Emerald Ash Borer Management Plan for
State College Borough

Adopted January 2015

STATE COLLEGE BOROUGH

Emerald Ash Borer Management Plan for State College Borough

(Modified from model plan prepared by Houping Liu, Pa - DCNR, Bureau of Forestry)

Council Members:

Thomas E. Daubert
Catherine G. Dauler
Sarah Klinetob
Theresa D. Lafer
Peter Morris
Evan Myers
James L. Rosenberger

Mayor: Elizabeth Goreham

Manager: Thomas J. Fountaine

January, 2015

Prepared by Joyce Eveleth, Christian Heinemann, Lauren Muthler and Alan W. Sam
State College Borough

Grant funding supported through the USDA Forest Service http://www.fs.fed.us/ucf/ and The Pennsylvania Urban & Community Forestry Council http://www.pacommunity forest.com/.
Technical assistance and Emerald Ash Borer Management Plan templatehttp://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr 20028830.pdf provided through the Department of Conservation & Natural Resourceshttp://www.dcnr.state.pa.us/, Bureau of Forestryhttp://www.dcnr.state.pa.us/forestry/index.aspx.

Table of Contents

Executive Summary 4

Definitions 5

Authority 6

Introduction 7

Ash Resources 8

EAB Infestation in State College 11

Management Approaches 13

Management Strategies 13

Chemical Treatment 13

Tree Removal 15

Replanting 16

Wood Utilization and Material Disposal 17

Community Outreach 18

Cost/Benefit Analysis 18

Data Collection and Reporting 21

Contacts and Information 21

Image courtesy of emeraldashborer.info

Executive Summary:

The Borough of State College has a long history of active management of its urban forest. Not long after its incorporation in 1896, State College formed a Tree Committee, precursor to the current Tree Commission, and began rallying support for community trees. Residents of the Borough understand the benefits urban trees contribute to the quality of life; property value, reduction in air pollution, mitigation of storm water, energy conservation, and carbon uptake and storage. For these reasons, the Borough has established a very aggressive management program to inspect all street trees annually, remove declining or hazardous trees, and plant more new trees than are removed. The Borough has also employed various strategies to fight the numerous insect and disease threats that the trees face.

Fortunately, the Borough learned long ago when dealing with American elms and Dutch elm disease, the folly of trying to maintain monocultures. The Tree Commission has actively supported the strategy of street tree diversity for many years which has resulted in over 150 varieties of trees growing along Borough streets. Although green and white ash were among the more popular replacement trees because of their many outstanding qualities, they still only amounted to a small portion of the canopy (5.43%). However, when considering the overall large number of street trees present in the Borough, even a 5% loss is significant in terms of numbers of trees (350 trees). Sadly, Emerald Ash Borer (EAB) is taking a major toll on this important tree species in our community.

To mitigate potential damages, save our canopy, and lessen the financial burden on the community, the Borough of State College is adopting a management plan geared toward the reduction and control of this invasive borer. The plan will remain in place over a period of at least 10 years (2015-2024) when our approach will be re-evaluated.

It is anticipated that over 160 trees will be treated with one of several insecticides numerous times over this period to prolong their life. The remaining, untreated ashes will be removed and replaced with a selection of other non-host tree species as they become infected. This will not only avoid rapid decline of streetscapes but will also spread out the cost of removal and replacement.

The total cost for this program over a period of ten years is estimated at $294,713 to $396,715 depending on approach. Yearly costs range from $17,933 to $71,046 including the costs of treatment, removal, and replacement. Grants from federal, state, and local agencies, organizations, and institutions will be sought to help offset a portion of the cost of the program. The program will be administered by the Borough's Public Works Department and the Environmental Coordinator/Arborist, who will also be serving as the program manager.

Ash trees growing on private property will remain the responsibility of the property owner. The Borough will provide information and resources for property owners so that they may make informed decisions and take action regarding the health of their trees. Community outreach will be carried out consistently throughout the program. The Borough will seek to inform the public of the program's progress, as well as providing educational material on EAB and other resources for private property owners. Borough residents will be welcome and encouraged to volunteer to be part of this program.

Definitions:

Borough – State College Borough, a municipality located in Central Pennsylvania and home to Penn State's main campus.

