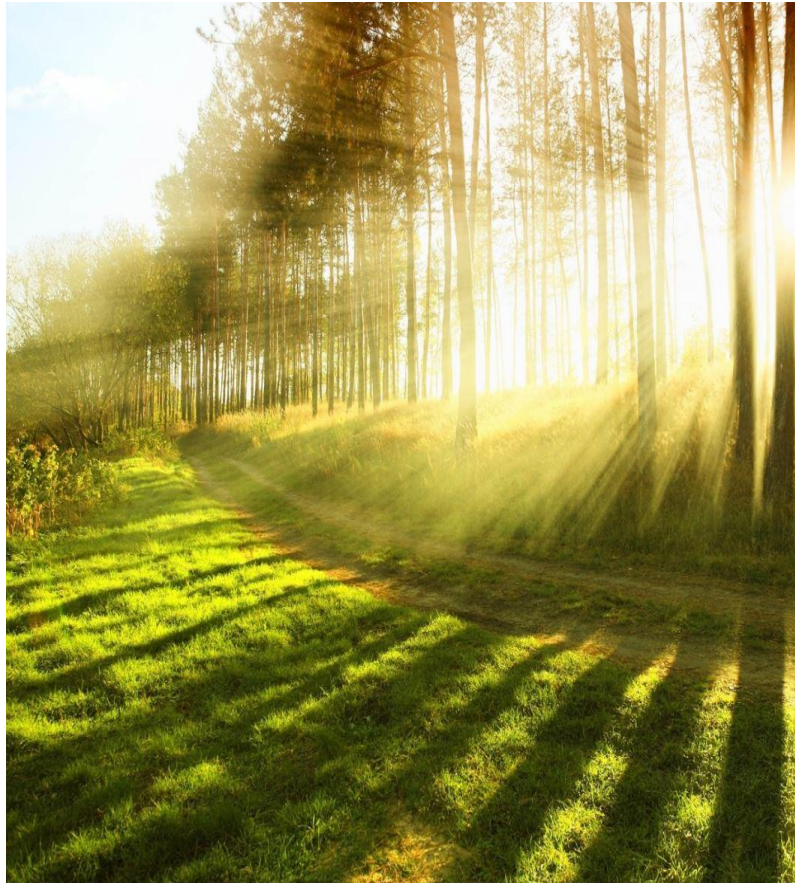


Emerald Ash Borer Management Plan

Newtown Township, Delaware County, PA

November 2015



This *Emerald Ash Borer Management Plan* was developed under the tutelage of Kendra McMillin with the Pennsylvania Community Forests Council. It uses a format created by Dr. Houping Liu with the Pennsylvania Department of Conservation & Natural Resources (DCNR) and used the Borough of West Chester EAB Management Plan as a template. This plan was made possible by the Newtown Township Environmental Advisory Council (EAC) and used the iTree Street tree inventory software. Ellen Roane and Dr. Donald Eggen with DCNR, West Chester University Graduate Students, Newtown Township Environmental Advisory Council volunteers, Newtown Township Public Works staff and Kendra McMillin worked together to complete the ash tree assessment and tree inventory.

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Administration

Newtown Township's Emerald Ash Borer (EAB) Management Plan will be headed by the EAB Task Force. The head of the EAB Task Force is Paul Seligson, Chair of the Environmental Advisory Council (EAC). Members include: Stephen Nease, Township Manager; George Sharretts, Director of Public Works and Cindy Mehallow, Vice Chair of the EAC. Residents are encouraged to contact the Environmental Advisory Council or the Public Works Department for any questions or concerns regarding the EAB Management Plan.

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Executive Summary

The increase in quality of life that trees offer to Newtown Township is invaluable. Fully aware of the benefits, Newtown Township intends to implement the following management plan. The intended results of the plan are to assist in protecting the safety, health, well-being and beauty of the community, ensure the continued vitality of the community's tree canopy, and to safeguard the essential ecological services which trees provide to all residents.

The ash tree inventory conducted for this report indicates there are 261 ash trees on township property. Due to the destructive capabilities of the emerald ash borer, the Township desires to take action immediately. Although it is difficult to predict precisely, it is likely that the EAB will arrive in Delaware County during 2016 and could possibly already be present in the county.

Of the various options described in this report, the Township has adopted the *Selective Management* option. This option includes chemical treatment of ash trees that are deemed highly valuable; recommends the removal of potentially dangerous dead or dying ash trees, as well as those in fair or poor health condition; and replanting of removed ash trees on a 2:1 ratio. The Selective Management approach will be carried out in a cost effective manner over the span of the next 10 years. The Township will actively and thoroughly seek out grants and awards to help cover the cost of funding through resources such as the Pennsylvania Department of Conservation and Natural Resources and USDA Forest Service. Furthermore, annual auditing will be conducted on the plan by the Township Manager and the Board of Supervisors. **Adjustments will be made as needed.**

The EAB Management Program will be administered by the Newtown Township Director of Public Works with support from the EAB Task Force. Adjustments will be recommended on a yearly basis through progress reports on the forest conditions and success of replanting efforts.

Community outreach is a crucial part of the plan. The community will be informed and updated throughout the process. Although maintenance of ash trees on private properties is the responsibility of the property owners, the Township will provide information and resources, which private landowners can use to manage ash trees on their own property. We welcome recommendations and suggestions on dealing with the EAB infestation. Volunteers in this effort are welcome and encouraged.

The format for this plan was provided by the Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry Division of Forest Health.

