EMERALD ASH BORER PREPAREDNESS PLAN

Town of Waterbury, VT

Submitted: March 16, 2020

Submitted To:

Town of Waterbury
Tree Committee
Contact: Steve Lotspeich
28 N. Main St., Suite 1
Waterbury, VT 05676
(802) 244-1012
slotspeich@waterburyvt.com

Submitted By:

Redstart Inc.
Contact: Ben Machin and Bill Musson
2332 Goose Green Road
Bradford, VT 05033
(802) 439-5252 x 4, x 5
redstart@redstartconsulting.com
http://www.redstartconsulting.com/

TABLE OF CONTENTS

Executive Summary

The Vermont Department of Forests, Parks, and Recreation, Urban & Community Forestry Program provided a grant that funded this project, and the U.S. Department of Agriculture, Cooperative Forestry Assistance Program was the source of the grant funds.

It is not a matter of *whether* emerald ash borer (EAB) will be found in Waterbury, but simply a matter of *when*. This plan will serve as a reference and decision-making guide for the Town of Waterbury regarding preparation for, and management of, EAB infestations. It pertains to all ash (*Fraxinus* spp.) trees in municipal rights-of-way (ROWs) and on municipal properties in the Town. Key decision makers include the Tree Warden, the Waterbury Tree Committee, the Public Works Director, the Highway Supervisor, and the Municipal Manager. Budget decisions are made by the Select Board and the Town voters.

Waterbury is in a high-risk area for EAB, according to the Vermont Agency of Natural Resources (ANR). The closest confirmed infestation as of 12/9/2019 is in Montpelier, on the National Life Building grounds. There is also a confirmed infestation in Bristol. 657 ash trees have been inventoried and mapped in Waterbury.

Possible Management Approaches

Proactive:

- ash tree removals prior to discovery of infestation
- replacement of ash street trees
- outreach and education
- preventative insecticide treatment to protect specific individual trees

Reactive:

- infestation detection and reporting (chain of command)
- ash tree removal after infestation is discovered
- replacement of ash street trees

Recommended Management Actions

Proactive:

- remove ash trees that pose a risk to public safety and/or property, particularly those that are dead or in poor health
- remove healthy ash trees; focus on individuals that are more difficult to remove, and focus on areas with a relatively high percentage of ash trees
- replace ash street trees with a diversity of species other than ash; plant species proven to be successful and chosen specifically for each site
- initiate outreach and education efforts; collaborate with private landowners
- treat most prized and valuable ash trees with preventative insecticides

Reactive:

- detect and report infestations, and employ the chain of command
- remove infested ash trees that pose a risk to public safety, and those in rapid decline
- replace ash street trees

Purpose and Scope of the Plan

This preparedness plan was developed for the Town of Waterbury to serve as a reference and decision-making guide regarding the management of emerald ash borer (EAB) (*Agrilus planipennis*) infestations. Management options and recommendations in the plan are intended to minimize risk to public safety, property and utilities, guide the Town in balancing short- and long-term costs, and increase public awareness of EAB.

This plan applies to all ash trees in municipal rights-of-way (ROWs) and on municipal properties in the Town of Waterbury. Outreach and education efforts will be targeted toward private landowners where one or more ash trees may pose a safety hazard on site, to adjacent public ROWs, other public properties, and adjacent property owners. This plan does not apply to sections of VT Route 100 and U.S. Route 2 that are maintained by the State of Vermont, or to utility ROWs maintained currently by Green Mountain Power.

This plan is based on the most recent scientific studies and recommendations from state and federal agency partners. Best management practices are subject to change as research continues to be conducted on EAB. Thus, this plan is a living document, and updates should be made accordingly.

Authority and Administration

Management decisions regarding EAB will made by:

- Tree Warden / Community Planner – Steve Lotspeich
- Public Works Director – Bill Woodruff
- Highway Supervisor – Celia Clark
- Municipal Manager – Bill Shepeluk

Decisions will also be guided by input from advisory groups, including:

- Waterbury Tree Committee:
  Current members: Barbara Blauvelt, Jane Brown, Jack Carter, Chuck Kletecka, Karen Maurice, Steve Lotspeich, Stuart Whitney

- Waterbury Conservation Commission:
  Current members: Allen Thompson (Chair), Krista Battles, Joan Beard, Steve Hagenbuch, Michael Hedges, Tracy Sweeney, Katrina Van Tyne, Billy Vigdor

All budget decisions are made by the Select Board and the Town voters. All grant applications must be authorized by the Select Board.

The Town does not currently have a Tree Ordinance in place. It is recommended that a Tree Ordinance be drafted and enacted.

Chain of command to be followed when EAB is detected and reported:

Order of Command	Name	Title	Responsibilities	Contact Information
1	Bill Shepeluk	Municipal Manager	Budget committments	802-244-7033
2	Bill Woodruff	Public Works Director	Coordination of removal and treatment	802-839-6199
3	Celia Clark	Highway Supervisor	Supervision of removal	802-793-6214
4	Steve Lotspeich	Community Planner	Application for & management of grant funding	802-244-1012
5	Tree Committee		First detection and reporting of possible EAB	

It is recommended for the Town to designate one or more First Detectors to be responsible for monitoring ash trees, detecting new EAB infestations, and reporting them to the Town, as well as state and federal officials.

EAB Information

Background

The emerald ash borer (EAB) is a non-native, wood boring beetle from Asia that was likely introduced to North America in the 1990's in ash wood used for shipping pallets and packing materials. The insect targets and kills all native North American ash species (*Fraxinus* spp.). In Vermont, the three species affected by EAB are white ash (*Fraxinus americana*), black ash (*Fraxinus nigra*), and green ash (*Fraxinus pennsylvanica*). EAB was first discovered in Detroit, Michigan and Windsor, Ontario in 2002. Since its discovery, EAB has spread into 35 U.S. states (USDA, APHIS) and 3 Canadian provinces (Figure 1).

(EAB was also found in white fringetree (*Chionanthus virginicus*) in Ohio in 2015, but a more widespread attack of this species has not been confirmed. White fringetree is sometimes used for landscaping in Vermont.)

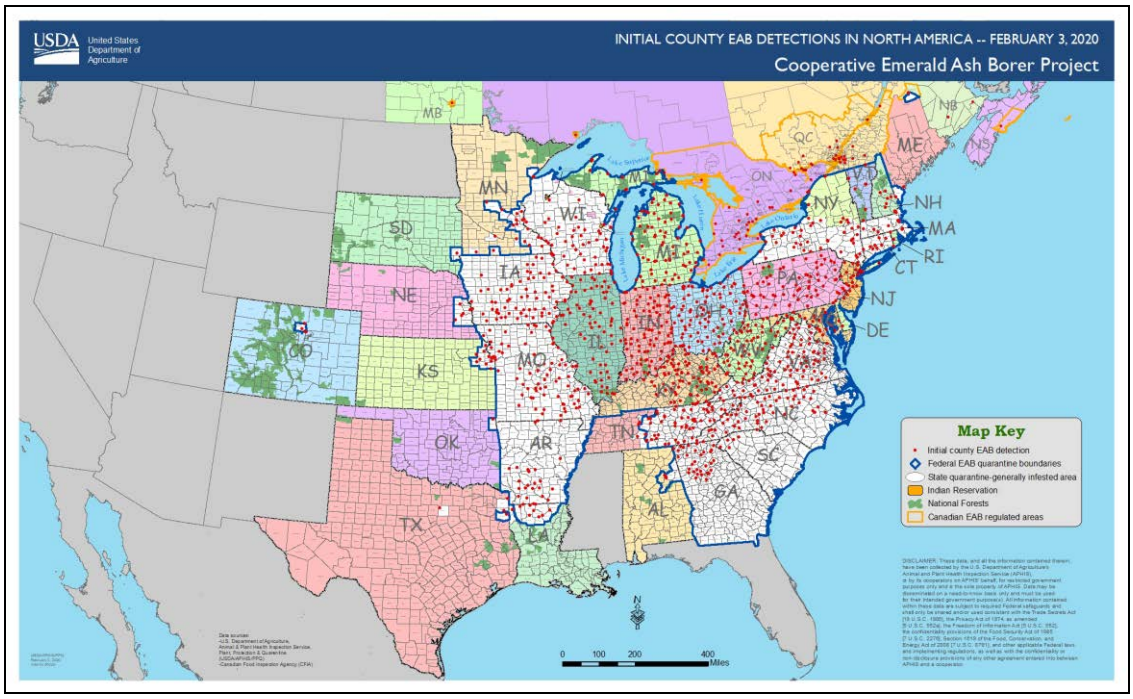

Figure 1. U.S. states and Canadian provinces where EAB has been confirmed as of February 3, 2020. (http://www.emeraldashborer.info/)

In Asia, EAB's population is kept in check by predators and pathogens, and its damage to native trees is limited by co-evolutionary resistance to attacks. Although a few predators exist (e.g., woodpeckers) in North America, native ash trees have no natural resistance. As result, the EAB has killed between 50 and 100 million ash trees in the region. Related costs to U.S. municipalities from EAB could exceed $12 billion over the next ten years. EAB can travel a half a mile per year, with the potential to expand its range of infestation up to several miles per year during adult beetles' flight period (June-August). Human activities, however, expedite EAB's spread through the transportation of infested nursery stock and firewood.