Dutch Elm Disease – A fungal disease that is extensively spread through an insect vector, elm bark beetles, and locally spread through root graphs. State College maintained a significant population of American elms for many years through effective use of sanitation practices and chemical control of both the fungus and insect vector.

Environmental Coordinator/Arborist – Person directly responsible for managing State College Borough's street and park trees and works directly for the Public Works Director. Also responsible for implementing emerald ash borer management plan.

Tree Commission – Voluntary board made up of five individuals and appointed by Borough Council. The Tree Commission advises the Environmental Coordinator/Arborist and Public Works Director on urban tree management including pest control.

Tree City, USA – An award given by the national Arbor Day Foundation that meets four basic requirements in the management of its trees; expenditure of $2 per capita on tree program, establishment of a tree board or commission, adoption of a tree ordinance, holds an annual tree celebration.

Tree-äge – An injectable insecticide (a.i. emamectin benzoate) used to control various insects in trees, including emerald ash borer.

Imidacloprid – A systemic insecticide belonging to the class of chemicals known as neonicotinoids. Can be applied on or injected into the soil and is readily taken up trees and translocated throughout all parts of the tree. Mentioned in this publication for control of emerald ash borer.

Tree Crew – State College Borough employs full-time professional arborist to trim, remove, plant, and maintain its street and park trees. The tree crew consists of a Foremen and two full-time Public Works employees called Dendricians.

i-Tree A collection of software programs that can be used to estimate various ecosystem benefits of urban trees.

Authority:

The Tree Commission and Borough staff are given authority to work together on management of the street trees as outlined **in State College Borough Shade Tree Ordinance 1618.**

Section 102c1. The Commission shall advise the Director and the Arborist on the planting, maintenance and removal of trees. Such advice may include:

(a) Recommendations of tree species for public areas;
(b) Recommendations for controlling diseases and pests damaging trees;
(c) Recommendations for tree maintenance;
(d) Recommendations for public education/information program concerning the importance and care of trees; and
(e) Recommendations on Departmental rules and regulations regarding tree planting, maintenance and removals.

Section 103e. Authorized Activity. Trees in public areas, which, in the opinion of the Arborist or the Director, are seriously damaged, diseased, disfigured or constitute a hazard to the public or to trees on private property, may be removed or pruned by the Director. Prior to removals from public rights-of-ways, notice shall be provided to the property owner(s) immediately adjacent to the tree(s) to be removed. Notice shall also be provided to Council and the Mayor. (*This notification requirement does not pertain to trees already killed by EAB before being removed*)

Section 103f. When, in the opinion of the Arborist or the Director, a tree or portion(s) of a tree in public areas constitutes an immediate hazard to persons or property, the Arborist or Director shall remove the hazard without notice or appeal.

Abatement of Nuisance. If the Borough Arborist determines upon inspection or examination of an infected tree that any public nuisance as herein defined exists in or upon any public street, alley, park, or other public place; and that the danger to public safety is imminent, he shall order the immediate removal of said tree.

Introduction:

The importance of trees on the culture and environment of State College cannot be understated, as the tree canopy covers 43% of the Borough's land area. Nearly 7,000 trees of over 150 varieties are planted along Borough streets. As of 2014, 342 (5%) of these 7,000 trees were ash (*Fraxinus*). Managing this urban forest cost the Borough taxpayers approximately $12 per person yet is widely supported. In addition, the Borough of State College has been a certified as a "Tree City USA" since 1984 and remains committed to the urban forest management ideals for which that title stands.

The Emerald Ash Borer, *Agrilius planipennis* Fairmaire, is a wood-boring beetle from Eastern Asia that was initially discovered in North America in Michigan in 2002. Since then it has spread to 24 states and 2 Canadian provinces. In Pennsylvania, it has been found in 55 counties since its initial introduction in 2007.

