

# THE CITY OF PHILADELPHIA

## EMERALD ASH BORER MANAGEMENT PLAN



A PLAN DEVELOPED TO PRIORITIZE RECOMMENDATIONS  
FOR THE COST-EFFECTIVE MANAGEMENT OF ASH  
(FRAXINUS SPP.) TREES IN THE CITY OF PHILADELPHIA  
*2012*



## 1.0 Executive Summary

All North American ash (*Fraxinus* spp.) species are susceptible to attack by the emerald ash borer (*Agrilus planipennis* Fairmaire), an insect pest introduced from Asia. This pest was discovered in Warrington PA, 15 miles north of Philadelphia, on March 14, 2012 and its arrival to our city is imminent. Once established, we can expect to lose the vast majority of the ash trees in Philadelphia County within 6-10 years.

The City of Philadelphia (hereinafter, “City”) recognizes the intrinsic value and benefits that a tree canopy provides to its citizens. Trees help to remove pollutants from the air and water; capture stormwater, which reduces impacts on the City’s combined sewer system (CSO); shade streets and residences, which provides cool relief on hot summer days; and their presence increases property values, benefiting individuals and entire neighborhoods alike.

Mayor Michael Nutter, in his 2008 inaugural address, promised to make Philadelphia the “greenest” city in the nation. This pledge resulted in the creation of the Office of Sustainability and the development of the Greenworks Philadelphia Plan<sup>1</sup> in 2009. A significant initiative (Target 11) of this plan is to “increase tree coverage toward 30% in all neighborhoods by 2025.” A recent (2010) tree canopy survey<sup>2</sup> found that about 20% of the City was covered by tree canopy. Unfortunately, the arrival of the EAB will have significant impacts on achieving the 30% tree canopy goal for our City.

According to Nowak<sup>3</sup> in a 2007 survey of the Philadelphia forest resource, the combined urban and woodland forests of the City are estimated to include 6% ash (*Fraxinus* spp.) or about 126,000 ash trees. However, this is an estimate and does not include any information on individual trees or stand locations. The vast majority of the ash trees within Philadelphia are located within the watershed parks or on privately-owned residential properties. In anticipation of the arrival of the EAB, the PP&R Street Tree Management Division has planted very few ash trees as street trees or in parks.

The City contains approximately 6,781 acres of watershed parks including East/West Fairmount Parks (2052 ac.), Wissahickon Valley Park (2042 ac.), Pennypack Creek Park (1343 ac.), Cobbs Creek Park (851 ac.), Tacony Creek Park (304 ac.), and Poquessing Creek Park (189 ac.). The City

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<sup>1</sup> Mayor Michael A. Nutter. 2009. Greenworks Philadelphia – Mayors Office of Sustainability, The City of Philadelphia. [www.greenworksphila.org](http://www.greenworksphila.org)

<sup>2</sup> O’Neil-Dunne, Jarlath. 2010. “A Report on the City of Philadelphia’s Existing and Possible Tree Canopy,” University of Vermont, Spatial Analysis Laboratory, 12p.

<sup>3</sup> Nowak, David J.; Hoehn, Robert E. III, Crane, Daniel E.; Stevens, Jack C.; Walton, Jeffrey T. 2007. “Assessing Urban Forest Effects and Values, Philadelphia’s Urban Forest Resource,” Bull. NRS-7. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 22 p.

is also responsible for numerous areas of “developed” parkland, including golf courses, recreation centers, playgrounds, senior centers, athletic fields, and urban parks. The City’s combined watershed parks and developed parks are estimated to cover 11,407 acres and comprise 419 individual properties. This management plan will address the two “types” of City property (watershed parks vs. developed parks) separately since the goals and objectives will differ based on policy and use.

Prior to developing management decisions, the City must first perform an ash tree inventory within the properties under our jurisdiction. The inventory will provide the information necessary to prioritize management objectives and implement this plan. The inventory will provide individual tree locations and will evaluate size, health, and potential targets.