EAB in Vermont

EAB was first detected in five Vermont counties in 2018 (Bennington, Caledonia, Grand Isle, Orange, Washington), and in three more counties in 2019 (Addison, Orleans, Windham). Figure 2 below shows 'Confirmed Infested' and 'High Risk' areas in the State.

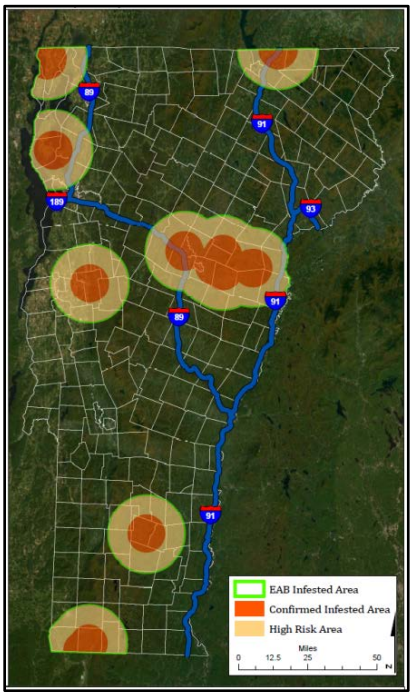

Figure 2. EAB infested areas in Vermont as of December 9, 2019.
(https://vtinvasives.org/land/emerald-ash-borer-vermont)

Impact of EAB on Waterbury

EAB infestations and the death of ash trees will have multiple adverse effects on the Town, residents, and visitors. The primary concern in preparing for and responding to EAB infestation is the risk to public safety caused by dying and dead trees. After infestation, the death of an ash tree can be relatively quick; small, healthy trees may be killed within 1-2 years, and large, healthy trees may be killed within 3-4 years. Upper branches often die and fall first, followed by larger limbs. It is important to note that ash trees tend to have particularly large, spreading crowns, and they can be more dangerous and difficult to remove than other species. (For example, American elms frequently die but tend to remain standing and do not drop as many large limbs.) EAB affects both healthy and stressed trees, and those that are in poor condition prior to becoming infested will likely suffer more rapid and severe breakage. As the insect becomes established, there will be increasing risk of personal injury and property damage. Simultaneous death of multiple trees will compound the problem, potentially causing aesthetic impacts, and to some extent, reducing the forest's ability to regulate temperatures, improve air and water quality, sequester and store carbon, and increase property values. Short- and long-term municipal financial costs are associated with significant ash tree mortality.

No EAB infestations have been confirmed in the Town of Waterbury as of the submittal date of this plan. Approximately 11.8 square miles, or 24% of the Town of Waterbury, is mapped by the Vermont Agency of Natural Resources as a 'High Risk Area' for EAB infestation (Figure 3). High risk areas are anywhere within a 5-mile radius of a confirmed infested area. The closest confirmed infestations to the Town of Waterbury, as of December 9, 2019, are in Montpelier on the National Life Building grounds, and in Bristol.

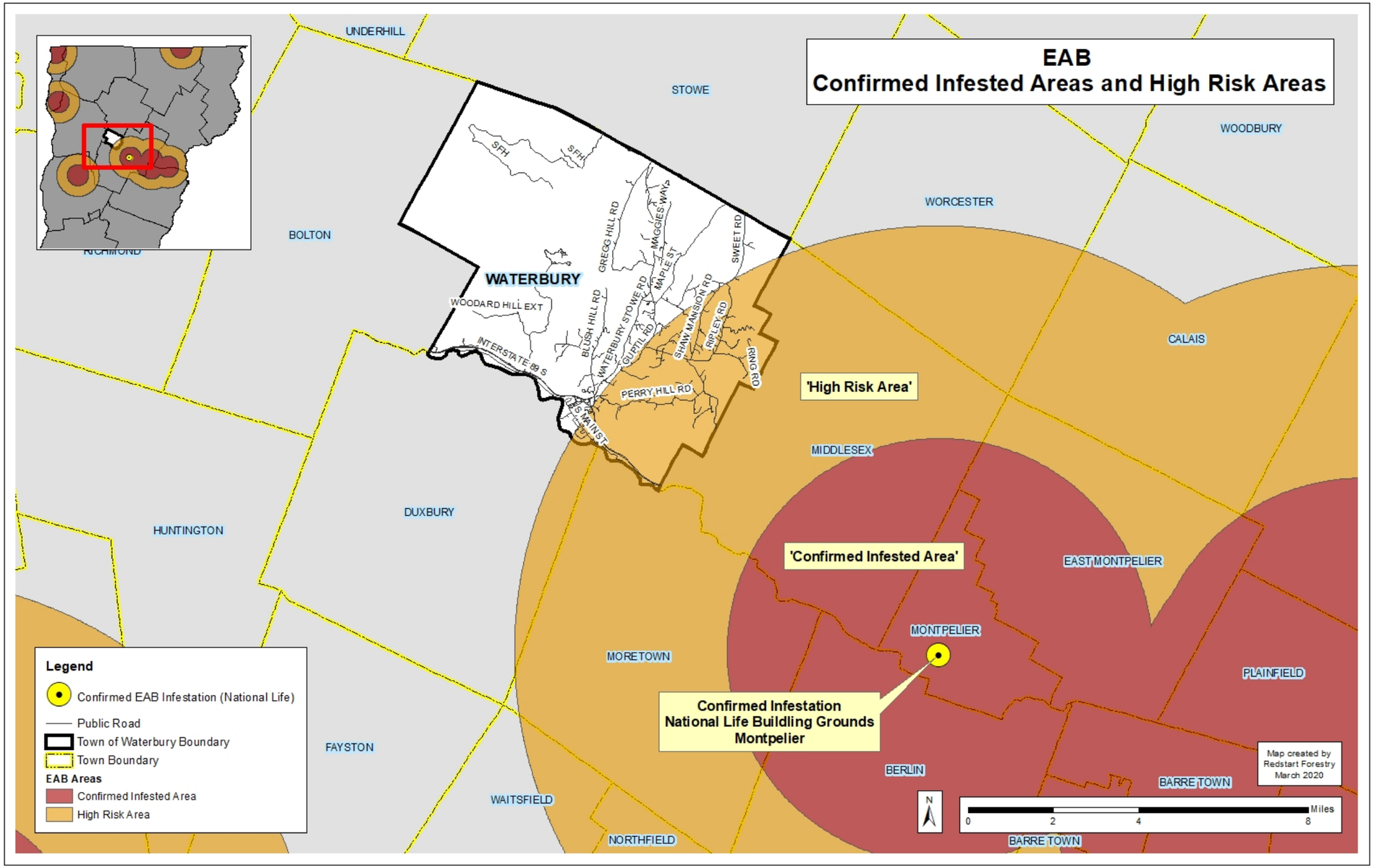

Figure 3. EAB confirmed infested areas and high risk areas near Waterbury, VT.