(http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20028831.pdf)

A survey of township lands revealed a total of 261 ash trees: 71 high value ash trees are proposed to be treated, 171 ash trees are recommended to be removed, and 19 ash trees will remain unmanaged due to their remote locations.

Estimated total costs for the 10-year management plan are projected to range from a low of \$274,552 to a high of \$307,754, including:

Treatment:	\$51,655 (low) to \$84,857 (high)
Removal:	\$188,100
Replacement:	\$35,389 (cost for new trees and labor to plant them)

Authority

Newtown Township's responsibility for planting, maintaining and removing trees on township-owned landscapes is set forth in the following provisions of township ordinances.

Article 1: General Provisions

Chapter 104: [Natural Features and Landscaping](#)

2 – [Purpose](#)

- A. It is the purpose of the Township of Newtown through this chapter to maintain the open character of a Greene Countrie Towne community, while accommodating future growth and protecting the community's natural resources from the adverse impacts of development.
- B. These regulations are also intended to protect the rights of the residents of Newtown Township to enjoy clean air, pure water and the natural, scenic, historic and aesthetic values of the environment, as set forth in the Pennsylvania Constitution and in other commonwealth and federal statutes.
- C. These regulations are also intended to require landscaping and planting that will enhance the properties being developed and complement surrounding communities.

3 – [Scope:](#) The scope of this chapter is as follows:

- A. To provide shade trees along public roads within the Township, including type of tree, initial planting, care of trees and replacement of trees.

Newtown Township has a rich history, spanning back to its establishment by William Penn, founder of Pennsylvania and an early Quaker leader. Penn laid out an area of 10.11 square miles and designated it “the first inland town west of Philadelphia.” While the residential and commercial sectors of the township are undergoing dramatic growth recently, emphasis is still placed on the uniqueness of the variety of local “mom and pop” shops in the area. (*Newtown Township, 2015*).

Within the tree canopy in the Newtown Township park network are 261 identified ash trees. These ash trees are being threatened by the emerald ash borer, a half-inch metallic green insect (DCNR, n.d.). *Agrilus planipennis* (scientific name) is an invasive wood boring insect (Whitehill, Rigsby, Cipollini, Herms, and Bonello, 2014). The threat to ash trees comes from the ash borer larvae which feed on the interior of the ash trees, inhibiting the trees' ability to transport water and nutrients. The result is a 99% tree mortality rate within five years of the initial feeding (Whitehill, Rigsby, Cipollini, Herms, and Bonello, 2014). *Agrilus planipennis* originated in Asia. Asian trees have grown a resistance to the insect, but the same chemical defense has not developed in American species, as they have not grown alongside EAB (Roberts, 2008). The first appearance of EAB on ash trees dates within the United States dates back to 2002 in Michigan and since then, it has been reported in 25 states (Emerald Ash Borer, 2008). Locally, it has been found in 52 counties in Pennsylvania and is as close as Bucks and Montgomery Counties (DCNR, 2015).



This is why it is crucial for Newtown Township to act now and take preventative measures. Timely action can reduce management costs and result in a healthier, more resilient tree canopy. The goals for this plan are as follows:

- **To implement strategies that will increase community safety from the impacts of EAB infestations and the risks posed by the presence of dead ash trees.**
- **To protect the existing ash tree resources and to replace trees that will have to be removed.**
- **To maintain a high level of environmental integrity.**

Under the recommendations in this management plan, trees that are already infected, in fair or poor health condition, sick, dying or already dead will be removed. Trees that are healthy enough (excellent and good health condition) will be considered for chemical treatment with a systemic insecticide, significantly increasing their chance of survival against EAB. Treatment will not improve the overall condition of trees; it will only provide protection against the EAB.

The following actions will be taken over the next 10 years:

- Periodically update the ash tree resource inventory
- Remove dead or dying trees that present a hazardous threat
- Chemically treat trees that are deemed high value
- Educate the public and hold community outreach sessions
- Dispose of ash wood properly, and
- Replant different trees species to replace ash trees that have been removed