The EAB poses a significant threat to natural resources and has the potential to create a substantial number of hazard trees. In order to protect the citizens and to preserve a portion of the native ash tree resource, the City will adopt a balanced or “selective” management approach that includes tree removal, replanting and treatment with insecticides. City urban foresters will develop plans, contracts, and specifications to perform the initial inventory. The results of the inventory will allow the City to identify individual trees for removal, trees to be retained and treated, and recommendations for replanting. Overall, compared to the entire population of ash trees within the City, a relatively small number of trees will ultimately be selected for removal or treatment.

PP&R will investigate the potential for working with the Pennsylvania Department of Conservation and Natural Resources (PADCNR) and the US Dept of Agriculture, Animal and Plant Health Inspection Service (APHIS) toward the release of biological control agents in appropriate locations. Should these bio-control agents ultimately become established, ash may return as a component of our future forest. PPR will also select a small number (approximately 50) of the native ash trees in the watershed parks for long term (10+ years) treatment in order to preserve their local genome and as a future seed source.

Secondary effects from this invasion will be numerous; however, two that are deemed most significant will be an increase in storm water runoff, as tree canopy cover declines, and colonization of forest gaps by non-native (invasive) plant species. Therefore, a goal of this plan will be to restore the forest understory with Philadelphia native forest tree species. Ideally, ash dominated areas should be planted prior to tree death. The existing canopy will improve transplanting success and limit the establishment of invasive plants. An increased effort to manage white tailed deer will also be needed to ensure the success of any reforestation efforts.

The City will provide expertise and public outreach, to the extent that staff are available, to assist homeowners in making reasoned and cost-effective decisions regarding trees on private property. However, it will ultimately be the responsibility of the individual homeowner to seek professional assistance and determine whether to preserve or remove the individual trees on their private property. PP&R has developed an informative presentation that provides an

overview of the problem as well as guidelines for decision making. PP&R will offer this presentation to community organizations and friends groups.

The City has invested in identifying, protecting and enhancing the urban forest resource. Unfortunately, the introduction of the EAB will have a considerable impact on this effort. With the implementation of this plan, the impacts to the tree resource can be ameliorated to the extent practicable. The plan will also ensure the safety of citizens who daily utilize or traverse our watershed and developed parks.

Grant funding supported through the USDA Forest Service <http://www.fs.fed.us/ucf/> and the Pennsylvania Urban & Community Forestry Council <http://www.pacommunityforests.com/>. Technical assistance and Emerald Ash Borer Management Plan template [http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr\\_20028830.pdf](http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20028830.pdf) provided through the Pennsylvania Department of Conservation & Natural Resources <http://www.dcnr.state.pa.us/>, Bureau of Forestry <http://www.dcnr.state.pa.us/forestry/index.aspx>.

## 2.0 Administration

The City of Philadelphia EAB Management Plan will be implemented by the City of Philadelphia, Dept. of Parks and Recreation, Urban Forestry & Ecosystem Management Division (PP&R). The following staff will be the points of contact.

Staff	Title	Phone	Email
Michael DiBerardinas	Commissioner	215-683-3666	michael.diberardinas@phila.gov
Mark Focht	Deputy Commissioner	215-683-0202	<a href="mailto:mark.focht@phila.gov">mark.focht@phila.gov</a>
Christopher Palmer	Director Operations and Landscape Mgmt	215-683-0220	christopher.palmer@phila.gov
Joan Blaustein	Dir. Urban Forestry	215-683-0215	joan.blaustein@phila.gov
Frances Piller	Park District Manager	215-685-4360	<a href="mailto:frances.piller@phila.gov">frances.piller@phila.gov</a>
Lori Hayes	Parks Grounds Maint Supervisor – Center/South	215-685-1662	<a href="mailto:Lori.hayes@phila.gov">Lori.hayes@phila.gov</a>
Richard Sunday	Parks Grounds Maint Supervisor - Northeast	215-685-0374	rich.sunday@phila.gov
Dan Dolan	Parks Grounds Maint Supervisor - Northwest	215-685-0696	<a href="mailto:dan.dolan@phila.gov">dan.dolan@phila.gov</a>
Curtis Helm	Park Manager II	215-683-0239	<a href="mailto:curtis.helm@phila.gov">curtis.helm@phila.gov</a>
Tom Witmer	Dir. Natural Resources	215-683-0216	tom.witmer@phila.gov
John Piller	Special Projects	215-683- 0230	<a href="mailto:john.piller@phila.gov">john.piller@phila.gov</a>
Nora Dougherty	Geospatial Analyst	215-683- 0235	<a href="mailto:nora.dougherty@phila.gov">nora.dougherty@phila.gov</a>