EAB Identification

Adult beetles

- ¼" to ½" long, narrow, bullet-shaped
- flat back
- metallic green color
- purple/red metallic abdomen beneath wing covers

Adult beetle

Larvae

- up to 3 cm (~1 ¼") in length
- creamy white color
- no legs
- body made up of flattened, bell-shaped segments

Larva

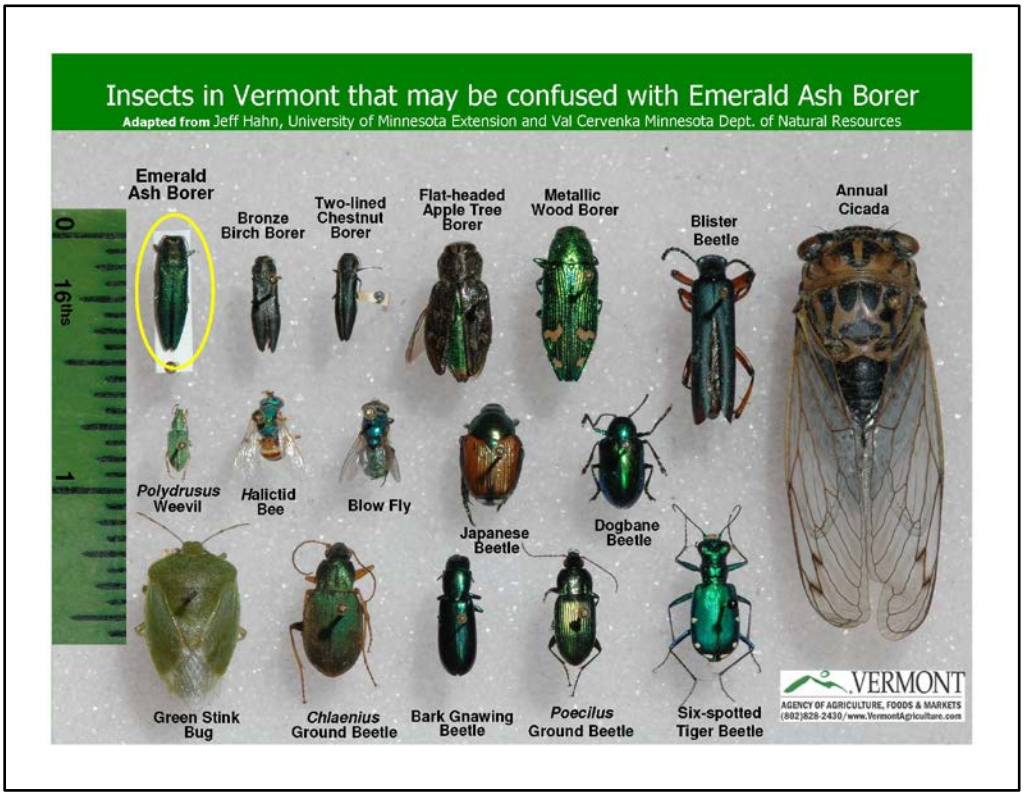

Figure 4. Insects that may be confused with EAB (VT Agency of Agriculture, Food, & Markets).

EAB Detection

EAB attacks all species of ash (Fraxinus spp.
Symptoms include:

Serpentine galleries under bark

D-shaped exit hole in bark surface, 1/8" wide

Woodpecker foraging

Epicormic branching (sprouting from dormant buds on stems/branches)

Crown dieback

Ash Tree Inventory

The data for this plan was collected in stages by members of the Town Tree Committee with assistance from Ashley Andrews with the Central Vermont Regional Planning Commission and Meredith Whitney, formerly with the UVM Extension Service. Information recorded for each tree includes location, diameter class* (1-11", 12-23", or 24"+), and overall condition (healthy, fair, poor, or dead) (Table 1). The data from one stage of inventory also includes whether or not each tree showed symptoms of potential ash borer infestation. Maps were created by the Central Vermont Regional Planning Commission that show ash trees inventoried in Waterbury by condition (Figure 5) and diameter class (Figure 6). **Diameters were measured as 'diameter at breast height' (DBH), or the diameter of the tree at 4.5' above the ground.*

The data for this plan includes ash trees in municipal ROWs and on municipal properties in Waterbury Village and Waterbury Center. It also includes ash trees along many town-maintained roads, such as Little River Road, Blush Hill Road, Gregg Hill Road, Maggie's Way, Sweet Road, Shaw Mansion Road, and Perry Hill Road.

Table 1. Summary of ash tree inventory data by diameter class and condition.

DIAMETER (DBH) CLASS	**CONDITION**				
	Good	Fair	Poor	Dead	**Total**
1-11"	388	50	10	2	**450**
12-23"	137	26	19	2	**184**
24" +	12	5	5	1	**23**
Total	**537**	**81**	**34**	**5**	**657**

About 68% of the ash trees inventoried are in the 1-11" DBH range; of these trees, 86% are in good condition. Twelve trees in this size class are in poor health or dead. Smaller trees pose the least risk to public safety if infested, and generally bear the lowest removal costs.

About 28% of the ash trees inventoried are in the 12-23" DBH range; of these trees, 74% are in good condition. 21 trees in this size class are in poor health or dead.

About 4% of the ash trees inventoried are above 24" DBH. About half of these trees are in good condition, 5 trees are in fair health, and 6 trees are in poor health or dead. Removing large, dying and dead trees bears the greatest removal costs in general due to the need for additional equipment and labor. However, these trees are also likely the highest priorities for removal; regardless of whether they are infested with EAB, they generally have the most potential to cause personal injury or property damage.

No EAB infestations have been confirmed in the Town as of the submittal date of this plan.

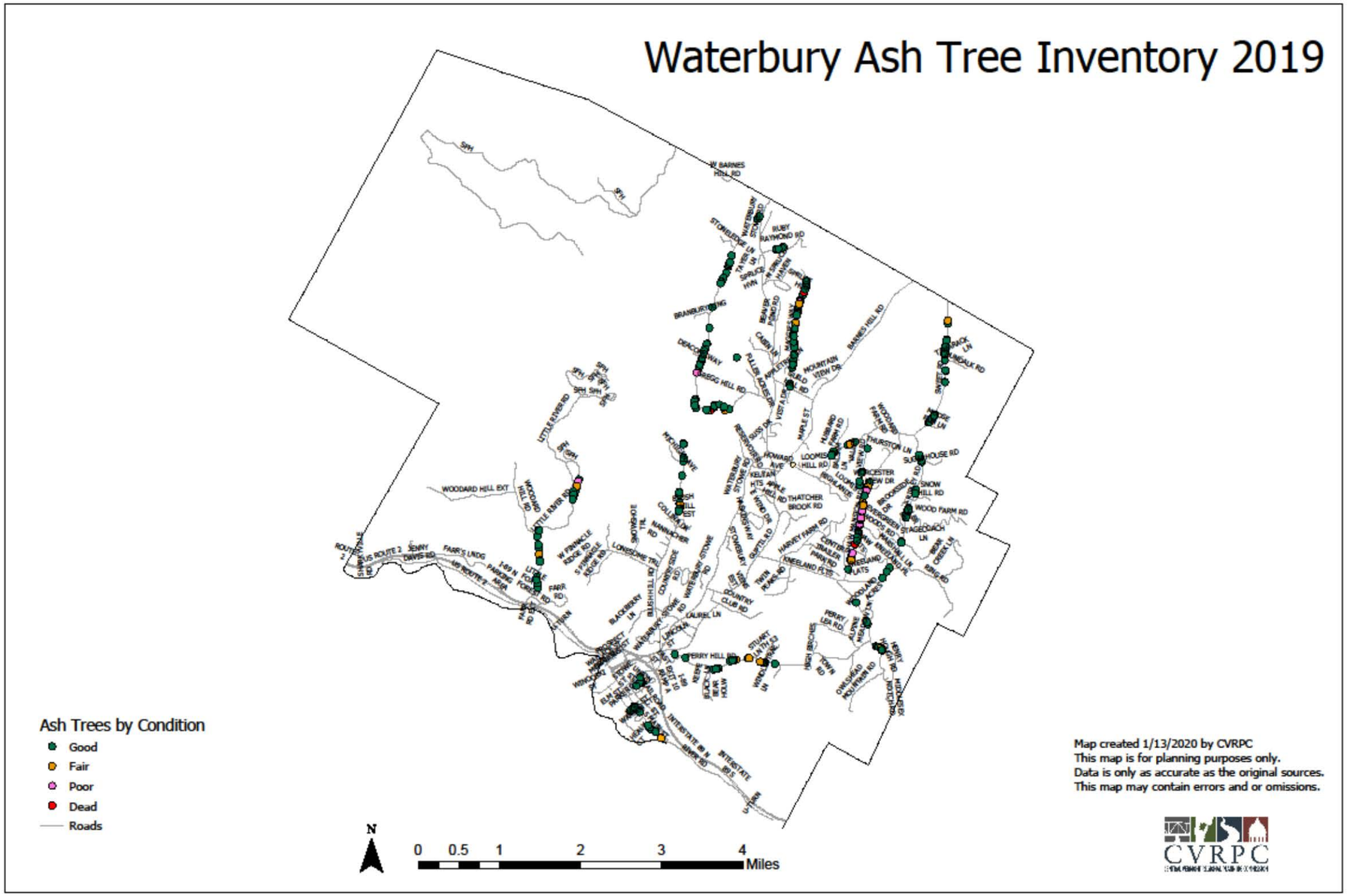

Figure 5. Ash trees in Waterbury by health condition (CRVPC).