Adult EAB lay their eggs under the bark of an ash tree, where the eggs hatch into larvae. The larvae feed until winter, when they grow into pupae in spring and finally emerge as adults in late spring and early summer, beginning the cycle again. The damage occurs from the larvae, whose feeding considerably disrupts the flow of water and nutrients through the tree. Trees so damaged exhibit a host of symptoms such as dying foliage, epicormic shoots along the tree trunk, strips of missing bark, serpentine feeding galleries from the larvae, and the signature D-shaped holes produced by emerging adults. Generally ash trees die within 4-5 years of initial infestation but can become hazardous even sooner. EAB can remain in the wood for up to two years after the trees die and contributes to its ease of spread through transport of firewood off site. The Borough recognizes that it cannot stop the spread of this insect but it can minimize its impact on our environment and has responsibility to its residents to provide information and assistance. Therefore the goals for the plan are as follows:

- Provide information to the public concerning control alternatives.
- Prevent unintentional spread of the insect to other areas.
- Establish future goals for our ash program.
- Estimate future costs for removal and treatment of infested trees.
- Determine manpower needs for removal and treatment.
- Explore alternatives to planting ash trees.

Typical symptoms of ash infected with EAB – thin foliage, epicormick sprouts, and woodpecker damage.

Ash Resources

A street tree inventory was conducted in 2010 that categorized all 7,000 street trees as to species, size and condition. The following tables are based on that inventory. Although a majority of the ash trees were identified as being in good to excellent condition (Table 1), a large proportion of the population, over 50% was made up of trees smaller than 10" in diameter (Table 2). This size tree can be quickly removed with little expense or use of major equipment. In addition, this proportion of the ash tree population had relatively little value ($98,000) as compared to the larger size trees ($1,302,900). Graph 1 illustrates the relative size distribution of ash street trees.

Table 1. Ash Trees by Species and Health

Condition	White Ash	Green Ash	Misc.*	Total
Excellent	22	31	0	53
Good	144	91	5	240
Fair	24	21	0	45
Poor	1	3	0	4

* Species not identified on inventory

Graph 1. Ash Trees by Species and DBH

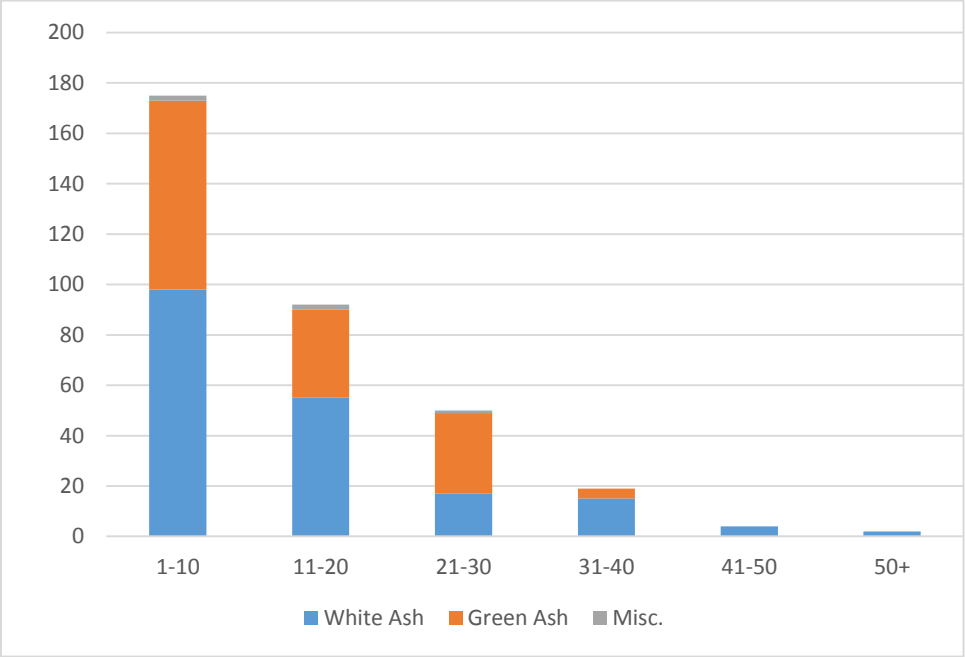


Table 2. Trees by Species & DBH

DBH	White Ash	Green Ash	Misc.*	Total
1-10	98	75	2	175
11-20	55	35	2	92
21-30	17	32	1	50
31-40	15	4	0	19
41-50	4	0	0	4
50+	2	0	0	2
Total	191	146	5	342