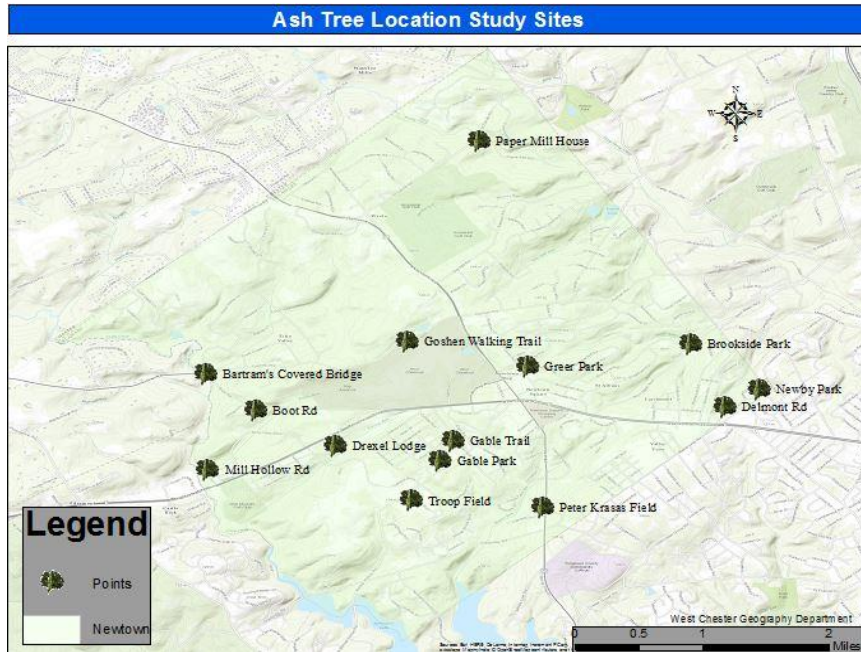
Data Collection

This comprehensive plan focused solely in gathering data for ash trees on Newtown Township property. Any ash trees on privately owned land were not assessed. Ash trees were found in parks, along trails and roads, and within historical areas and open spaces, totaling 15 different locations. For each ash tree, a number of factors were collected: longitude and latitude; DBH (inches); land use type (park/vacant/other); size of the tree (large or small); management task chosen (chemical treatment, removal, crown raising, or no action required); the urgency of implementing the chosen management task (critical = as soon as possible, immediate = within three months, routine = within 12 months); wood condition (excellent, good, fair, poor, dead); leaves condition (excellent, good, fair, poor, dead); and tree factors (decay, dead branches, leaning, vines, split bark, insects, multiple trunks, bole damage). The equipment used for collecting this data was a DBH tape in inches. Data was recorded using a hand-held device to capture longitude and latitude, and the software i-Tree was used to store the captured data.

The method of collecting data was a two-staged approach.

First, an expert identified and marked all ash trees within an area. Then, the data collectors located the marked trees. Along with the data factors already mentioned, the data collectors would also record the name of the location (e.g., Goshen Walking Trail, Mill Hollow Lane, etc.), the segment number of that location, and the ID number of the tree. The ID number was determined simply by counting up trees within the individual segments. Again, this data was stored into i-Tree.

Ash Resources



The ash tree inventory was undertaken by the Newtown Township Department of Public Works, members of the Environmental Advisory Council, and West Chester University graduate students in October 2015.

A total of 261 ash trees were recorded with tree diameter measurements ranging from 4.6 to 54.7 inches at diameter breast height (DBH) (4.5 feet above ground), with a mean DBH of 22 inches. During the inventory, the health condition of each tree was assessed in two respects: the tree's wood (trunk and branches) and its canopy (leaves). Both of these assessments were used to determine the tree's overall health condition.

Condition of wood: 5 levels - Excellent, Good, Fair, Poor, or Dead

3	Excellent	(1%)
103	Good	(39%)
68	Fair	(26%)
52	Poor	(20%)
33	Dead	(13%)
2	N/A	(1%)

Condition of leaves: 5 levels - Excellent, Good, Fair, Poor, or Dead

4	Excellent	(2%)
102	Good	(39%)
81	Fair	(31%)
45	Poor	(17%)
27	Dead	(10%)
2	N/A	(1%)

Maintenance level: **3 levels- Routine, Immediate, Critical (public safety issue)**

- **Routine** 207 (79%) To be addressed within one year
- **Immediate** 32 (12%) Need to be addressed within three months
- **Critical** 17 (7%) Need to be addressed as soon as possible

Table 1: Tree Health Condition and DBH Classes

Overall Tree Health Condition	DBH - Diameter at Breast Height (inches)					Total
	0-10	10-25	26-35	36-50	>50	
Excellent	0	0	3	1	0	4
Good	3	60	36	4	0	103
Fair	7	49	8	3	0	67
Poor	5	27	14	4	2	52
Dead	0	26	5	2	0	33
N/A	0	0	0	0	0	2
	15	164	66	14	2	261

No ash tree inventories were conducted on private property. Property owners are strongly encouraged to identify ash trees on their own to take preventative measures. For assistance please visit the Newtown Township website at www.newtowntownship.org for resources and assistance in species identification, inventory, and tree health evaluation.

EAB Infestation

Due to the fact North America failed to immediately detect the EAB early on, the EAB wave is now composed with billions of insects which cannot be eradicated. This means North America needs to preserve as many Ash Trees as possible before they are completely destroyed. The EAB came to North America in 2002 from South East Asia. However, interestingly enough, there are no concerns of the EAB in SE Asia. The Ash Trees there have grown to be resistant, possibly even immune to the EAB itself; a product of past evolution that occurred within the area. Unfortunately, a developed resistance like this would take thousands of years. The Ash Trees in North America will not be able to achieve this resistance with the 100% mortality rate the EAB is having on these trees at this time. (*Roberts, 2008*)

As of November 2015, the EAB had not been detected in Newtown Township. However, if the EAB arrives prior to any preventative chemical treatments are administered to the trees, nearly 100% of the ash trees will die. When EAB arrives, even extremely healthy ash trees will die and become unsalvageable in a single season. Although the EAB may arrive at any time, it may not arrive for another one to three years. The Township Department of Public Works will monitor the tree canopy in township owned lands for the presence of the EAB. Residents are encouraged to monitor the ash trees on their property and report any suspicious signs concerning their ash trees to the township at 610-356-0200 and/or the Pennsylvania Department of Agriculture at 866-253-7189.



Emerald ash borer adults create distinctive “D” shaped exit holes (left).

Their larvae create S-shaped galleries in the wood just under the tree bark. (right)

Photo Credits

http://www2.ca.uky.edu/forestryextension/eab/Graphics/adult_on_leaf.gif; <http://landpol.ca/wp-content/uploads/2014/05/ash-tree.jpg>

<http://www.backtree.com/images/eab-page/icons-large/d-shape.jpg>; http://www.ci.lenexa.ks.us/parks/trees_ashwalnut.html

<http://www.emeraldashborer.info/firewood.cfm#sthash.M6lwCEZS.dpbs>

Management Approaches

The following are four management approaches a community can choose. *Newtown Township has chosen the **Selective Management** approach:*

Option 1: No Actions: No tree inventory or survey will be collected. Ash trees will be treated as all other trees in the municipality. This approach will result in the continued decline of affected ash trees. Potential risks and safety hazards may be associated with this option. Changes in the community tree canopy are to be expected. This is the most costly option in the long run due to removal costs of dead ash trees in a short period of time.