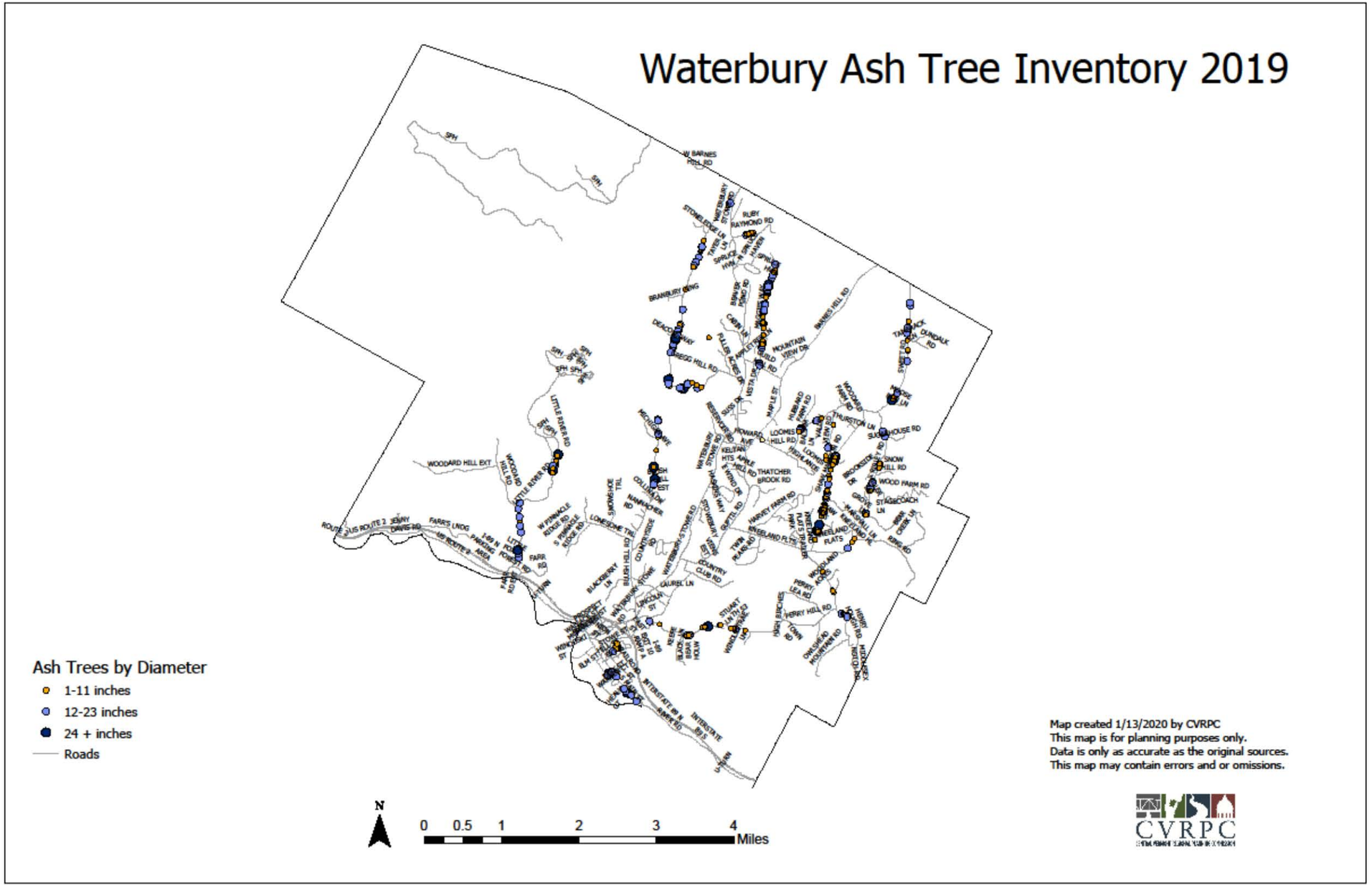

Figure 6. Ash trees in Waterbury by diameter (CRVPC).

Management Options and Estimated Costs

Management strategies can be divided into two categories: proactive and reactive.

Proactive management activities include removal of ash trees before they are discovered to be infested, replacement of street trees with a diversity of other species, initiation of outreach and education, and treatment of healthy trees with preventative insecticides. Proactive management carries greater short-term costs than reactive management, but it allows the Town to spread costs out over multiple years and yields a lower eventual cost, assuming EAB infests Waterbury. Proactive management also helps avoid the public safety risks and negative aesthetic impacts of a large number of ash trees declining and dying in a short time period.

Reactive management activities include EAB detection and reporting, removal of ash trees that are confirmed to be infested, and replacement of infested street trees once they have been removed. Reactive management pushes tree removal and replacement costs further into the future, but it also concentrates costs into a shorter time frame once EAB is well established in the area and ash trees are rapidly declining in health and dying. It is also likely to increase the total cost of EAB management, because trees that are dead and dying are almost always more expensive to remove than healthy trees; they are more dangerous, less predictable, take longer to clean up due to splintering and shattering, and often require additional equipment costs. Relying solely on reactive management is not recommended and can make responding to EAB more challenging and expensive in the future.

Proactive Management Approaches

1. Preemptive Removal

Removing trees before they are discovered to be infested carries significant short-term costs but is likely the least expensive approach over the long-term. Removal costs are significantly lower when trees are healthy; declining and dead ash trees are more dangerous, complicated, and time-consuming to remove, and thus costs are higher. Anecdotal evidence from arborists suggests that trees that are dead or dying are at least 20-30% more expensive, and up to twice as expensive, to remove than they would have been when they were still healthy and structurally sound.

Site factors and tree characteristics vary widely. These variables will determine what type of equipment and methods are needed for tree removal, as well as the costs for removal.

Site characteristics that affect equipment used and removal costs:

- **Quantity and location of *'targets'*. The term 'target' refers to anything that could potentially be damaged during tree removal**, including but not limited to:
    - utility lines;
    - buildings / structures;

    - other trees and plants;
    - cultural and historic features (cemeteries, stone walls, statues, sculptures, fountains, etc.).
- Proximity to a public road; hiring traffic control is required for many tree removals along public roads, which carries additional cost.
- Topography; steep slopes can create challenges and increase costs.

Tree characteristics that affect equipment used and removal costs:

- Size (diameter, height, crown width)
- Tree form (single stem versus multiple stems, growing vertically versus heavy lean, etc.)
- Structural stability / integrity
    - indicators of good structural integrity are:
        - a single, dominant stem, growing vertically;
        - a healthy crown;
        - strong branching junctions with no major 'narrow forks';
        - tight, intact bark without cracks or seams;
        - no hollow areas or woodpecker damage;
        - no previous sitework that would compromise root system (changing grade, changing soil hydrology, cutting roots, etc.).
    - indicators of poor structural integrity are:
        - multiple stems/trunks competing for dominance (rather than one dominant stem/trunk);
        - significant leans, sweeps, or crooks;
        - an unhealthy crown;
        - epicormic branches (sprouting from dormant buds on stems/branches, which is often a sign of health problems higher in the tree)
        - loose bark, and/or missing bark;
        - cracks, seams, and hollow areas;
        - woodpecker or boring insect damage;
        - a compromised root system due to previous sitework (changing grade, changing soil hydrology, cutting roots, etc.).

General tree removal equipment and methods:

Felling whole trees from the ground is the simplest and least expensive method of tree removal. For this situation to be possible, the tree must be structurally sound and located where it can safely fall in one direction. Many municipal trees are too close to utility lines, buildings, and other potential targets for this option.