* Species not identified on inventory

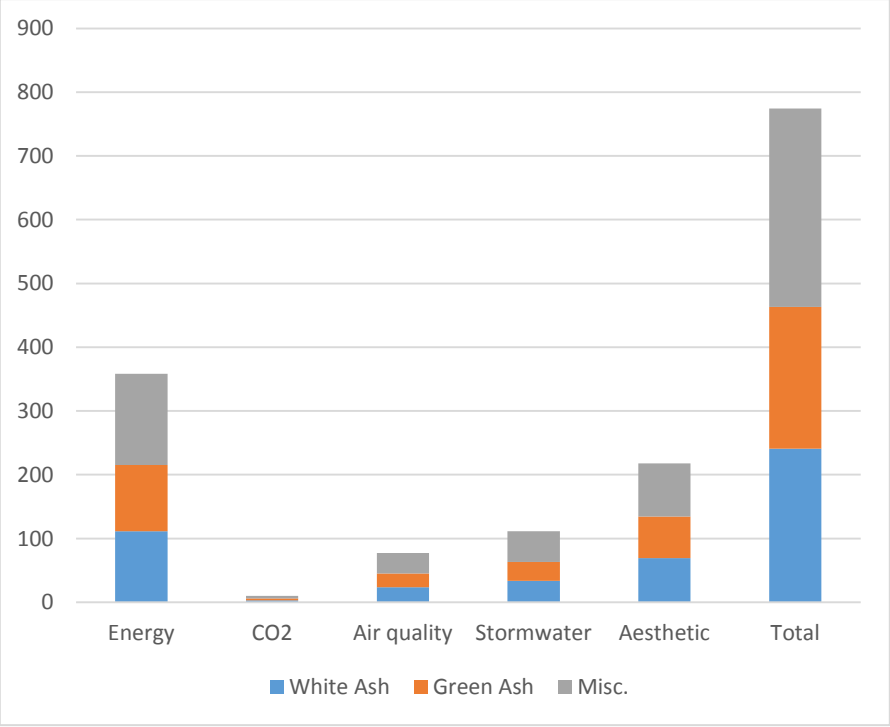
As stated earlier, the current Tree Commission and Arborist, have recognized the problems of planting monocultures along streets, but prior to the 1980s planting all the same species of tree for long stretches of streets was still being conducted. For this reason, many of our older ash trees are concentrated on only a few streets. Losing entire rows of these trees to EAB could be devastating to those residents affected. Using chemical control on these older plantings will also help spread out the loss over several years and minimize the drastic change to the neighborhood.

Table 3. Ash Trees by Species & Annual Benefit (in Dollars/Tree)*

Benefit	White Ash	Green Ash	Misc.*	Total Value for all Ash
Energy	111.20	104.11	143.17	$38,155
CO_2	2.95	2.90	4.15	$1,008
Air Quality	23.61	21.33	32.17	$7,785
Stormwater	33.72	29.22	48.20	$10,948
Aesthetic	69.22	65.15	83.44	$23,150
Total	240.71	222.44	311.14	$81,046

*I-Tree generated values

Graph 2. Ash Trees by Species and Annual Benefits



The existing ash trees in State College also provide significant ecological benefits as highlighted in Table 3 and graphically illustrated in Graph 2. The Borough's ash tree population when looked at in its entirety provides over $81,000 in environmental benefits on an annual basis. Larger trees contribute significantly more than smaller diameter trees.

EAB Infestation in State College

EAB was initially detected in Centre County in 2011, then within the Borough in 2012. However, preparations for EAB began long before the first beetles even made it to central

Declining crown of infected Ash

Pennsylvania. Ash trees were an important component of the Borough's urban forest and were often considered as replacements for lost elms and other large species. Their ability to establish quickly and thrive under difficult soil and environmental conditions made them an obvious choice as a street tree. They also had few serious pest problems to worry about. Once it became clear, however, that EAB was quickly marching towards our borders, the Borough's Tree Commission reacted. After 2006, ash trees were no longer planted along Borough streets or in Borough parks. In 2009, the Tree Commission began looking at our existing ash tree population very critically and started removing unhealthy or structurally compromised trees. The goal was to reduce our overall ash population to only the strongest and healthiest individuals.