Option 2: Preemptive Management: All ash tree species located on township property, primarily in parks, shall be removed and replaced by non-host species. The initial cost will be significant due to the tree removal and replacement process; however there will be no additional costs as the host species will no longer exist. Tree canopy change is to be expected temporarily while host trees are replaced by non-host tree species.

Option 3: Aggressive Management: In this approach, all ash trees under the care of the township will be managed proactively with all available treatment options. Ash tree inventory will be conducted and used to guide management. All ash trees which are in fair to excellent condition will be treated via chemical injection. Following treatment, the inventory will be periodically updated and the species health monitored. Only trees that are dead or dying will be removed and replaced by non-host species. This approach will be the least environmentally and socially harmful, however it is also the most expensive of the options. Canopy change is to be expected temporarily while the host trees are replaced by non-host tree species.

Option 4: Selective Management: Under this approach, trees will be evaluated with some being treated, some removed and some in remote areas left in place to die. High value trees, as determined by the tree inventory, will be prioritized and managed actively by chemical treatment. Private property trees will be left alone. Tree removal will take place, but in the most cost effective manner. Trees that pose the largest threat, as determined by the tree inventory will be removed first. This option ensures the future generation to enjoy the highest value trees, while selectively eliminating potential threat caused by the pest. State funding through USDA Forest Service grants may be available to partially offset the cost of treatment of excellent or good condition trees, thus reducing the cost to the township. Tree canopy change in untreated natural areas is to be expected.

Selective Management Case Study - Village of Northbrook, Cook County, Illinois, USA

EAB was first detected in Northbrook, Illinois in 2010. The community implemented a Selective Management approach. The plan included conducting a tree inventory, treating trees with chemical insecticide, and removing and replacing dead or dying trees. During their ten year plan, 730 trees will be removed and replaced, while 268 ash trees will be chemically injected. The total cost is projected at \$ 426,000, including tree replanting. (Houping Liu, *Emerald Ash Borer Management Plan for Pennsylvania Communities*)

In keeping with the Newtown Township's status as *Tree City USA*, all tree planting, treatment, and removal will be performed according to standards set forth by the *International Society of Arboriculture (ISA)*.

Chemical Treatment

A survey of Township lands revealed a total of 261 ash trees: 71 ash trees are being considered for chemical treatment, 171 ash trees will be removed and 19 ash trees will remain unmanaged due to their remote locations. Only trees deemed to be of high value in the Township will be treated with TREE-äge® (pronounced "triage"), an insecticide that can be used to protect valuable landscape ash trees from EAB in many states. Through the Department of Public Works, Newtown Township will employ **licensed arborists** to administer treatments to the designated ash trees.

TREE-äge is registered in all states where EAB has been found. It represents a new tool for protecting valuable landscape ash trees from emerald ash borer. TREE-äge contains emamectin benzoate, a chemical insecticide which has not previously been used to protect ornamental trees. It can be purchased and applied only by trained insecticide applicators and certified arborists licensed by the Pennsylvania Department of Agriculture.

The emamectin benzoate insecticide injection is applied to the trunks of the ash trees and is a closed system. It is not sprayed on the tree nor applied to the soil, therefore reducing the risk of impacting the environment and other wildlife.

Like any systemic insecticide, this product must be transported through the vascular system in the trunk and into the tree canopy. Therefore, it will usually be more effective in a tree that is reasonably healthy than in a tree that has already been severely injured by EAB larvae or any other damage-causing agent. A research study conducted by Dr. Deborah McCullough of Michigan State University found that all trees in three sites injected with TREE-äge had no more than 10-30% dieback. (*Emerald Ash Borer, 2008*). This chemical provides superior protection against EAB larval development up to three years with a single application. Large diameter trees are favored for this treatment because of their high value and survival rates. Other factors considered are; cost, location, logistics and local support.

Newtown Township intends to treat up to a total of 71 trees. Up to four applications will be administered over a 10-year period.

It is not recommended to use alternative treatments that rely on the chemical insecticide imidacloprid, particularly when used as soil drenches. When used as soil drench, chemicals such as imidacloprid can flow through the soil, enter nearby bodies of water and pose a threat to aquatic life such as macro invertebrates that form the base of the food chain. Given the topography of Newtown Township and the prevalence of slopes and steep slopes, and to protect the health of local surface waterways, it is recommended that all commercial landscapers and residents be prohibited from using soil drench treatments for EAB. (*Hahn, Herms, McCullough, 2011*) See Appendix 3.

Highly effective, multi-year control of EAB with emamectin benzoate may substantially reduce costs and logistical issues associated with annual treatments, particularly for municipalities where large numbers of ash trees are at risk (*McCullough et al., 2011*)

Removal

The township will utilize a combination of Public Works staff as well as outside professional contractors to remove 171 ash trees, using location data from the i-tree inventory. The Township will require that appropriate ISA guidelines be followed.

Exact tree removal costs will be determined after site visits are conducted by removal crews. That cost estimating process will occur when the Township obtains estimates through the bidding process. Generally, removal costs for a mature tree can range from \$800-\$3,000 per tree, depending on location. Accessibility to trees can significantly impact the removal costs, with accessible trees being less costly to remove. For the purposes of this report, we are estimating an average removal cost of \$1,100 per tree.