It is likely that most municipal tree removals will involve the use of a bucket truck, with an arborist cutting the tree down in pieces. This method is safe and efficient, and can be used for trees in a variety of size classes and health conditions.

Trees may also be climbed and taken down by an arborist, who can move around the tree and remove it methodically, in pieces. This can only be done if the tree is structurally sound and hence safe for the arborist to climb.

Cranes are used for the largest, most dangerous trees in the riskiest situations. The expense of hiring a crane and operator are substantial. If possible, it would be ideal for the Town to consolidate tree removals requiring a crane, which would likely lower the cost per tree.

Hiring **traffic control** bears its own additional cost and will be necessary for most trees removed along public roads.

Estimated removal costs:

As described above, **costs for tree removals vary widely and are determined by many site factors and tree characteristics**. Approximate cost ranges for different tree removal scenarios are below.

The low end of the cost ranges would apply best to trees that are:
- healthy and growing vertically, with one dominant stem
- structurally sound
- in a location with no targets and easy access
- in a location with gentle topography

The high end of the cost ranges would apply best to trees that are:
- dead or dying
- leaning heavily and/or have multiple codominant stems
- not structurally sound
- in a location with numerous targets (utility lines, buildings, other trees, etc.)
- in a location with difficult access and topography

a. **1-3" DBH**
   Estimated removal cost: < $100 per tree
   Although EAB larval galleries have been found in trees or branches as small as 1" in diameter, it is unlikely that trees this small will be tall or heavy enough to pose a significant risk to public safety, utilities, or property.

b. **4-11" DBH**
   Estimated removal cost: $150 - $1,500 per tree
   It is not cost effective to remove trees in this size class one at a time. If possible, multiple removals should be consolidated into one contract to lower the cost per tree.

c. **12-23" DBH**
   Estimated removal cost: $400 - $3,000

Trees in this wide diameter range could fall into many different cost scenarios. For example, a healthy 12″ tree that can be safely and easily felled and cleaned up bears a much lower removal cost than a dead 23″ tree with multiple stems near utility lines, buildings, roads, and other potential targets.

d. 24″+ DBH
Estimated removal cost: $1,200 - $4,000(+)
As with the 12-23″ trees, those above 24″ in diameter can also fall into numerous cost scenarios. The same reasoning applies; a healthy 24″ tree that can be safely and easily felled and cleaned up bears a much lower removal cost than a dead 24″ tree with multiple stems near utility lines, buildings, roads, and other potential targets. **Removing the largest trees can present particular challenges in terms of safety, equipment, and clean-up.**

Note: The costs above are provided as a rough guide for planning and budgeting purposes. Every tree and every removal situation is different; costs could be lower or higher than the ranges given. **It is very important to note that the costs above are based on removing a single tree as an entire project. Removal costs on a per-tree basis will be lower if removals can be consolidated into larger projects**, especially when the trees are relatively close to each other (all along the same road or couple of roads, in a park or cemetery, etc.). The Town has already identified some priority areas and trees, which will help in planning and achieving cost-effective removal projects.

Example removal scenarios and costs on Maggie's Way:
The following tree removal cost estimates are based on quick assessments made by an arborist of a few ash trees growing along Maggie's Way.

Example 1:
12″ DBH; dead;
not near power lines;
Estimated removal cost: $400-450

Example 2:
10-12″ DBH; good condition; ~60′ tall;
not near power lines;
Estimated removal cost: $400

Example 3:
22″ DBH; good condition;
not near power lines;
Estimated removal cost: $800

Example 4:
40+″ DBH; good condition;
near power lines;
Estimated removal cost: $1,800 without crane; $2,500 if crane is needed

2. Street Tree Replacement

When street trees and trees in parks, cemeteries, and other public spaces are removed, it is recommended that they be replaced with a diversity of species genera other than ash (*Fraxinus*). Species that are proven to be successful street trees should be planted; plants should be chosen

based on each specific location and set of circumstances. In other words, 'the right plant for the right place'. It would be ideal to plant species native to the Northeastern U.S., such as red oak (*Quercus rubra*), river birch (*Betula nigra*), paper birch (*Betula papyrifera*), black cherry (*Prunus serotina*), sycamore (*Platanus occidentalis*), American linden (*Tilia americana*), thornless hawthorn (*Crataegus crus-galli*), serviceberry (*Amelanchier* spp.), and honey locust (*Gleditsia triacanthos*). Non-native species may be considered as well. Some non-native species which tend to do well along roadsides and in urban and suburban settings are European linden (*Tilia cordata*), gingko (*Gingko biloba*), and crabapples (*Malus* spp.). Smaller trees such as thornless hawthorns and crabapples are particularly well-suited to areas where there are overhead wires, as they require little to no pruning for clearance.

It is recommended to plant shade trees that are a minimum 2" in caliper (diameter) and flowering trees that are a minimum of 1½" in caliper. At these sizes, the tree's root systems are well developed but have likely not been cut back as aggressively as larger trees for their harvest and transport. They are large enough to be structurally sound and withstand some minor disturbances, as well as providing an immediate improvement to aesthetics.

Municipal tree planting should follow the State of Vermont tree planting specifications for the "communities caring for canopy" program. For urban situations such as trees planted in tree wells in sidewalks, it is recommended to use the most up-to-date techniques and materials for street tree planting, including modular suspended pavement systems (e.g. Silva Cells), structural soil, and permeable pavement. These represent greater short-term costs but would save the Town money over the long-term due to lower tree removal and replacement costs.

Estimated tree planting costs:

Shade trees in the 2" – 2 ½" caliper size → $400 - $500 per tree, planted and guaranteed.

Flowering trees in the 1 ½" – 2" caliper size → $300 - $400 per tree, planted and guaranteed.

3. Community Outreach and Education

The anticipated decline, death, and removal of the ash trees in Waterbury will be a source of concern and stress for the community. An education and outreach strategy should be part of the Town's response to EAB, including the following key components:

- Education about the extent of the threat, as well as identification and detection;
- Outreach to private landowners with ash trees in or near public ROWs, and on other areas of their property;
- Informing the community about plans for EAB management;
- Involving as many people as possible to help with monitoring, detection, reporting, and continued outreach and education;

- Clear and consistent notifications to the community regarding notifications of tree removals, tree plantings, insecticide treatment, current best management practices, and volunteering opportunities;
- Utilization of existing networks and community groups, such as Waterbury Tree Committee, Waterbury Conservation Commission, Friends of the Winooski, and others.

The following goals are to be developed and pursued by the Town to implement outreach and education:

- Reach out to private landowners with ash trees in or near public ROWs;
- Reach out to partners for technical expertise such as University of Vermont Extension, Vermont Department of Forests, Parks and Recreation, USDA Animal Plant and Health Inspection Service (APHIS), Washington County Forester, and Central Vermont Regional Planning Commission;
- Develop clear, effective messages and outreach materials to use in communicating about EAB;
- Identify target audiences and opportunities for grassroots leadership and engagement; this includes community events where there is an opportunity for direct communication;
- Create an EAB webpage to be used as a source of up-to-date information on infestations, quarantines, initiatives, and best management practices, as well as key resources and contacts;
- Develop and maintain a presence on one or more popular platforms for communication, such as Front Porch Forum or social media;
- Coordinate with the Tree Warden as needed to notify property owners about planned tree removals and/or replacements;
- Hold public meetings and open houses when necessary or appropriate.

4. Prevention (chemical control)

Insecticide treatments are available that are effective in protecting ash trees from EAB. They must be administered by a licensed applicator, and trees must be treated while they are healthy and leafed out, for the insecticide to work properly. It is important to note this is a periodic cost, as trees must be treated every two years for it to be effective. Chemical control is not currently cost effective for implementation on a large scale but is a good way to protect individual trees. It may be worth considering replacement of all ash trees over time because the insect is expected to be a long-term mortality agent for ash.

The Town plans to start an insecticide treatment program within the next two years. Treatment will be focused on individual trees along public roads, in parks, cemeteries, and other public green spaces. Specimen trees on private properties may also be included in the treatment program, if permission is received from the owner(s) of the tree(s).

Estimated insecticide treatment costs:
$9-18 per diameter-inch per treatment

Insecticide treatment cost per tree will likely be lower if multiple trees are treated as part of the same contract.