EAB adult exit holes

Woodpecker damage on bole of infected tree

Lower water sprouts on infected tree

The Tree Crew was briefed on the signs and symptoms of EAB so they could recognize infected trees and give us the earliest detection possible. The Arborist attended webinars and presentations on EAB detection and control. Information was disseminated to residents and Borough Management was alerted to the looming problem. However, even with this preparation and planning, the initial infestation and its aftermath were devastating to both residents and staff.

Management Approaches

Chemical treatment, tree removal and replacement of ash trees began in 2014 and will be expanded in 2015. The Tree Commission, Arborist and Public Works Director determined that the Management strategy should include all options in order to limit the Borough's financial, manpower and aesthetic impact. This strategy is outlined below.

Management Strategy

The Borough will annually treat 1/3 to 1/2 of the trees identified as maintainable. To be considered maintainable, trees must meet one or more of the following criteria:

- Larger than 20" DBH;
- Structurally sound (no wounds or instability) and healthy;
- Trees between 10" and 20" DBH that are deemed to be part of a significant landscape;
- Trees between 10" and 20" DBH in an area deemed to be difficult to establish new trees (i.e. high vandalism rate).

Currently 161 ash trees are considered maintainable with 50 to 80 trees proposed for treatment annually. Trees smaller than 10" in diameter generally will not be scheduled for treatment and will be removed as they become infected. Treatment for maintainable trees will continue until the tree must be removed for reasons other than EAB or if the treatment is unsuccessful.

Chemical Treatment

High-value ash trees will be treated with Tree-äge. This pesticide provides near-total protection against EAB larvae for up to 2 years with a single application. Large diameter trees will be favored over small diameter trees as they typically have higher value and provide more benefits to the community. Additional chemicals and application techniques will be evaluated as they become available. It is anticipated that in 2015 a technique of soil injection using Imidacloprid will be used on an experimental basis on some of the larger diameter trees. This application, although it must be done annually and may be less effective than Tree-age, it is significantly less expensive.

Injecting the tree using Tree-age

Tree-injectors

It is anticipated that overall effectiveness will be aided by the use of “trap trees.” These are trees that are highly preferred by EAB and further augmented by “girdling,” a technique wherein a ring of bark is removed from the trunk of the tree to create stress.

Trap tree

Michigan State University has found that emerald ash borers are attracted to the chemicals produced by stressed ash trees, and will lay their eggs in such trees over others. Girdled trees would then be removed over the winter months helping to reduce overall beetle populations and reducing stress on desirable trees. This approach should help to mitigate both cost and spread of EAB. A similar program was implemented in the Borough to limit the spread of Dutch elm disease in the 1990s and 2000s with some success.

Tree Removal

Tree removal is already well underway and has been since before the discovery of EAB in the area. The Borough initially targeted unhealthy and structurally compromised trees for removal in the hopes of producing the healthiest ash population possible even before EAB appeared. As stated under the Management Strategy, the Borough will remove all infected ash trees of less than 10” DBH, and all ash trees between 10” and 20” DBH unless they meet the criteria outlined above to be maintained.

Otherwise healthy trees measuring above 20” DBH will be kept as long as possible, and will undergo yearly inspection as with all street trees. All wood and brush from felled infected trees will be chipped on site or stored off site to await destruction using a tub grinder. Controlled utilization of infected trees is permitted as outlined below.

Replanting

All removed ash trees will be evaluated for replacement to provide canopy cover as per the Borough's standard practice. The Tree Commission evaluates each replacement site during a drive-around work session and makes a recommendation to the Public Works Director and Council about what species or variety of tree should be planted. Prior to this, each affected property owner is sent a letter asking for their input and inviting them to a public hearing. All existing trees and planting sites are evaluated once a year by the Borough Arborist prior to the Tree Commission work session. Some areas where ash trees are removed may not be replanted due to utility conflicts, site distance considerations or other unforeseen circumstances. In general, trees will be replanted on a 1-for-1 basis, which will cost the borough approximately $300 per tree to purchase and plant the replacement.