Disposal

The Township will explore opportunities for harvesting and utilizing wood from ash trees that will be removed. Various options may help offset the cost of tree removal and wood disposal, including selling the wood to saw mills or other users of ash wood which is prized for use in sports equipment (e.g. baseball bats and canoe paddles), furniture, and interior uses such as paneling, flooring, mantels, and trim. There are several ways to properly dispose of the wood. Some options offer the opportunity for cost recovery and utilization of a valuable natural resource.

- **Sell** -- Landowners with a significant amount of wood can sell it to saw mills or other forestry businesses. It is recommended to obtain a statement from the buyer of how the wood should be handled or cut before removal.
- **Local disposal** -- Disposed wood is typically used for mulch, firewood or lumber.
- **Donate** -- Wood can be donated to local wood workers, craftsmen, schools, parks, or community organization such as Habitat for Humanity.
- **Repurpose** -- The EAC will work with the Department of Public Works to pursue opportunities for harvesting and reuse of the ash wood, to the extent possible. For example, potential uses include interior furnishing in retail and commercial construction projects such as Ellis Preserve retail establishments such as Whole Foods, residential construction in Liseter and Toll Brothers townhomes and apartments in Ellis Preserve.

Firewood Control

Although there is no official explanation for the movement patterns of the EAB, many believe the movement of firewood from EAB infested area to adjoining areas is the primary cause. The USDA now requires facilities to inspect their stocks of firewood and send it through a heat treatment process to kill EAB larva before sale. This is required for any distribution occurring within quarantined areas by Code of Federal Regulation. However, many people unaware of the situation may unintentionally cause EAB movement with collecting their own firewood and moving into non-infested areas. (*Wang, 2014*) Education and outreach is key to solve this issue. Refer to appendix 4 for federal quarantined areas.



Replanting

The removal of ash trees in the township will leave a void in the tree canopy and on the ground. To fill the void, replanting will need to be done. The township will work with the Environmental Advisory Council to develop a replanting plan to compensate for the loss of tree canopy by implementing an intended replacement rate of two replacement trees for each tree removed. This intended replacement rate is recommended to adequately replace the void in the tree canopy and in recognition of a less than 100% survival rate among replacement trees. Preference will be given to tree species which are native to Southeastern Pennsylvania as these species will provide the greatest wildlife value, are best suited to the habitat and climate and will make the greatest contribution to the overall habitat. To maintain diversity in the tree canopy, we recommend that a variety of species be planted. Non-host trees recommended for ash tree replacement include:

- Acer rubrum (Red maple)
- American Beech (Fagus grandiflora)
- American Hornbeam (Carpinus caroliniana)
- American Sweetgum (Liquidambar styraciflua 'Moraine')
- American Yellowwood (Cladrastis kentukea)
- Blackgum/Tupelo (Nyssa sylvatica)
- Carolina Silverbell (Halesia tetraptera)
- Eastern Redcedar (Juniperus virginiana)
- Hawthorne (Crataegus species)
- Honey Locust (Gleditsia triacanthos var. inermis)
- Littleleaf Linden (Tilia cordata 'Greenspire,' 'Glenleven')
- Pin Oak (Quercus palustris)Platanus occidentalis (Sycamore)
- Shagbark hickory (Carya Ovata)
- Swamp White Oak (Quercus bicolor)
- Tulip Tree (Liriodendron tulipifera)
- Tilia Americana (Basswood)
- White Oak (Quercus alba)

A complete replacement tree table can be found at
<http://www.na.fs.fed.us/urban/WhyAReplacementTreeTable140101.pdf>

Temporary reduction in canopy cover will occur until trees are replanted. The Township will work with nonprofit organizations and private citizens throughout the replanting process. Trees will be replanted over a period of nine years to help defray costs and to build a canopy with trees of different ages. Two trees are intended to be planted for each tree removed.

Table 2: Proposed Tree Replanting Plan				
<u>Tree Species</u>	<u>Common Name</u>	<u>Size</u>	<u>Price</u>	<u>Qty</u>
Acer rubrum	Red maple	6-8'	\$31.50	20
Carpinus carolinana	American hornbeam	3-4'	\$35.50	40
Liriodendron tulipifera	Tulip poplar	4-6'	\$35.50	40
Liquidambar styraciflua	Sweet gum	6-8'	\$31.50	40
Nyssa sylvatica	Black gum	4-6'	\$35.50	40
Quercus bicolor	Swamp white oak	6-8'	\$35.50	40
Quercus palustris	Pin oak	4-6'	\$35.50	40
Quercus rubra	Red oak	4-6'	\$35.50	40
Tilia americana	Basswood	4-6'	\$35.50	42
Total				342

For purposes of this report, these costs were obtained from *Octoraro Nursery*, a wholesale native plant nursery located in Kirkwood, Pennsylvania. Octoraro Nursery has provided trees to Newtown Township in the past. The Township will source trees through its customary bidding and procurement process, and will determine actual costs at that time. Trees will be planted by Department of Public Works employees and / or volunteers involved with the effort.

Community Outreach

Community outreach efforts will inform Newtown Township residents of the management plan, including treatments used to control the impact of emerald ash borer, as well as the cost for implementing such plan, the timeline for implementation, and sources for learning more about emerald ash borer and its effects upon ash trees. This information will be disseminated through the monthly reports at the Board of Supervisors meetings; informational presentations hosted by the EAC at the township library and led by a county forester; press releases to local media; free literature at popular local events; and informational postings on the Newtown Township website.