If there are no Town employees currently licensed for the category of pesticide application needed for the insecticide treatments (Category 3A – Ornamental & Shade Tree Pest Control), it is recommended that someone become trained and licensed, as this could save the Town money.

Example cost scenarios for chemical treatment:

Using a tentative budget of ~$2,000 per year for chemical treatment of ash trees, and an average cost of $12 per diameter-inch, the town could treat:

28 trees with a 6" DBH = $2,016
or
14 trees with a 12" DBH = $2,016
or
9 trees with an 18" DBH = $1,944
or
7 trees with a 24"DBH = $2,016

Note that trees must be treated every two years for the insecticide to be effective. Thus, the costs above are biannual. Treatment could alternate between groups of trees. For example, 14 trees with a 12" DBH could be treated in years 1, 3, 5, and so on, while 9 trees with an 18" DBH could be treated in years 2, 4, 6, and so on. In that case, the Town would be spending about $2,000 per year on chemical treatment while treating 23 trees total.

Two important notes on insecticide treatment:
- As stated above, the cost per tree will likely be lower if multiple trees are treated as part of the same contract.
- As trees grow in diameter, the cost to treat them will increase.

Reactive Management Approaches

1. Detection and Reporting (Chain of Command)

It is recommended that the Town designate one or more First Detectors to be responsible for monitoring ash trees, detecting new EAB infestations, and reporting them to the Town, as well as state and federal officials. All suspected new infestations should be reported using the "Report It" button on the Vermont Invasives website (https://www.vtinvasives.org/), and the preparedness response should be initiated, starting with the first person in the chain of command on Page 5.

2. Reactive Removal

Reactive management pushes tree removal further into the future, but it also concentrates costs into a shorter time frame once EAB is well established in the area and ash trees are rapidly declining in health and dying. It is also likely to increase the total cost of EAB management, because trees that are dead and dying are almost always more expensive to remove than healthy trees; they are more dangerous, less predictable, take longer to clean up due to splintering and shattering, and often require additional equipment costs. Relying solely on reactive management is not recommended and can create significant challenges to being able to respond to EAB effectively in the future. Please refer to Page 12 for information regarding tree removals and estimated costs.

3. Street Tree Replacement

Replacing trees after reactive removals is no different than after proactive removals, except in that there is likely to be less time to plan and budget for it. Please refer to Page 15 for information regarding street tree replacement.

Management Recommendations

Proactive:

- remove trees that pose a risk to public safety, utilities, and property, particularly those that are dead or in poor health; start with large, poor-quality trees on Maggie's Way and Shaw Mansion Road
- remove healthy ash trees; focus on individuals that are more difficult to remove, and focus on areas with a relatively high percentage of ash trees
- replace street trees with a diversity of species other than ash; plant species proven to be successful and chosen specifically for each site
- initiate outreach and education efforts; collaborate with private landowners with ash trees, such as Shaw's and Community Bank
- treat most prized and valuable ash trees with preventative insecticides; ash trees in parks and cemeteries, as well as those on South Main Street, are likely to be treated starting within the next two years

Reactive:

- detect and report infestations, employ the chain of command, initiate preparedness response
- remove infested trees that pose a risk to public safety
- remove infested trees that are in rapid decline
- replace street trees

Priority Areas

Chemical Control

The Town plans to start an insecticide treatment program within the next two years. Treatment will be focused on individual trees along public roads, as well as in parks, cemeteries, and other public green spaces. Specimen trees on private properties may also be included in the treatment program, if permission is received from the owner(s) of the tree(s).

Tree Removal

Priority areas for ash tree monitoring and removal include Waterbury Village and Waterbury Center as well as parks, cemeteries, and other public green spaces. Certain Town-maintained road ROWs should also be prioritized for tree removals. The inventory data were used to identify some of these ROWs, shown in the table (Table 2) and the map (Figure 7) below.

Table 2. Priority Town-maintained road ROWs for ash tree removal in Waterbury.

	High-Risk Ash Trees		
Road Name	**Condition**	**Diameter Class**	**Quantity**
Blush Hill Road	Fair	24″+	1
Gregg Hill Road	Poor	12-23″	11
	Dead	12-23″	1
	Dead	24″+	1
Maggie's Way	Poor	24″+	1
	Dead	12-23″	1
Perry Hill Road	Fair	24″+	1
Ripley Road	Poor	12-23″	2
Shaw Mansion Road	Fair	24″+	4
	Poor	24″+	6
	Poor	12-23″	7

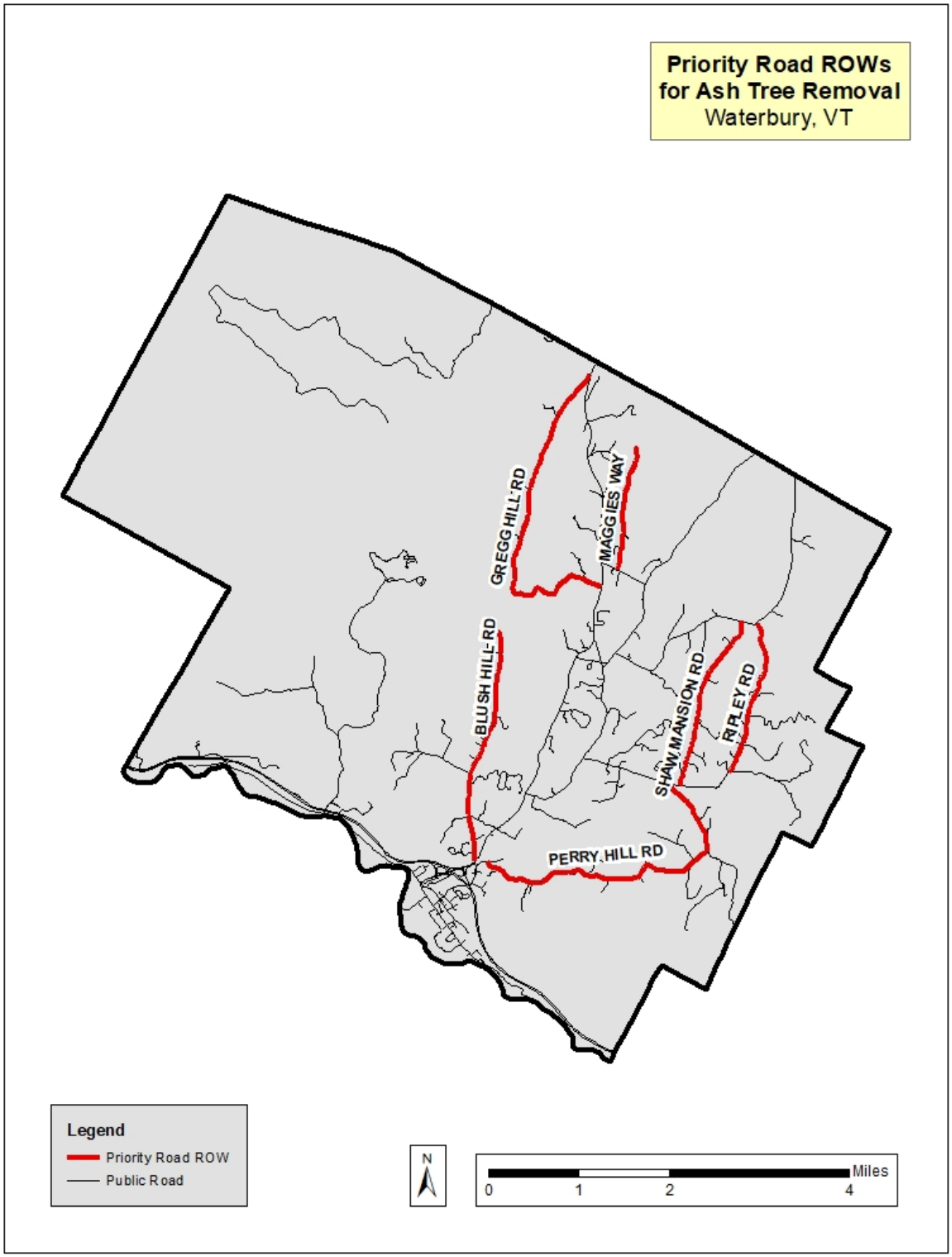

Figure 7. Priority Town-maintained road ROWs for ash tree removal in Waterbury.