### **3.0 Authority**

All trees located on City property, including trees planted along our city streets and trees growing in our parks and public use areas, will be the responsibility of the City. Trees growing on private property are not the responsibility of the City and will be the sole responsibility of each individual landowner.

In accordance with the Philadelphia Code, Chapter 15-200, the Fairmount Park Commission (now Philadelphia Parks & Recreation) shall have exclusive custody and control of, and responsibility for, the street trees on the streets of Philadelphia, and shall make rules and regulations consistent with Section 15-203 regarding the planting, setting out, removal, maintenance, protection and care of said trees as are necessary. The Commission may grant permission to individuals, groups or firms to perform such services either voluntarily or by contract. In addition, the Commission shall itself or by contract, provide maintenance for all street trees whether abutting private or public property, including but not limited to, trimming, pruning and spraying. The Commission shall be responsible for taking appropriate action to eliminate dangerous conditions caused by dead, dying, dangerous or diseased street trees whether abutting private or public property.

Note that the powers and responsibilities vested in Fairmount Park Commission were transferred to the Department of Parks and Recreation pursuant to a change in the Home Rule Charter, effective July 1, 2009. The Philadelphia Code gives exclusive custody and control over street trees and the plenary powers to make rules and regulation for planting, removing and maintaining street trees. This authority extends to all trees located on lands under the jurisdiction of Fairmount Park Commission.

### **4.0 Quarantine**

State and Federal quarantines on the movement of ash wood products in Pennsylvania became effective during 2007 following initial detection of the pest in Butler County, PA. The quarantine restricted the movement of ash nursery stock, green lumber and any other ash material, including logs, stumps, roots and branches, and all wood chips beyond the quarantined area. The movement of all hardwood firewood was also restricted. However on April 15, 2011, acting Agriculture Secretary George Greig lifted the State quarantine. According to Greig, "As emerald ash borer has moved rapidly across the state, the in-state quarantine restrictions no longer serve a productive purpose." Lifting the quarantine now allows for the free movement of emerald ash borer-regulated materials within Pennsylvania. Although the State quarantine has been lifted, a Federal quarantine remains in effect. Specifically, the Federal quarantine restricts the interstate movement of wood products including firewood of all hardwood species, nursery stock, green lumber, waste, compost and chips of all ash species.

## 5.0 Tree Inventory

According to the PADCNr ([http://www.dcnr.state.pa.us/forestry/fpm\\_invasives\\_EAB.aspx](http://www.dcnr.state.pa.us/forestry/fpm_invasives_EAB.aspx)), ash is estimated to comprise about 3.6% of the forests in Pennsylvania, with more than 300 million trees throughout the state. Other sources identify white, black, and green ash as making up over 7 percent of the hardwood stand mix and 5.5 percent of the total stand mix (when including conifers) in the northeastern United States and eastern Canada. Some individual forest stands may be dominated by as much as 20-40% ash. According to Nowak<sup>4</sup> in a 2007 survey of the Philadelphia forest resource, the combined urban and woodland forests of the City include 5.1% white ash and 0.9% green ash. The entire forest resource in Philadelphia, comprising all species, was found to include approximately 2.1 million trees. Assuming 6% of the trees in the city are members of the genus *Fraxinus*, we can anticipate that about 126,000 trees within the City will be ash trees subject to attack by the EAB.

The PP&R Street Tree Management Division has discontinued planting green ash as street trees since the EAB was first detected in Pennsylvania. A review of records found that a total of only 83 ash trees were planted as street trees between 2002 and 2010. The vast majority of the estimated 126,000 ash trees within Philadelphia are located within Fairmount Parks 6,781 acres of natural area or on private properties. Only a very small percentage are expected to be street trees, and these trees are typically small in stature.