It will be the landowner's responsibility, and decision, on how to properly prepare for the effects of emerald ash borer regarding any ash trees found on their private property. The Township highly encourages any private owners with ash trees to chemically treat, or to remove and replace any ash trees they find on their property. If any private land owner would like more information on how to properly prepare their ash trees against Emerald Ash Borer, they should visit the Newtown Township website at www.newtowntownship.org , or contact the PA Department of Conservation and Natural Resources (DCNR) at 717-783-2066.

Anticipated Cost Analysis

Table 3 - Total 10-Year Management Costs

Year	Treatment Costs	Treatment Costs	Replanting Costs	Replanting Labor Cost	Tree Removal	Total	Total
	Low End	High End				Low End	High End
2016	\$11,913	\$19,570	\$0	\$0	\$188,100	\$200,013	\$207,670
2017	--	--	\$1,323	\$2,432	\$0	\$3,755	\$3,755
2018	--	--	\$1,350	\$2,432	\$0	\$3,782	\$3,782
2019	\$12,642	\$20,768	\$1,377	\$2,432	\$0	\$16,451	\$24,577
2020	---	---	\$1,404	\$2,432	\$0	\$3,836	\$3,836
2021	---	---	\$1,433	\$2,432	\$0	\$3,865	\$3,865
2022	\$13,416	\$22,039	\$1,461	\$2,432	\$0	\$17,309	\$25,932
2023	---	---	\$1,490	\$2,432	\$0	\$3,922	\$3,922
2024	---	---	\$1,520	\$2,432	\$0	\$3,952	\$3,952
2025	\$13,684	\$22,480	\$1,551	\$2,432	\$0	\$17,667	\$26,463
Total	\$51,655	\$84,857	\$12,909	\$21,888	\$188,100	\$274,552	\$307,754

Calculation Assumptions

Insecticide Application Calculation Assumptions

- 71 trees with differing DBHs need treatment
- DBHs were rounded to the nearest tenth
- Low and high costs reflect potential differentials between prospective vendors
- Average total cost per tree in year 1: low: \$167.78; high: \$275.63

- Annual low cost (insecticide and application) with 2% annual increase
 - Year 1: \$11,912.38
 - Year 4: \$12,641.51
 - Year 7: \$13,415.27
 - Year 10: \$13,683.58
- Annual high cost (insecticide and application) with 2% annual increase
 - Year 1: \$19,569.73
 - Year 4: \$20,767.55
 - Year 7: \$22,038.69
 - Year 10: 22,479.46

Removal Calculation Assumptions

- Average cost per tree: \$1,100
- 171 trees to be removed X \$1,100 = \$188,100

Replanting Calculation Assumptions

- Average purchase cost per tree: \$ 36 with 2% annual increase
- Average labor costs per tree: \$ 64
- Average total cost per new tree: \$100

Intended Replanting to removal ratio: 2:1

A total of 342 trees to be planted; 38 trees annually for 9 years

Cost relief options include:

- DCNR or USDA Forest Service funding is potentially available to significantly defray costs of chemical treatment.
- Removal and disposal costs can be defrayed by engaging businesses that wish to use harvested wood and loggers who will offer reduced fees in exchange for harvesting wood.
- Tree-Vitalize grants may be available for purchase of replacement trees.
- Volunteer labor (e.g., EAC, students, scouts, etc.) can be combined with some Township efforts to offset replanting labor costs.

Fiscal Planning

The EAB infestation has added a fiscal responsibility to the Township. To address this, budgeting of appropriate funding has become part of the annual financial planning process. The budget numbers each year depend on the estimates and bids received from arborists / landscaping contractors. The Township will look for and explore financial saving avenues to complete this task, and will also strive to obtain grants from government agencies to assist with treatment and replacement costs.

Time Table

A 10-year time table (see above) will be put in place for this project, from the beginning of data collection until the last replacement tree is planted. In the first year, it is anticipated that all targeted trees will be removed and all designated trees will receive their first treatment. Replanting will occur in Years 2-10 to spread out costs and to create a tree canopy with trees of various ages. Treated trees are expected to receive follow up treatments on a three-year interval to maintain their protection from the EAB, unless the infestation conditions warrant a shorter or longer interval.

Throughout the process, the township will continually monitor tree health, EAB infestation, replanting, tree removal, and chemical treatments. The township will conduct further tree inventories, as needed.

Adjustments to the plan can be added as needed in response to changes in the field. Prediction of the spread and scope of an infestation is not an exact science. Depending on the status of the EAB infestation at the conclusion of this 10-year period, it may be necessary to develop another management plan, which may call for continuation of treatment of remaining ash trees.

Contacts and Information

Bureau of Forestry (<http://www.dcnr.state.pa.us/forestry/index.aspx>)

Emerald Ash Borer (www.emeraldashborer.info)

Emerald Ash Borer Cost Calculator
(<http://extension.entm.purdue.edu/treecomputer/index.php>)

Emerald Ash Borer Management Plan Template
(http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20028830.pdf)

i-Tree - Tools for Assessing and Managing Community Forests (<http://www.itreetools.org>)

National Tree Benefit Calculator (<http://extension.entm.purdue.edu/treecomputer/index.php>)

Newtown Township Contact Form
(<http://www.newtowntownship.org/contact-newtown-township>)

Newtown Township Emerald Ash Borer Community Management Plan
(<http://www.newtowntownship.org/community/our-environment/>)

Pennsylvania Department of Agriculture EAB Hotline: 1-866-253-7189 or Badbug@state.pa.us