Wood Disposal and Utilization

EAB infestations naturally spread 1-2 miles every year. Movement of infested material, particularly ash firewood and logs, expedites the spread to uninfested areas. The movement of infested or potentially infested material must be done with careful planning and management, and all state and federal regulations must be followed. The Town should use the Slow the Spread recommendations (Appendices A, B, and C) provided by the Vermont Department of Forests, Parks and Recreation as a guide. This will ensure that all state and federal regulations and best management practices are being followed. The most up-to-date Slow the Spread recommendations are at the following website: https://vtinvasives.org/land/emerald-ash-borer-vermont/slow-spread-of-eab

A substantial amount of wood will need to be either used or disposed of as a result of ash tree removals. A sizeable materials storage area is just east of the Ice Center located at 546 River Road, at the southeastern edge of Waterbury Village. The Town is exploring other areas for stockpiling wood, although anything beyond short-term storage is seen as a last resort. Little processing would be necessary at the stockpile area, as most of that will be done on site where trees are removed. The amount of processing largely depends on what the Town decides to do with the firewood generated through removals.

NOTE:

- **Do NOT sell or move ash firewood/logs outside of the infested area.**
- **Do NOT move any ash material outside of Vermont.**
- **CHIPPING infested ash material can kill all life stages of EAB, through both mechanical destruction and heat generated as chip piles decompose.** The ideal chip size is 1" x 1" or smaller, but many chippers do not create chips that small. The smaller the chips, the better; however, **there is no requirement for chip size.**

Logs can be bucked into saleable lengths at the site of removal, as long as the wood is still sound and not beginning to rot. Trees with a diameter of 12" or greater may have some value as sawlogs.

Firewood can be brought to the stockpile area in log-length pieces. It is up to the Town whether it would like to keep the firewood in log length there, or cut/split the firewood there. It is recommended that the Town explore options for using firewood locally, especially if it can be distributed to low-income individuals and families in need. This process could be similar to the Firewood Program that is in place in Lamoille County, which is run in partnership between the United Way of Lamoille County and the State of Vermont. This type of program relies heavily on volunteer work. More information can be found at the following website: https://uwlamoille.org/programs/local-programs/firewood-program.html. If it makes more sense, most of the firewood can be chipped at the site of removal. It is normally up to the tree

company to determine where to dump the chips, but the Town could collaborate with them, particularly if the Town has use for chips.

Large, low-quality wood would normally be processed into firewood. All chippers have a diameter limit, and it becomes labor-intensive to chip the largest pieces of wood, as they must be cut down to smaller sizes before being chipped.

Brush should be chipped on site. Again, it is normally up to the tree company to determine where to dump the chips, but the Town could collaborate with them, particularly if the Town has use for chips.

Budget

Budget decisions are made by the Select Board and the Town voters. All grant applications must be authorized by the Select Board.

The Town will likely create an annual budget line specifically for ash tree removal, as well as pursuing funding through state and federal grants. In the meantime, there is a $4,000 budget item proposed for 'Tree Maintenance' for the 2020 fiscal year.

The maximum predicted funding available for EAB preparedness and response is $20,000 per year. The Town hopes to generate 50% of that through grants. The first attempt to implement this plan will be in the 2021 fiscal year.

In 2020, Vermont Urban and Community Forestry sought and chose three municipal partners to each receive a $15,000 grant, for a total of $45,000 in cost-share grants described at this website: https://vtcommunityforestry.org/programs/financial-assistance/eab-management-grants. To be eligible, the projects had to include removal of ash trees and replacement tree plantings. Other components related to EAB management were not required but also qualified for the funding, including increasing municipal staff capacity, engaging property owners and the public, and monitoring the spread of EAB. It is likely that other grants similar to this will be available in 2021 and the coming years.

References / Resources

- All those who did ash inventory work (Waterbury Tree Committee, Ashley Andrews, and Meredith Whitney)
- Waterbury Tree Committee
- United States Department of Agriculture – Animal and Plant Health Inspection Service (USDA APHIS): https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/emerald-ash-borer
- Vermont Department of Forests, Parks and Recreation: https://fpr.vermont.gov/
- Vermont Urban and Community Forestry: https://vtcommunityforestry.org/community-planning/tree-pests
- Vermont Department of Environmental Conservation: https://dec.vermont.gov/
- https://vtinvasives.org/ - website developed by UVM Extension, Vermont Department of Forests, Parks and Recreation, Vermont Department of Environmental Conservation, and the Vermont Chapter of The Nature Conservancy
- http://www.emeraldashborer.info/ - website developed as a multinational effort to share the latest information about EAB
- Maine Department of Agriculture, Conservation and Forestry: https://www.maine.gov/dacf/php/caps/EAB/EABsigns.shtml
- Town of Williston Emerald Ash Borer Preparedness Plan: https://vtcommunityforestry.org/community/williston
- Green Mountain Power
- International Society of Arboriculture (ISA)

Appendices

A. Slow the Spread Recommendations – Moving Ash from the Infested Area

Recommendations to SLOW THE SPREAD of Emerald Ash Borer When Moving Ash from the Infested Area

Emerald ash borer (EAB) infestations naturally spread one to two miles annually. However, without due care, movement of infested material, especially ash firewood and logs, results in a faster and wider spread of EAB to uninfested areas. Carefully planning and managing the movement of infested or potentially infested material will slow the spread and provide greater protection for uninfested forests.

To slow the spread of EAB, follow these recommendations for the movement of forest products harvested within the Infested Area to other locations within the federal EAB quarantine boundary, which includes the rest of Vermont.

SLOW THE SPREAD Recommendations

Material to be Moved	Optimal Practices NON-FLIGHT SEASON October 1 – May 31	FLIGHT SEASON June 1 – September 30
Ash sawlogs	• Notify purchaser of origin. • Purchaser utilizes prior to May 31 and treats* bark properly – *see recommendations for bark below.*	• Delay harvest until October 1. • If harvesting must occur, notify purchaser of origin. Purchaser processes **immediately** and treats* infested bark properly – *see recommendations for bark below.*
Ash roundwood (pulpwood, log length firewood, bole wood)	• Notify purchaser of the origin. • Move to a purchaser that will process or treat* by May 31. • **Do Not** sell for use as homeowner-firewood **outside** the infested area.	• Delay harvest until October 1. • If harvesting must occur, delay movement until after October 1. • If movement is unavoidable before October 1, notify purchaser of origin. Purchaser processes and/or treats* **immediately.** • **Do Not** sell as homeowner firewood or bole wood **outside** the infested area.
Whole tree chips	• Notify purchaser of the origin.	• Notify purchaser of the origin.
Bark treatments	• Burn in boilers onsite. • Grind before May 31.	• Burn in boilers onsite **immediately.** • Grind **immediately.**
Split ash firewood	• Do not move ash firewood, that has not been **heat treated***, outside the infested area.	• Do not move ash firewood, that has not been **heat treated***, outside the infested area.
Visibly infested trees (flaking bark, galleries)	• Leave on site or treat as above.	• Leave or treat on site.

* See VTinvasives.org/land/emerald-ash-borer-vermont/slow-spread-of-eab for processing options. For additional information or questions, contact (802) 828-1531.

VERMONT AGENCY OF AGRICULTURE, FOOD & MARKETS DEPARTMENT OF FORESTS, PARKS & RECREATION

March 2019

B. Slow the Spread Recommendations – Ash Processing Options

Ash Processing Options to SLOW THE SPREAD of Emerald Ash Borer

Ash Processing Options are for use with Recommendations to Slow the Spread of Emerald Ash Borer When Moving Ash from the Infested Area in Vermont to other locations within the Federal EAB Quarantine Boundary. These recommendations are similar to, but may not be substituted for, Animal and Plant Health Inspection Service, Plant Protection Quarantine (APHIS PPQ) requirements for treatment of regulated articles for movement out of the Emerald Ash Borer (EAB) Federal Quarantine area. More details on treatments may be found at USDA APHIS's EAB Regulatory website.[1]

SLOW THE SPREAD Treatment or Processing Recommendations

Ash Material from EAB Infested Area	Recommended Treatment or Processing Measures
Ash sawlogs and roundwood	Sawlogs: Removal of bark and additional ½ inch of wood from logs: 100% of the bark to be removed and an additional ½ inch of wood. No residual bark or cambium shall remain. Bolewood: Chip for boiler fuel or debark and chip for production of wood pulp.
Ash Lumber (green)	Kiln Sterilization of ash lumber. • Treatment: T404-b-4 Kiln Sterilization • The maximum thickness of allowable wood is three inches. ----------OR---------- Heat Treatment of ash lumber for use in wood packing material. • Treatment: T404-e-2
Whole tree chips	No further processing of whole-tree chips is necessary.
Ash Bark & Processing Residues (slabs, edgings, trim ends).[2]	Grinding or chipping. ----------OR---------- Burning as boiler fuel on-site, in compliance with state and local regulations. ----------OR---------- Compost.[3]
Ash firewood	Heat Treatment of Ash Firewood • Treatment: T314-a Heat Treatment[4] • No treatment available for log length firewood; do not move outside infested area.

Learn more at VTinvasives.org/eab

VERMONT AGENCY OF AGRICULTURE, FOOD & MARKETS DEPARTMENT OF FORESTS, PARKS & RECREATION

June 2018

[1] aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/downloads/compliance_agreement/EAB_CA_Template_Attachment.pdf

[2] Once logs have been debarked to the standard for treating ash sawlogs (removal of all bark and ½" of wood), they are no longer considered potentially infested. If lumber, edgings, slabs and trim ends are produced from logs treated to this standard, they need no further processing. However, bark from those logs must be treated by one of the listed measures.

[3] See: Appendix E of the APHIS Emerald Ash Borer Program Manual
aphis.usda.gov/import_export/plants/manuals/domestic/downloads/emerald_ash_borer_manual.pdf

[4] While this standard meets the APHIS requirement for heat treating ash firewood for EAB, it DOES NOT meet all state firewood quarantine requirements. Check with individual states for information on their specific requirements.

C. Slow the Spread Recommendations – Tree Care and Clearing

Recommendations for Tree Care and Clearing to **SLOW THE SPREAD** of Emerald Ash Borer

Emerald ash borer (EAB) infestations naturally spread 1-2 miles per year. People moving infested ash material (ash wood, branches, stumps, debris, etc.) to un-infested areas, however, spread EAB much farther distances each year. Carefully planning and managing the movement of infested or potentially infested ash material will slow the spread and provide greater protection for our forests and trees not yet affected by EAB.

TO SLOW THE SPREAD OF EAB, FOLLOW THESE RECOMMENDATIONS IN THE INFESTED AREA:

1) Consider the Timing of Activities

The EAB flight season is from June 1 to September 30. The optimal time to prune out infested ash material is autumn to early winter when EAB is not active or mobile. An extended drying period before the next season will cause some EAB larvae to dry up and die before spring. To ensure safety when removing trees, conduct a hazard tree evaluation before working on dead or dying ash trees; this is best accomplished when leaves are present.

2) Chip or Mulch Ash Material

Chipping infested ash material can kill all life stages of EAB through both the mechanics of the process and the heat generated afterwards in chip piles. Chip or mulch wood to as small of size as possible to minimize the wood available to EAB for survival. To be effective chippers should be maintained and cared for on a regular basis. Chipping or mulching ash material is effective at any time of year.

3) Keep It Local Whenever Possible

Minimize the distance ash material is moved by chipping it on site, using it as local firewood in the infested area, or aging it within the infested area for at least a full growing season. **Do not sell ash firewood to homeowners outside of the Infested Area.** Minimize the risk of wood theft and possible movement outside of the Infested Area by leaving wood in larger sizes that make it difficult to move or posting signage indicating the risk of moving ash. Visit VTinvasives.org/eab for a list of approved ash wood disposal sites located within the Infested Area. If you must move wood out of the Infested Area, please refer to the Recommendations When Moving Ash from the Infested Area.

4) Protect High-Value Ash Trees with Insecticides

To determine if an ash tree warrants long-term protection with insecticides, consider factors such as the health of the tree, location, proximity to the infestation and landowner objectives. Next, decide the optimal insecticide product* and delivery system for the size and location of the tree. Systemic insecticides are preferred as they eliminate drift and reduce non-target impacts. Applications of insecticides should be done by certified pesticide applicators that hold an active commercial license with the Agency of Agriculture in Ornamentals & Shade Tree Pest Control. Although there are homeowner products available, they can harm pollinators and are not recommended. Remember, treatment is not needed until trees are within the infested area.

*See VTinvasives.org/eab for insecticide treatment options, updated maps of the Infested Area, and more information.
For additional information or questions, contact (802) 828-1531.

March 2019

VERMONT AGENCY OF AGRICULTURE, FOOD & MARKETS DEPARTMENT OF FORESTS, PARKS & RECREATION

D. International Society of Arboriculture – Basic Risk Tree Assessment Form

ISA Basic Tree Risk Assessment Form

Client _____ Date _____ Time _____
Address / Tree location _____ Tree no. _____ Sheet _____ of _____
Tree species _____ dbh _____ Height _____ Crown spread dia. _____
Assessor(s) _____ Tools used _____ Time frame _____

Target Assessment

Target number	Target description	Target protection	Target zone: Target within drip line	Target with in 1 x Ht.	Target within 1.5 x Ht.	Occupancy rate (1 – rare, 2 – occasional, 3 – frequent, 4 – constant)	Practical to move target?	Restriction practical?
1								
2								
3								
4								

Site Factors

History of failures _____ Topography Flat ☐ Slope ☐ _____% Aspect _____
Site changes None ☐ Grade change ☐ Site clearing ☐ Changed soil hydrology ☐ Root cuts ☐ Describe _____
Soil conditions Limited volume ☐ Saturated ☐ Shallow ☐ Compacted ☐ Pavement over roots ☐ _____% Describe _____
Prevailing wind direction _____ Common weather Strong winds ☐ Ice ☐ Snow ☐ Heavy rain ☐ Describe _____

Tree Health and Species Profile

Vigor Low ☐ Normal ☐ High ☐ Foliage None (seasonal) ☐ None (dead) ☐ Normal _____% Chlorotic _____% Necrotic _____%
Pests / Biotic _____ Abiotic _____
Species failure profile Branches ☐ Trunk ☐ Roots ☐ Describe _____

Load Factors

Wind exposure Protected ☐ Partial ☐ Full ☐ Wind funneling ☐ _____ Relative crown size Small ☐ Medium ☐ Large ☐
Crown density Sparse ☐ Normal ☐ Dense ☐ Interior branches Few ☐ Normal ☐ Dense ☐ Vines/Mistletoe/Moss ☐ _____
Recent or expected change in load factors _____

Tree Defects and Conditions Affecting the Likelihood of Failure

— Crown and Branches —

Unbalanced crown ☐ LCR _____%
Dead twigs/branches ☐ _____% overall Max. dia. _____
Broken/Hangers Number _____ Max. dia. _____
Over-extended branches ☐
Pruning history
Crown cleaned ☐ Thinned ☐ Raised ☐
Reduced ☐ Topped ☐ Lion-tailed ☐
Flush cuts ☐ Other _____

Cracks ☐ _____ Lightning damage ☐
Codominant ☐ _____ Included bark ☐
Weak attachments ☐ _____ Cavity/Nest hole ___% circ.
Previous branch failures ☐ _____ Similar branches present ☐
Dead/Missing bark ☐ Cankers/Galls/Burls ☐ Sapwood damage/decay ☐
Conks ☐ Heartwood decay ☐ _____
Response growth _____

_____ Condition(s) of concern _____

Part Size _____ Fall Distance _____
Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Part Size _____ Fall Distance _____
Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Trunk —

Dead/Missing bark ☐ Abnormal bark texture/color ☐
Codominant stems ☐ Included bark ☐ Cracks ☐
Sapwood damage/decay ☐ Cankers/Galls/Burls ☐ Sap ooze ☐
Lightning damage ☐ Heartwood decay ☐ Conks/Mushrooms ☐
Cavity/Nest hole _____% circ. Depth _____ Poor taper ☐
Lean _____° Corrected? _____
Response growth _____
Condition(s) of concern _____
Part Size _____ Fall Distance _____
Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Roots and Root Collar —

Collar buried/Not visible ☐ Depth _____ Stem girdling ☐
Dead ☐ Decay ☐ Conks/Mushrooms ☐
Ooze ☐ Cavity ☐ _____% circ.
Cracks ☐ Cut/Damaged roots ☐ Distance from trunk _____
Root plate lifting ☐ Soil weakness ☐
Response growth _____
Condition(s) of concern _____
Part Size _____ Fall Distance _____
Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Page 1 of 2