The City does not currently have any formal tree inventory; therefore, as an initial step in the implementation of the EAB plan, PP&R intends to perform a detailed inventory of the ash resource within areas under our jurisdiction. Ash trees will be inventoried within the following locations:

- Urban Parks (e.g., Rittenhouse Square, McPherson Square, Wissanoming Park)
- Recreation Centers (e.g., Olney Recreation Center, Cruz Recreation Center)
- Special Use Facilities (e.g., Mann Center, Bartram's Garden, FDR Golf Course)
- Watershed Parks (e.g., Wissahickon Valley Park, Pennypack Creek Park)

The inventory will be performed as two distinct studies. The "Developed Parks" which include Urban Parks, Recreation Centers and Special Use Facilities will be inventoried as a group; and the large natural areas or "Watershed Parks" will be inventoried as a group. The Developed Parks will require thorough searches that will locate and document all ash trees; since public use is intensive throughout these spaces; whereas, the Watershed Parks will require only a partial inventory, since usage is more focused to roads, trails and assembly areas. Healthy ash trees located in the Developed Parks will also be judged more critically for treatment, since they are more likely to provide an important landscape amenity.

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<sup>4</sup> Nowak, David J.; Hoehn, Robert E. III, Crane, Daniel E.; Stevens, Jack C.; Walton, Jeffrey T. 2007. Assessing urban forest effects and values, Philadelphia's Urban Forest. Resource. Bull. NRS-7. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 22 p.

## 5.1 Watershed Parks

Because the watershed parks are so vast, including 6,782 acres, the inventory will be restricted to those ash trees located within 100 feet (100) of a potential target. The 100 foot buffer has been imposed along both sides of roads and trails, abutting public assembly areas, and adjacent to onsite structures and offsite residential/commercial properties. The one hundred foot distance was selected as a reasonable buffer for the inventory since most ash trees will be 60-80 ft in height; and, according to the Tree Risk Assessment Manual<sup>5</sup> the “target zone” is typically 1 to 1.5 times the height of a tree. However, if particularly tall ash trees (> 100 ft hgt.) are noted beyond the 100 ft buffer, they will be included in the inventory. A potential target may include public roads, multi-use trails, utilities, structures, buildings, parking lots, and public assembly areas. The inventory will focus on only those trees that have the potential to strike a “target.” For example, a 50 ft tall ash tree that is located > 75 ft (1.5 X hgt) from a target, will not need to be inventoried. For trees that are inventoried, the information that will be collected will include:

- 1) Species (white ash/green ash/Other)
- 2) Diameter (diameter at breast height)
- 3) Height (10 ft increments – visual estimate)
- 4) Crown Health (excellent, good, fair, poor, dying)
- 5) Target (Onsite/Offsite - Road, Trail, Building, Utility, Parking, Other)
- 6) Treat/Remove/Fell/Uncertain (requires further evaluation by PP&R)
- 7) Inventory Number (Aluminum Marking Tag)

Inventoried trees will be located with GPS and will be individually numbered with round aluminum tree tags and additionally painted with a letter indicating what action is to be taken on the tree. Trees painted with an “F” are to be felled and left in place; trees painted with an “R” are to be removed; trees painted with a “T” are to be treated; and, trees painted with a “dot” are to be further evaluated for removal or treatment. Tree marking will facilitate staff review and to assist contractors in responding to Requests for Proposal and eventually for removal or treatment. In addition to inventory of ash trees, PP&R will also identify obvious hazard trees of any species during this field inventory. These trees will be included in the tree removal contract.

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<sup>5</sup> Smiley, E.T, Matheny N and S. Lilly. 2011. Best Management Practices - Tree Risk Assessment. International Society of Arboriculture, Champaign, ILL.

A summary of the acreage required to be inventoried within each park is as follows:

Table 1: Inventory Acreage Estimates

Watershed Park	Existing Acreage	Estimated Inventory Acreage
East Fairmount	650	385
West Fairmount	1403	821
Wissahickon Valley	2042	896
Pennypack Creek	1343	892
Cobbs Creek	851	417
Tacony Creek	304	121
Poquessing Creek	189	156
<b>TOTAL</b>	<b>6782</b>	<b>3688</b>

We estimate that a total of approximately 3688 acres of parkland within the 100 foot buffer will have to be evaluated for potential hazards. Based on our best professional judgment, it will take approximately one hour to inventory each two acres of 100 foot buffer. A total of approximately 1850 hours of labor are estimated to perform the field work within the natural areas.

In addition to the GPS survey of buffer areas, PP&R staff will identify several stands of ash within two of the watershed parks, Wissahickon Valley and Pennypack Creek, for treatment. According to NRDC staff entomologist Dr. H. Liu<sup>6</sup> an approximate ratio of 5:1 (female/male) ash trees should be selected in order to ensure adequate pollination. These stands will be retained in order to maintain the local genetic strain and native seed source. The identified stands will be located on mesic sites and include trees that appear healthy and free of disease. These stands will include between 6 and 12 trees and each and each tree will be treated with insecticide for at least 10 years.

## 5.2 Developed Parks

The inventory of the developed parks will be more intensive than the inventory of the watershed parks. All areas within and abutting Recreation Centers, Playgrounds, Older Adult Centers, Pools/Skating Rinks, and Urban Parks will be inventoried. Special Use facilities, such as Bartram's Gardens, Mann Music Center, Wissanoming Park, and/or FDR Golfcourse, which may include large stands of trees, will be subject to a modified inventory. This will require the person performing the inventory to use best professional judgment and determine which areas are subject to highest public use and which do not need inventory.

Table 2 below provides a listing of the different types of facilities under PP&R jurisdiction based on their identified type of use. There is some overlap since some playgrounds, ballfields, pools and ice rinks are located within Recreation Centers. However this does help to identify the scale of the effort that will be required.

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<sup>6</sup> Pers. Comm. Dr. H. Liu, PA Dept of Cons. & Nat Resources, E-mail dated Jan 04, 2013



Table 2: PP&R Facilities listed by District

District #	1	2	3	4	5	6	7	8	Total
Recreation Centers	9	9	9	2	5	7	6		<b>47</b>
Playgrounds	18	16	9	8	2	11	15	18	<b>97</b>
Parks	14	16	17	43	17	16	27	28	<b>178</b>
Special Use Areas	6	-	1	9	35	-	4	6	<b>61</b>
Ballfields	4	1	-	7	8	3	-	1	<b>24</b>
Older Adult Centers	1	-	2	1	-	1	1	-	<b>6</b>
Ice Rinks & Pools	1	1	-	1	1	1	4	3	<b>12</b>
<b>TOTAL</b>	<b>53</b>	<b>43</b>	<b>38</b>	<b>71</b>	<b>68</b>	<b>39</b>	<b>57</b>	<b>56</b>	<b>425</b>

In order to reduce the scope of the Developed Park inventory effort, PP&R Street Tree Management Division staff has preliminarily eliminated some facilities where it is known that no ash trees occur. Based on this preliminary survey, PP&R anticipates having to evaluate and inventory a total of approximately 250 developed park facilities.

The inventory will include all street trees and all ash trees that are larger than 4" diameter. The information that will be collected will be the same as that required for the watershed parks (above). Similarly, all trees that are known or questionable hazards will be located with GPS, tagged and painted for removal, treatment or further evaluation.

Based on our best professional judgment, each of these 250 developed park facilities is anticipated to require approximately 2.0 hours to perform an inventory, including driving time. A total of approximately 500 hours of labor are estimated to perform the field work within the developed parks.

### 5.3 Staffing

PP&R anticipates hiring interns to perform the inventory work. PP&R will conduct a 2-day training seminar in the field to ensure consistency. An Inventory Protocol are provided in Appendix A and B, which summarize our guidelines for performing field work within Watershed Parks and Developed Parks, respectively. PP&R staff will also assist with the inventory, especially along high-priority sites, such as major roads (e.g., Lincoln Drive, Kelly Drive) or highly used trails. PP&R's trail use census data indicates that as many as 7399 citizens may traverse the Boathouse Row trail during a single day. PP&R staff will also re-evaluate any trees that require a second opinion.

Upon completion of the inventory, the GPS data will be compiled and separated based on Philadelphia's existing management districts, 1 through 8. PP&R will develop separate contracts for tree removal and for insecticide treatment for each pair of districts (i.e., 1-2, 3-4, 5-6 and 7-8). Once a subcontractor has been identified, PP&R will provide project management. The scale and scope of the potential work effort is beyond the capability of the PP&R's existing staff and will have to be subcontracted.

## **6.0 EAB Monitoring**

The first emerald ash borer infestation in Pennsylvania was detected June 2007 in Cranberry Township, Butler County, which is located about 20 miles NW of Pittsburgh. It has been determined that the infestation in Cranberry Township had been there since about 1999 ~ 2000. As of December 2012, EAB has been found in 31 Counties in Pennsylvania, primarily in the western and central part of the state. However, on March 14, 2012, Pennsylvania Department of Agriculture confirmed that EAB has been detected in Warrington, Bucks County. The infestation was first observed by an arborist who contacted Penn State Extension. Department of Agriculture entomologists collected specimens and positively identified larvae taken from infested trees. Warrington Township is located approximately 20 miles north-northwest of downtown Philadelphia. It is likely that the Warrington trees had been infested for at least two (2) years before the detection. This being the case, it is possible that the EAB has already reached the Philadelphia city limits despite the fact that it has not yet been found.

The EAB poses a significant threat to natural resources and will reportedly kill 99% of all ash trees.<sup>7</sup> In an effort to prepare for the loss of the City's population of ash trees, PP&R has scheduled two outreach and training sessions for city staff and arborists. Dr. Cliff Sadof, entomologist from Purdue University, provided a presentation on August 2, 2012 entitled "Taking Charge of EAB." Dr. Sadof covered signs/symptoms, insect identification, municipal issues, and potential treatments. Rainbow Tree Care provided a second educational session and field training on September 18, 2012. This session also covered signs/symptoms and pesticide treatments, and included a demonstration of Arbor-Jet insecticide injection equipment. Each of these sessions was very well attended by staff. In addition, PP&R has prepared a PowerPoint Presentation intended for public outreach. To date, PP&R has presented this to the "Friends of Pennypack Park," an active park friends group that assists with invasive plant removal and replanting in Pennypack Park. PP&R has also developed detailed information discussing the EAB and this community management plan, which is included on the PP&R Website (<http://www.phila.gov/parksandrecreation>).

As a result of the training sessions, PP&R staff are well aware of the EAB and are familiar with the signs and symptoms, along with other damaging insects and diseases. PP&R currently examines and peels sections of wood from the middle and upper two-thirds of dead and dying

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<sup>7</sup> Vermont Forest Health. 2012 (April). Ash Management Guidance for Forest Managers, Dept. of Forests, Parks & Recreation 8pp. [www.vtfpr.org/resource/for\\_forres\\_useapp.cfm](http://www.vtfpr.org/resource/for_forres_useapp.cfm)

ash trees that are removed by staff or as part of our sub-contracted tree removal. Sampling follows a recommended methodology<sup>8</sup>. Contractors are asked to retain tree sections and mark the sections with location information. These are later examined by PP&R staff. To date EAB has not been identified within the city limits. PP&R staff have recently examined dead and dying ash trees located at Walnut Lane Golf Course and no evidence of EAB was found.

## 6.1 Insect Biology

In its native range (Asia), emerald ash borer (*Agrilus planipennis* Fairmaire) is considered a secondary pest, colonizing already stressed or dying ash trees. In the U.S. it also preferentially attacks stressed trees; however, it will also attack and kill perfectly healthy trees, of all sizes. The susceptibility of our native ash to this introduced pest may be attributed to a lack of coevolved resistance. The trees are injured through the activity of the feeding larvae which create serpentine galleries beneath the bark. These galleries physically disrupt the tree's conductive tissue, which essentially starves the tree of water and nutrients.