Pennsylvania Department of Conservation and Natural Resources (<http://www.dcnr.state.pa.us>)

Pennsylvania State University Extension
(<http://ento.psu.edu/extension/trees-shrubs/emerald-ash-borer>)

Pennsylvania Urban & Community Forestry Council (<http://www.pacommunityforests.com>)

Tree Vitalize - A Partnership to Restore Tree Cover in Pennsylvania Communities
(<http://treevitalize.net/TreeCare/SelectingTrees.aspx>)

USDA Forest Service (EAB) (<http://na.fs.fed.us/fhp/eab>)

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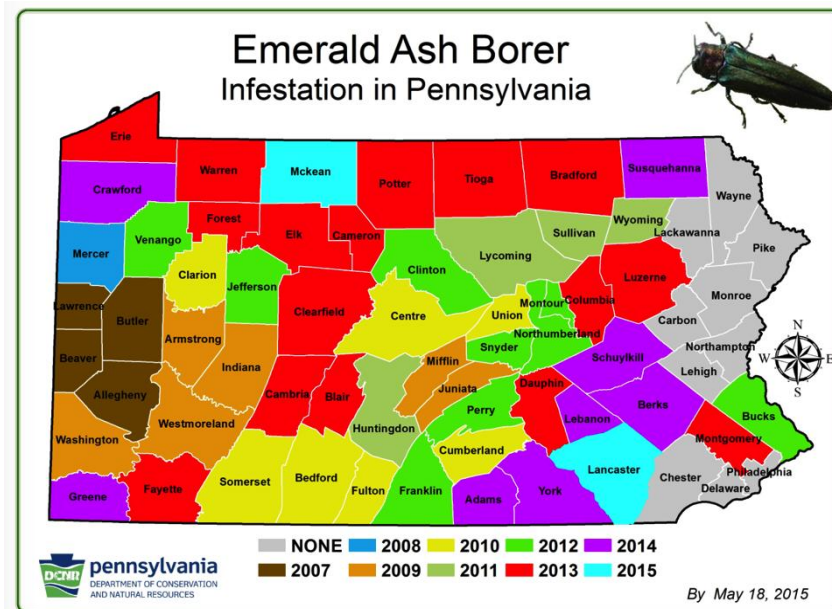
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Appendix 1 – Spread of Emerald Ash Borer

The following map is from the Emerald Ash Borer section of the Pennsylvania Department of Conservation and Natural Resources website and can be found at:

http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20029653.pdf



Appendix 2 – Use of Insecticide Emamectin Benzoate (excerpts)

Excerpted from: "Emamectin benzoate: Human Health and Ecological Risk Assessment, FINAL REPORT," Syracuse Environmental Research Associates, Inc., for USDA Forest Service, Oct. 2010.

General Considerations

Emamectin benzoate is used for control of the emerald ash borer (*Agrilus planipennis* Fairmaire, commonly abbreviated as EAB), an insect pest of ash trees (*Fraxinus* spp.). This document provides human health and ecological risk assessments to support an assessment of the environmental consequences of using this pesticide in Forest Service programs. Emamectin benzoate is an insecticide that acts by adversely affecting the nervous system. This insecticide is registered for national use on a variety of agricultural commodities. The anticipated uses of emamectin benzoate in Forest Service programs is limited to one formulation of emamectin benzoate, Tree-äge, and one application method, tree injection. Relatively little information is available on the transport of emamectin benzoate in trees following tree injection and uncertainties with the movement of emamectin benzoate in ash trees following tree injection is a dominant factor in the current Forest Service risk assessment in terms of adequately assessing exposures to humans and other non-target species.

Human Health Consideration

In terms of potential human health effects, the most plausible exposure scenarios are those for workers applying emamectin benzoate in a manner that is consistent with labeled directions including the proper use of chemical resistant gloves. If workers handle emamectin benzoate with care and effectively use chemical resistant gloves, no substantial or significant risks to workers are anticipated. If workers fail to effectively use chemical resistant gloves or if workers do not effectively and rapidly respond to accidental exposures, adverse effects in workers, possibly including degenerative changes in nerve tissue, could occur.

Substantial exposures to members of the general public do not appear to be plausible although quantitative estimates of expected exposures and hence quantitative estimates of risks cannot be developed at this time. Based on accidental exposure scenarios associated with the spill of emamectin benzoate into a pond, the central estimates of hazard quotients are below the level of concern (HQ=1). The upper bound estimates of the hazard quotients range from 0.6 to 3. The inability to estimate exposures to members of the general public associated with the normal and expected use of emamectin benzoate – i.e., injection into ash trees – is a serious limitation in this risk assessment. Nonetheless, the upper bound HQ for all of the accidental exposure scenarios is only 3. Thus, in the normal use of emamectin benzoate, about one-third of the emamectin benzoate that is injected into an ash tree would need to be transported to surface water in order for the HQs associated with non-accidental exposures to reach a level of concern. It does not seem reasonable to assert that this level of exposure would or could occur.

Ecological Effects

As with the human health risk assessment, the ecological risk assessment for emamectin benzoate is dominated by uncertainties in the exposure assessment. Because of limited information on the transport of emamectin benzoate in trees following tree injection and the lack of information on the transport of emamectin benzoate in ash trees, reliable estimates of exposures in non-target species associated with the injection of emamectin benzoate into ash trees cannot be made. The inability to estimate expected exposures of non-target species limits confidence in the risk characterization for non-target species.

Uncertainties in the exposure assessments associated with the potential contamination of surface water in the normal use of emamectin benzoate for the injection of ash trees are addressed with an accidental spill scenario. Based on the accidental spill scenario, no risks are apparent for mammals, birds, fish, aquatic plants, or tolerant species of aquatic invertebrates. The lack of risk in the accidental spill scenarios for these groups of organisms suggests that the contamination of surface water associated with the normal use of emamectin benzoate to inject ash trees is not likely to adversely impact these organisms. Risks to sensitive species of aquatic invertebrates, however, are apparent in the accidental spill scenario with an upper bound HQ of 120. Thus, in the event of an accidental spill of a significant amount of emamectin benzoate into a pond, adverse effects including mortality could be anticipated. The high hazard quotients for

sensitive species of aquatic invertebrates associated with the accidental spill scenario also prevent a clear risk characterization for this group of organisms in the normal use of emamectin benzoate. At least in situations in which high doses of emamectin benzoate are used or a relatively large number of trees are treated near surface water, risks to sensitive species of aquatic invertebrates can neither be discounted nor characterized clearly.

While uncertainties associated with contaminated surface water can be addressed reasonably well, other exposure pathways are problematic. The most likely exposures for mammals or birds involve the consumption of bark, stem tissue, or seeds of ash trees as well as the consumption of herbivorous insects that may feed on ash leaves. Only the 24 pathway involving the consumption of herbivorous insects is developed quantitatively. Under worst-case exposure assumptions, risks to mammals are marginal (an upper bound HQ of 1.1) and risks to birds are negligible (an upper bound HQ of 0.03). For herbivorous insects, however, the risk characterization is well-defined. Both tolerant and sensitive species of herbivorous insects are likely to be adversely affected if they feed on ash trees injected with effective doses of emamectin benzoate.

While the risk characterization for emamectin benzoate is dominated by uncertainties in the exposure assessments, it is worth noting that the most relevant toxicity studies on aquatic organisms and birds are limited to relatively standard bioassays on relatively few species of organisms compared to other more fully studied pesticides. In addition, no data are available on reptiles, amphibians, or soil invertebrates.

Appendix 3 – Potential Side Effects of Systemic Insecticides

Excerpted from: “Frequently Asked Questions Regarding Potential Side Effects of Systemic Insecticides Used To Control Emerald Ash Borer,” University of Minnesota Extension, Michigan State University, The Ohio State University, OARDC Extension, Feb. 2011.

What systemic insecticides are commonly used to protect ash trees from emerald ash borer(EAB)?

Systemic insecticides containing the active ingredients imidacloprid, dinotefuran or emamectin benzoate are commonly used to protect ash trees from EAB. All three are registered for agricultural use and have been designated by the Environmental Protection Agency as Reduced-Risk insecticides

for certain uses on food crops. The most widely used insecticide in the world, imidacloprid has been utilized for many years to control pests of agricultural crops, turfgrass, and landscape plants. Because of its low toxicity to mammals, it is also used to control fleas and ticks on pets. Dinotefuran is a relatively new product that has properties similar to those of imidacloprid, but it has not been researched as thoroughly. Emamectin benzoate, derived from a naturally occurring soil bacterium, has been registered for more than 10 years as a foliar spray to control pests in vegetable and cotton fields and parasitic sea lice in salmon aquaculture.

...Emamectin benzoate and specific formulations of imidacloprid are injected directly into the base of the tree trunk. Systemic insecticides are transported within the vascular system of the tree from the roots and trunk to the branches and leaves. This reduces hazards such as drift of pesticide to non-target sites and applicator exposure that can be associated with spraying trees with broad-spectrum insecticides, and has less impact on beneficial insects and other non-target organisms. Many products registered for control of EAB can be applied only by licensed applicators. In all cases, the law requires that anybody applying pesticides comply with instructions and restrictions on the label.

Will systemic insecticides applied to the soil impact ground or surface water quality?

Excerpt: Every precaution should be taken to protect surface and groundwater from pesticide contamination. Trunk-injected insecticides pose little risk to ground and surface water when used as directed because the material is placed inside the tree.

To protect groundwater, soil applications of systemic insecticides should be made immediately adjacent to the trunk of the tree, which increases uptake (and efficacy) because the high density of absorptive roots in this area filters the chemical from the soil. Systemic insecticides bind to varying degrees to organic matter, silt, and clay, which restricts their movement in soil. They should not be applied to porous sandy soils lacking organic matter, especially where the water table is shallow, or when heavy rain is predicted within the next 24 hours.

To protect surface water, systemic insecticides should not be applied to soil near ponds, lakes, or streams. Soil drenches should not be applied to sloped surfaces from which runoff can occur, nor should pesticides be misapplied carelessly to impervious surfaces such as sidewalks or streets, or otherwise allowed to reach conduits to surface water such as drains, ditches, or gutters....

Will these insecticides harm honey bees?

Excerpt: Ash trees are wind-pollinated and are not a nectar source for bees. Furthermore, ash flowers are produced early in the growing season and are present for only a limited number of days. It is highly unlikely that bees would be exposed to systemic insecticides applied to ash trees.

Will these insecticides harm other insects?

Excerpt: All of the systemic insecticides used to control EAB will impact other species of insects that feed on treated ash trees. However, ash trees that are not treated will be killed by EAB, which will also impact these insects. Some products can affect many kinds of insects, while others affect only certain groups of insects. For example, emamectin benzoate has been shown to affect a broad range of plant-feeding insects.

The following map is from the United States Department of Agriculture. If can be obtained at: <http://www.emeraldashborer.info/firewood.cfm#sthash.WE4K1VHs.dpbs>