Wood Utilization and Material Disposal

Wood from infested or dead trees can still be put to use for the community. While EAB can remain in unworked ash wood for up to two years after the death of the tree, the wood is still viable for manufacturing, lumber, and firewood. However, it will be necessary to impose a strict quarantine on the wood because of this two-year window: no ash wood may cross the designated limits set by the Borough.

Ash wood is exceptionally valuable for making baseball bats, but is also valued for veneer, furniture, and lumber. Because of this, the Borough will reach out to manufacturers and wood-related businesses for the purpose of selling our removed trees.

There are seven lumber companies within the Borough or neighboring townships that may be willing to buy ash wood from the Borough. The Borough will need to ensure that the company (or companies) that buy the ash wood will follow the quarantine in its entirety.

Ash wood that is not sold to companies can be chopped, stored in a community firewood center or immediately utilized by individual wood workers. The Borough will evaluate the possibility of developing a community drop-off site to assist homeowners and tree companies dispose of the wood properly.

Community Outreach

There are two main goals in our community outreach program: 1) Educate the public on the problem confronting their trees and the measures being taken to resolve it, and 2) allowing citizens with ash trees on their properties access to EAB treatment resources.

If an infected ash tree exists on private land, it will be up to the landowner to decide what course of action to take. In these cases, information will be provided in seminars and workshops about treatment and removal plans, options, and costs, or in the form of informational pamphlets and electronic newsletters. If the Borough becomes aware of an infected tree on private land, the Borough may approach the owner with information resources.

General information regarding EAB and the actions being taken against infestation will be updated on the Borough website, and the community will be made aware through public announcements via flyers, email, radio, or similar public service announcements.

Cost/Benefit Analysis

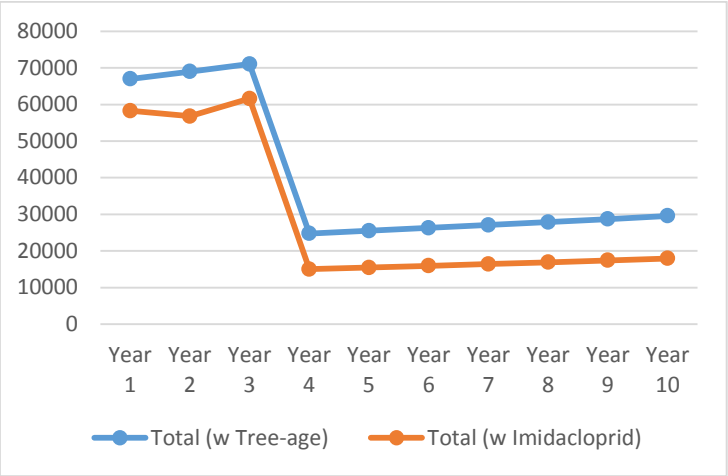
.

Table 4. Cost of Initial Chemical Treatment of Ash Trees Compared to the Costs to remove the Same Trees

DBH	No. Trees	Total DBH	Tree-age Chemical Treatment ($13/inch)	Imidacloprid Chemical Treatment ($4/inch)	Removal* Costs	Estimated** Value
10-20	90	1350	$17,550	$5,400	$38,520	$277,200
21-30	46	1173	$15,249	$4,692	$47,380	$488,520
31-40	19	675	$8,775	$2,700	$31,065	$386,460
41-50	4	182	$2,366	$728	$6,540	$100,480
50+	2	106	$1,378	$424	$3,270	$50,240
TOTAL	161	3486	$45,318*** ($22,659/yr)	$13,944/yr***	$126,775	$1,302,900

*Removal cost based on average time to remove all trees in associated size class using average manpower and equipment costs.
**Values determined using trunk formula method of average size tree in each size class with no deductions for species or defect.
***Tree-äge treatments are effective for a period of two years, requiring only half of the retained trees to be treated each year. Imidacloprid soil injection treatments are good for a period of only one year and would have to be applied annually to all trees.

Graph 3. Total Cost of Tree Plan Over 10 Years



Prices in table 4 are based on actual bid prices received in 2014. A public bid will be conducted to select a tree care service with the lowest bid for treatments each year but it is anticipated that prices will increase at least 3% per year.

Table 5. Cost of Ash Tree Removal of Non-treated trees

DBH	No. Trees	Removal Cost	Estimated Value	Replacement Cost	Total (Less Value)
<10	175	$37,450	$98,000	$87,500	$124,950
10-20	2	$856	$6,160	$1,000	$1,856
21 -30	4	$4,120	$42,480	$2,000	$6,120
31 - 40	0	$0	$0	$0	$0
TOTAL		$42,426	$146,640	$90,500	$132,926

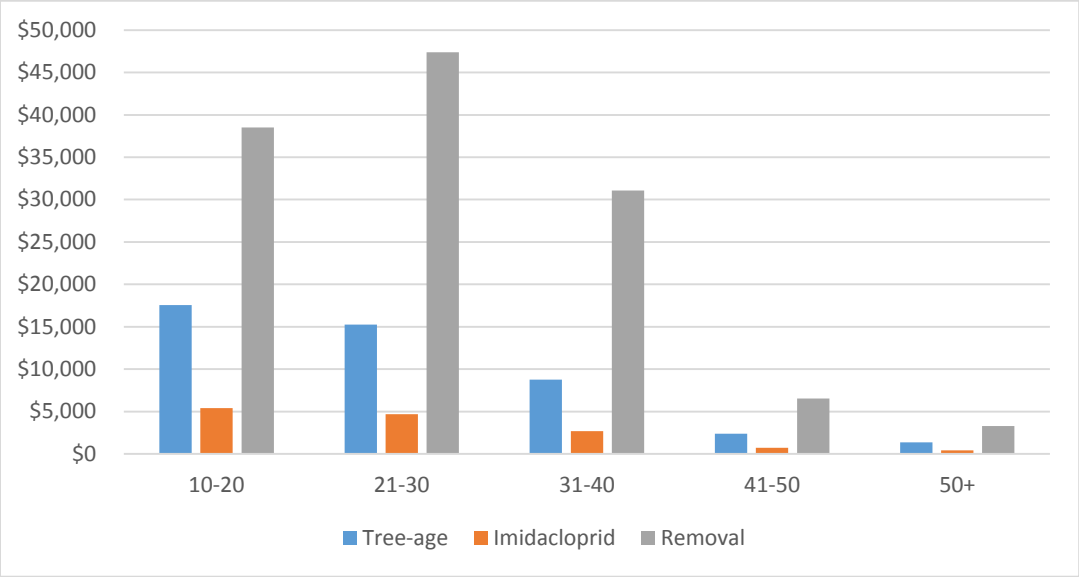
Table 6. Cost of Ash Tree Plan Over 10 Years

Year	Tree-age Chemical Treatment	Imidacloprid Chemical Treatment	Removal*	Planting*	Total (w/ Tree-Age)	Total** (w/ Imidacloprid)
2015	$22,659	$13,944	$14,142	$30,167	$66,968	$58,253
2016	$23,339	$14,156	$14,566	$31,072	$68,977	$59,794
2017	$24,039	$14,581	$15,003	$32,004	$71,046	$61,588
2018	$24,760	$15,018	-	-	$24,760	$15,018
2019	$25,503	$15,469	-	-	$25,503	$15,469
2020	$26,268	$15,933	-	-	$26,268	$15,933
2021	$27,056	$16,411	-	-	$27,056	$16,411
2022	$27,868	$16,903	-	-	$27,868	$16,903
2023	$28,704	$17,411	-	-	$28,704	$17,411
2024	$29,565	$17,933	-	-	$29,565	$17,933
TOTAL	$259,761	$157,759	$43,711	$93,243	$396,715	$294,713

*Anticipated that 176 trees not treated would be removed and replaced within next three year

**2015 prices based on actual bids. Subsequent year's prices multiplied by a factor of .03 to account for inflation.

Graph 4. Cost of Chemical Treatment vs. Removal



Data Collection and Reporting

All current data from the program has been collected and entered electronically into a central database. Status reports will be required for all parts of the plan as it continues, and an annual report will be issued to summarize the progress of the program each year. A final report will summarize the program as it concludes.

Contacts and Information

Emerald Ash Borer (https://www.emeraldashborer.info)

i-Tree (https://www.itreetools.org)

USDA Forest Service (https://na.fs.fed.us/fhp/eab/)

SLAM EAB (http://www.slameab.info/)