The adult beetle is small in size (7.5 – 11.5 mm length) usually bronze, golden, or reddish green overall, with darker, metallic emerald green wing covers. In the Philadelphia area, the adult beetles emerge from the trees in mid-May through June and begin feeding on the foliage of ash trees. This feeding activity causes only negligible damage. After about a week of feeding the adult beetles will mate. The adult female will feed for another week and then begin to lay eggs in crevices on the bark of ash trees. Each female will lay about 30-60 eggs. After about a week, the eggs hatch and the first instar larvae burrow down through the bark into the tree where they begin feeding on cambial tissue. As they feed and grow, they create ever expanding serpentine (S- shaped) galleries. The larva pass through four instars (growth stages) and overwinter beneath the tree's bark. The following spring, the insects pupate and emerge as the adult beetle, completing their life cycle. As they emerge, they leave a characteristic "D" shaped exit hole. Depending on various conditions, some larva may require two growing seasons before they pupate and emerge, however a one-year life cycle is more common.

Beetles will often attack the same tree from which they emerged although they will also fly to nearby ash trees to feed. They are reported to be strong fliers but researchers have found that most emerging adults will re-infest and lay eggs on trees within a 100 yard radius of their parent/host tree. Most outlier infestations have been traced back to shipments of nursery stock, saw logs or firewood, and have been introduced by humans ignorant of quarantine restrictions.

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<sup>8</sup> Ryall KL, Fidgen JG, and JJ Turgeon. Undated. Detection of emerald ash borer in urban environments using branch sampling. Frontline – Forestry Research Applications, Canadian Forest Service, Sault St marie. Technical Note No. 111. 3pp.

## 6.2 Signs and Symptoms

Detection of trees during early stages of attack can be difficult since trees with low density of larval feeding show few if any symptoms. The beetles are small in size and generally feed in the mid or upper canopy of the tree, so they too can be difficult to see. In early stages of infestation, most eggs are laid in the mid and upper branches of the tree, where they would also be difficult to observe. It is only after several years of feeding that trees will begin to show obvious signs of decline. At this point, the activity of woodpeckers feeding on larvae is often observed, which may be the first sign that a tree is infested. However, woodpeckers commonly feed on dead and dying trees since our North American native borers often attack and colonize stressed trees. The D-shaped exit holes left by emerging adult beetles may sometimes be seen on branches or the trunk. Upon peeling the bark of infested trees, the S-shaped galleries found in the cambium beneath are characteristic. These galleries will be partially packed with frass, which looks like sawdust. Bark splits may occur over the larval feeding galleries due to death of the underlying cambial tissue.

As the EAB densities build, the foliage wilts, branches die, and the tree canopy becomes increasingly thin and chlorotic. Many trees will lose up to half their canopy after several years of infestation. Trees may die after 3 to 4 years of heavy infestation. The tree may sprout shoots (epicormic shoots) from the trunk or along branches and a cluster of shoots may arise from the base of the tree. Once a tree is attacked it will usually be dead in three to five years. Stressed trees are attacked first, and the insects will congregate at these trees. Trees tend to look healthy and then die fairly rapidly.

## 6.3 Other Pests Affecting Ash Trees

Ash trees suffer from a variety of disease and insect pests (Pirone 1978)<sup>9</sup>. The most common diseases of ash include anthracnose, rust, leaf spots, cankers, and ash yellows. Ash yellows, which is the most serious of the diseases, is caused by a mycoplasma-like organism. Ash yellows is responsible for the decline and premature death of ash trees in north central and north eastern US and has been a consistent problem for ash trees in Philadelphia. White ash sustains the greatest damage from this organism while red and green ash are somewhat less susceptible (Sinclair et al., 1987).

Trees suffering from ash yellows may appear to have symptoms similar to that caused by the EAB, such as smaller than normal leaves, weak or sparse canopy and die-back, epicormic sprouts, and trunk splits. The most diagnostic symptoms however, which include the formation of witches brooms (an abnormal cluster of weak, twiggy growth), are not symptoms that result from EAB. The epicormic sprouts that form as a result of EAB retain their apical dominance (they grow as clusters of vertical shoots) whereas the witches brooms resulting from ash

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<sup>9</sup> