocystis fagacearum*), a fungal disease that causes vascular wilt in oak trees (*Quercus*) was confirmed for the first time in Montgomery, Philadelphia and Delaware counties in 2021. The disease is spread by insect vectors who are attracted to fresh wounds on oaks, as well as through root grafts. Therefore, we strongly recommend pruning oaks only during the dormant season (winter), when the insect vectors are not around. Additionally, if you notice a very rapid decline and death of an oak tree at St. Thomas', consider having the tree inspected or tested by an arborist or diagnostics lab for oak wilt. Since mature oaks make up some of the church's most valuable and charismatic trees, this disease is something to watch out for.



Beech Leaf Disease is a rather new, enigmatic disease first observed in 2012. The disease is rapidly spreading and threatens native and non-native species of beech trees. It is associated with a leaf-feeding nematode, but scientists are currently unsure about what causes the disease. Symptoms include a darkening of the leaf between veins, leaving behind infected stretches of leaf that eventually turn leathery and fall off (**Photo 9**). Scientists are observing that trees die within 3-7 years after infection, with younger trees dying sooner. We

Photo 9: Beech Leaf Disease affects native and non-native beech, killing most infected trees. Image courtesy of Mary Pits / Holden Forests and Gardens

observed only 4 beech trees on the property, but this disease is still something to keep in mind.

Tree-Related Issues Recommendations:

- Avoid planting problematic species without first considering their susceptibilities.
- Consider removing exotic invasive plant species from the property.
- Consider hiring a skilled arborist to structurally prune redbuds with poor structure.
- Consider expanding the rooting space around the large American sycamore currently in the middle of the parking lot.
- Periodically monitor the trees for symptoms of Oak Wilt and Beech Leaf Disease.

R. CONCEPTUAL TREE PLANS FOR VARIOUS LOCATIONS

These areas are delineated on a map in Appendix 3. Recommendations or suggestions within this section are not listed in the **Recommendations Summary** section.

Conceptual Tree plans for defined sub-areas:

1. **Ridgetop Grove:** located at the heart of the campus between the Church and Church Hill Hall. Parishioners love the current mature canopy, but it has been hit hard by several storms.

Objective in this area: Populate/replenish the tree canopy. Our suggestion mainly includes larger-maturing canopy trees, but there are several understory species (underlined below). Most of these species are found in upland forests in our area. Since this arguably the most valued outdoor space on the campus, consider offering these trees as memorial trees.

Soil type / setting: Upland forest, well-draining.

Suggested species: chestnut oak (*Quercus montana*), black oak (*Quercus velutina*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), mockernut hickory (*Carya tomentosa*), black cherry (*Prunus serotina*), black gum (*Nyssa sylvatica*), sweet birch (*Betula lenta*), tuliptree (*Liriodendron tulipifera*), American hornbeam (*Carpinus caroliniana*), Green Mountain sugar maple (*Acer saccharum* ‘Green Mountain’), Kentucky coffeetree (*Gymnocladus dioica*), American holly (*Ilex opaca*), cucumbertree magnolia (*Magnolia acuminata*), umbrella magnolia (*Magnolia tripetala*), eastern white pine (*Pinus strobus*), chokecherry (*Prunus virginiana*).

2. **“Bowl”:** large area off of Church Hill Road entrance with declining Ashes present.

Objective in this area: Plant a new grove of trees to replace declining ash trees and fill in the space. Some evergreens were requested here by the landscape committee.

Soil type / setting: Lowland forest, moist soil, bottom of hill.

Suggested species: swamp white oak (*Quercus bicolor*), bitternut hickory (*Carya cordiformis*), common hackberry (*Celis occidentalis*), pin oak (*Quercus palustris*), white pine (*Pinus strobus*), eastern redcedar (*Juniperus virginiana*), American holly (*Ilex opaca*), eastern arborvitae (*Thuja occidentalis*), dawn redwood (*Metasequoia glyptostroboides*), baldcypress (*Taxodium distichum*), American sweetgum (*Liquidambar styraciflua*), Sugi (*Cryptomeria japonica*), Hinoki falsecypress (*Chamaecyparis obtusa*), Japanese falsecypress (*Chamaecyparis pisifera*),

Site suggestions:

- Any trees that are planted should be planted far enough away from the existing powerlines along Church Road so as to not overhang the lines in the future when trees are mature.
- Consider reducing mowing in this area to save resources, costs and time, and to allow for the expansion of the small existing forest fragment. For example, much of this area could be mowed once per year in the spring to allow grasses, forbs and other wildflowers to return. Consider seeding this area with native wildflower seeds to help speed along meadow establishment.
- A border with a width of two or three mowers could be mowed regularly to give a tidier appearance and to keep meadow away from Church Road.
- Over time, reducing mowing will allow for native trees to naturally seed into this area. Consider monitoring the meadow occasionally to look for desirable volunteers that may pop up. When they do, fence in the trees to protect from deer. The nearby small piece of forest at the bottom of the hill has many good native species present such as sugar maple, black gum, black cherry, hemlock, and basswood.
- Consider installing a rain garden along Church Road. At the bottom of the hill, the water drains under Church Road. The drain is located around a natural dip / depression. This area appears to be rather wet, and could be an ideal place for a rain garden. The rain garden could be constructed, or built into the existing landscape. Regardless, the grass would have to be killed and native, water-loving, deer-resistant plants would be installed. These plants include swamp milkweed (*Asclepias incarnata*), beebalm (*Monarda fistulosa*), switchgrass (*Panicum virgatum*), rushes (*Juncus*), and more.

- 3. Parking Area:** the largest parking lot contains 3 or 4 planting strips between parking spaces, with room for additional trees.

Objective in this area: Add trees in the planting strips of the parking lot that are able to withstand those conditions.

Soil type / setting: Relatively disturbed soil, more limited root space, drier conditions

Suggested species: Kentucky coffeetree (*Gymnocladus dioica*), swamp white oak (*Quercus bicolor*), DED-resistant American elms (*Ulmus americana*) such as ‘Princeton’, ‘Valley Forge’ or ‘Jefferson’, seedless American sweetgum varieties (*Liquidambar styraciflua*) such as ‘Happidaze’ / ‘Hapdell’ or ‘Rotundiloba’, Thornless honeylocust (*Gleditsia triacanthos* var. *inermis*) such as ‘Shademaster’ or ‘Skyline’, Yellowwood (*Cladrastis kentuckea*), London planetree (*Platanus × hispanica*), Persian ironwood (*Parrotia persica*), Freeman’s maple (*Acer x freemani*), Ginkgo (*Ginkgo biloba*), or common hackberry (*Celtis occidentalis*).

Site suggestions:

- For this site, we are recommending species that are tolerant of urban soils and conditions including drought, limited root space, salt, and heat.
- Consider creating small cutouts in the parking lot perpendicular to the flow of water downhill to collect more rainwater. Small rain gardens could be installed in these spaces as well. (See **photos 10 and 11**).

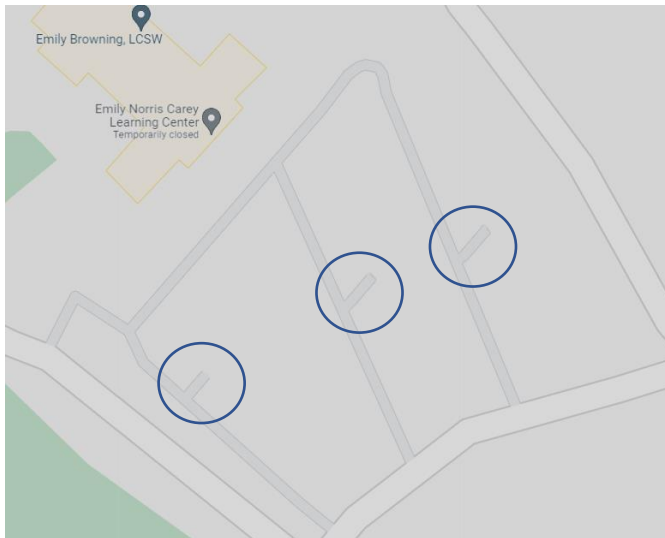


Photo 10: Creating small parking lot cutouts can intercept more storm water and provide more place for planting.



Photo 11: Water can be directed into these cutouts where it will be absorbed by the plants and allowed to percolate.

4. Old Cemetery: The older part of the cemetery adjacent to the church building and adjacent to Church Road.

Objective in this area: Restore some plants to the area, including evergreens that have historically been used in cemeteries.

Soil type / setting: Average soil conditions and moisture.

Suggested species: eastern redcedar (*Juniperus virginiana*), American holly (*Ilex opaca*), eastern arborvitae (*Thuja occidentalis*), Sugi (*Cryptomeria japonica*), Hinoki falsecypress (*Chamaecyparis obtusa*), Japanese falsecypress (*Chamaecyparis pisifera*), common yew (*Taxus baccata*)

Site suggestions:

- Plant where more trees are desired and where enough space between grave stones exists.

5. New Cemetery: The newer part of the cemetery adjacent to Camp Hill Road.

Objective in this area: Plant large native canopy trees with ornamentals bordering the road. These trees could potentially be memorialized as well.

Soil type / setting: Average soil conditions and moisture.

Suggested species for within: white oak (*Quercus alba*), swamp white oak (*Quercus bicolor*), white pine (*Pinus strobus*), American holly (*Ilex opaca*)

Suggested ornamentals for along the roadside: Continue with ornamental cherries such as ‘Yoshino’, ‘Kwanzan’, ‘Okame’, ‘Autumnalis’, etc., and replace dead ones. Consider showy, disease-resistant crabapples such as *Malus* ‘Prairifire’, ‘Sargentii’, ‘Adirondak’, ‘Pink Princess’ or ‘Sugar Tyme’. Also consider other showy native ornamentals such as Winter King Hawthorn (*Crataegus viridis* ‘Winter King’), but plant these away from any

existing eastern red cedars (*Juniperus virginiana*) to avoid potential cedar-hawthorn rust fungus issues.

6. Green Screen: The strip of land adjacent to Camp Hill Road.

Objective in this area: Plant screening trees but allow for long views into the cemetery by passing vehicles.

Soil type / setting: moist soil

Suggested species: eastern redcedar (*Juniperus virginiana*), American holly (*Ilex opaca*), eastern arborvitae (*Thuja occidentalis*), Sugi (*Cryptomeria japonica*), Hinoki falsecypress (*Chamaecyparis obtusa*), Japanese falsecypress (*Chamaecyparis pisifera*),

Site suggestions:

- Consider how much screening is desired at this location.

RECOMMENDATIONS SUMMARY

These recommendations are summarized from the report. Tree removal and pruning activities are the highest priority.

Tree Life Expectancy Recommendations:

- Anticipate the removal and replacement of approximately 11 trees per year to maintain The St. Thomas canopy under reasonably normal biotic and abiotic influences.
- Anticipate budget requirements to remove and replant trees expected to live less than five years.

Tree Removal and In-Depth Inspection Recommendations:

- Address all high-priority removals as soon as possible and intermediate removals within one year.
- Decide which, if any, of the 31 trees coded as “consider removal” will be removed and schedule the others for appropriate maintenance work.
- Hire a knowledgeable and experienced arborist to do the in-depth inspections for the three trees indicated by “HI” in the “Re” (removal) column of the appended spreadsheet.

Tree Pruning Recommendations:

- Schedule all high-priority pruning needs as soon as possible, and schedule intermediate-priority pruning soon.
- All pruning should be consistent with ANSI A300 Part 1 standards.
- It may be fiscally prudent to bid out the tree pruning and removal work under the same contract.
- The pruning recommendations in the tree spreadsheet should be used to guide pruning activities; however, anticipate that the working arborist may find other issues once they are working in the tree.

Cabling and Bracing Recommendations:

- Schedule cabling within 1 year for the hickory, and within 2-3 years for the others.
- Cabling should only be designed and installed by an experienced arborist following the ANSI A300 standards.
- These systems should be periodically inspected.

Mower Damage Recommendations:

- Decide which trees to protect with mulch and which tree circles should be treated with Roundup® or its equivalent. If desirable, in lieu of turf around tree trunks apply a layer of mulch two to four inches thick. Larger mulched areas are recommended around trees with surface roots that are susceptible to damage from mowers.
- Mulch should be at least 6 inches away from any above-ground trees parts and should never be placed in direct contact with the trunk.
- Care should be taken to avoid spraying any herbicide on thin-barked trees or the trees’ trunks, roots, or any suckers arising from the trunk or roots.
- All mower decks should be set at a minimum of 3 inches and, if possible, should be set at a 4-inch height.

- Mower/string trimmer operators should be informed that contacting trees with mower decks or string trimmers is an unacceptable maintenance practice that produces undesirable results.

Tree Planting Recommendations:

- When planting new trees in St. Thomas' cemetery, follow industry standards¹³ and include reference standards in contract specifications.
- Make sure trees are planted at the right height,
- Do not plant fall planting hazards until the spring,
- Remove stakes and ties after one full growth year unless the tree is planted in a high wind area, then remove after two growing seasons. Use a flexible tie material installed correctly.
- Plan for a plant a diversity of desirable tree species.
- Consider planting only a limited number of tree species that are common in the landscape.

Deer-Related Recommendation:

- When planting new trees, always plan for and install robust deer protection.

Mulch Management Recommendations:

- Mulch as much of the tree's surrounding area as possible or practical, using no more than two inches of material with mulch at least 6" away from the trunk.
- Trees labeled in the tree inventory spreadsheets as having too much mulch require that some mulch is removed.
- When mulch builds up, excessive mulch should be removed were necessary and spread out around the tree.
- Appropriate specifications regarding mulch management should be included in landscaping and tree planting contracts; work should be checked after landscapers are finished.

Emerald Ash Borer Recommendations:

- Decide what, if any, untreated ash trees are worthy of treatment. You will have to wait until after full leaf-out to see if the trees are still good candidates for treatment.
- For untreated ash, proactively remove the trees or reduce their height to reduce tree-related risk of failing onto targets.
- Anticipate budget requirements for trees to be treated over time.

Hemlock Treatment Recommendations:

- Consider treating any or all the 36 hemlocks deemed to be in good enough shape for treatment.
- Remove any untreated hemlocks as they decline and die.

Leaving Deadwood / Snags Recommendations:

- Consider retaining part of the tree's trunk if it is being removed.

¹³ ANSI A300 Standards for Tree Care Operations, Part 6 Transplanting

Tree Assessment Update Recommendations:

- The Landscape Committee should determine how best to proceed with updating and using the provided GIS data
- St. Thomas should plan and budget for periodic updates of the tree inventory/assessment and GIS map, which was delivered with this report in electronic format.
- Tree assessment updates should be performed by an appropriately qualified person who possesses sufficient education, training, and experience in inspection techniques and tree hazard detection.

Establishing an Arboretum Recommendation:

- The Landscape Committee should review and fulfill the requirements for, and then apply to become a Level 1 Arboretum through the ArbNET accreditation program.

Arbor Day Recommendation:

- If an Arbor Day tree planting event is adopted by the Church, an area of campus could be set aside for an “Arbor Day Grove” or “Arbor Day Allée”.

General Arboricultural Budget Recommendation:

- Keep records of all arboriculturally-related expenditures at the Church to guide future budgets, it would be beneficial to record expenses over time using the budget headings
- This budget can be used to inform the ArbNET Arboretum application and recertification

Memorial Tree Recommendations:

- Consider developing a Tree Memorialization/Commemoration Policy.
- Update the STLC Policies and Procedures Manual with the ratified Tree Memorialization/Commemoration policy.

Tree-Related Issues Recommendations:

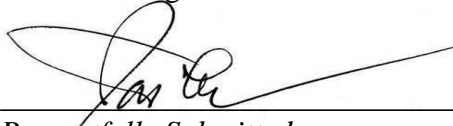
- Avoid planting problematic species without first considering their susceptibilities.
- Consider removing exotic invasive plant species from the property.
- Consider hiring a skilled arborist to structurally prune redbuds with poor structure.
- Consider expanding the rooting space around the large American sycamore currently in the middle of the parking lot.
- Periodically monitor the trees for symptoms of Oak Wilt and Beech Leaf Disease.

ASSUMPTIONS AND LIMITING CONDITIONS

1. During the inspections and evaluations, only above-ground parts were observed. Decayed roots are difficult to detect and evaluate and were not part of this scope of work, nor was any sub-surface condition.
2. Visual inspection was limited to what could be seen readily from the ground.
3. This report covers trees on the agreed-upon sections of the St. Thomas Cemetery, no other trees were assessed as part of this scope and report.
4. The information in the inventory represents conditions only at the time of the inspection. Tree conditions can degrade or change due to progressive decay, storm, and/or mechanical injury.
5. Even healthy, sound trees constitute some risk. Most trees, especially older trees, have defects. Not all trees with defects should be considered unreasonable risks. The tree inspections and assessments are designed to identify those trees that have warning signs of structural weakness.
6. There may be inventoried trees with hidden defects that may not have been detected.
7. Consider all trees to be field identified. We strive for accuracy; however, because of field conditions, unusual species, or the availability of discernible plant characteristics from buds, fruits, flowers, or leaves, some plant species may be misidentified.
8. We used high-quality GIS receivers to locate the trees on the GIS map; however, we are not surveyors and, therefore, tree locations should not be considered survey accurate.

CERTIFICATION

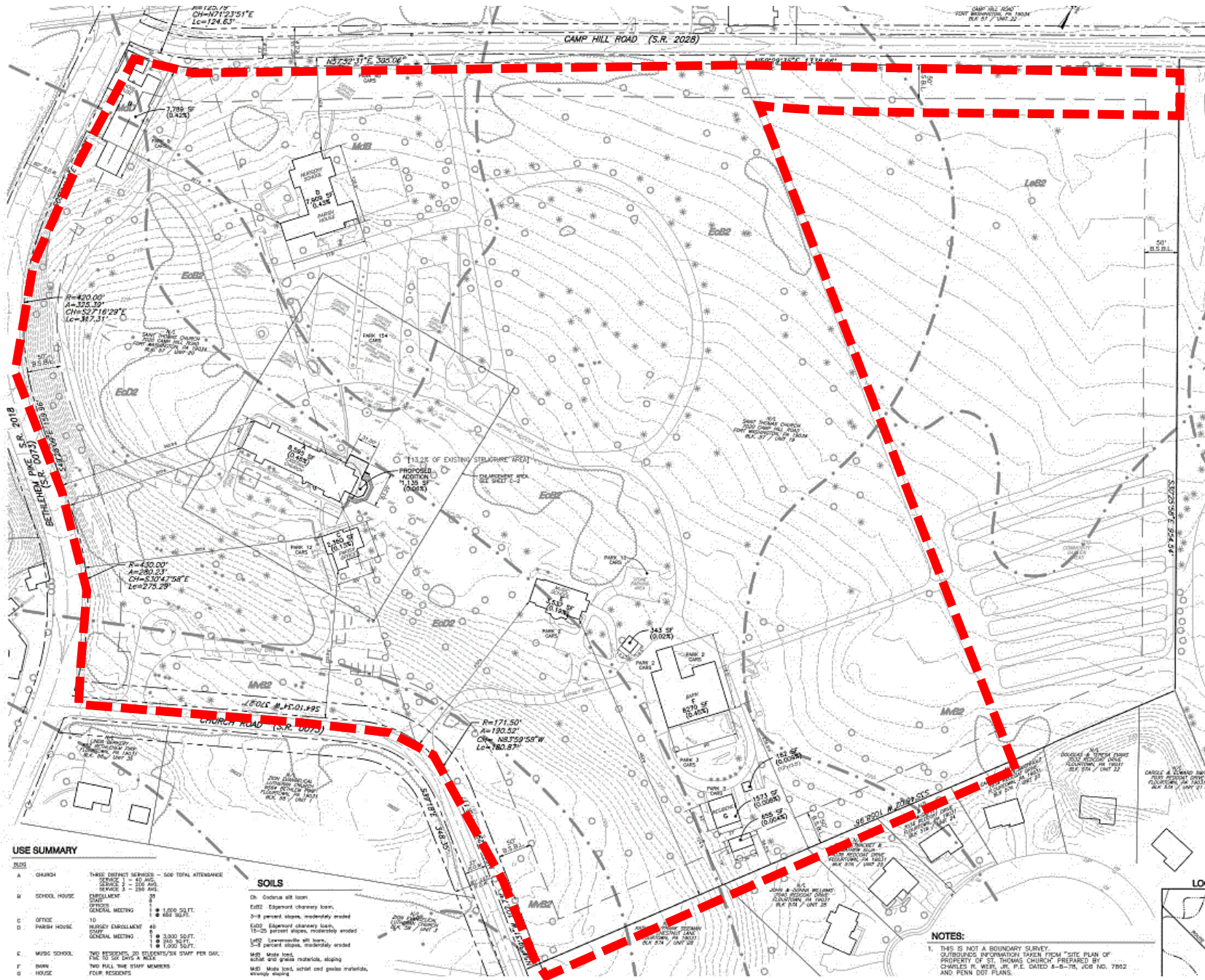
I certify that I am a member in good standing of the International Society of Arboriculture and am a Board Certified Master Arborist, ISA Tree Risk Assessment (TRAQ) qualified, and that I am a member in good standing of American Society of Consulting Arborists (ASCA). I further certify that I represent the Morris Arboretum of the University of Pennsylvania and that this is my work product based on my professional judgment and current industry standards and understanding.



Respectfully Submitted:
Jason Lubar, ISA BCMA
Associate Director of Urban Forestry

21 December 2022
Date

APPENDIX 1: PROJECT BOUNDARY



APPENDIX 2: 10-YEAR ARBORICULTURAL BUDGET

Ten Year Tree-Related Budget for St. Thomas' Church														
	actual	actual	actual											
	FY* 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	TOTAL
Emergency Tree Removals	\$ 25,000	\$ 26,000	\$ 26,900	\$ 2,500		\$ 2,500		\$ 2,500		\$ 2,500		\$ 2,500		\$ 12,500
Tree Inspections/Assessment								\$ 5,000						\$ 5,000
Pruning				\$ 12,000	\$ 10,000	\$ 4,000	\$ 4,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 42,000
Removals				\$ 24,000	\$ 20,000	\$ 10,000	\$ 10,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 76,000
Cabling				\$ 1,000			\$ 1,500							\$ 2,500
Lightning protection					\$ 1,000									\$ 1,000
Tree Planting (inc fencing, mulch, etc.)				\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 20,000
Tree Planting Grants (income)					\$ (5,000)				\$ (5,000)					\$ (10,000)
After Planting Tree Care				\$ 500	\$ 500	\$ 500	\$ 500	\$ 500	\$ 500	\$ 500	\$ 500	\$ 500	\$ 500	\$ 5,000
Arbor Day Program				\$ 350	\$ 350	\$ 350	\$ 350	\$ 350	\$ 350	\$ 350	\$ 350	\$ 350	\$ 350	\$ 3,500
Public Relations/Outreach														\$ -
Software and Updates				\$ 250	\$ 250	\$ 250	\$ 250	\$ 250	\$ 250	\$ 250	\$ 250	\$ 250	\$ 250	\$ 2,500
Shed/Tools/Equipment				\$ 100	\$ 100	\$ 100	\$ 100	\$ 100	\$ 100	\$ 100	\$ 100	\$ 100	\$ 100	\$ 1,000
Training & Professional Development														\$ -
Consultant fees														\$ -
Pest treatments (EAB, HWA, etc)				\$ 500		\$ 500		\$ 500		\$ 500		\$ 500		\$ 2,500
Contingencies				\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 1,000	\$ 10,000
TOTAL	\$ 25,000	\$ 26,000	\$ 26,900	\$ 44,200	\$ 30,200	\$ 21,200	\$ 19,700	\$ 16,200	\$ 3,200	\$ 11,200	\$ 8,200	\$ 11,200	\$ 8,200	\$ 173,500
	*FY = July 01-June 30th													
	NOTE: current and on-going agreement is \$4,000 per work day/full crew/removal of all wood													

APPENDIX 3: LANDSCAPE SUB-AREAS (DEFINED BY THE LANDSCAPE COMMITTEE)

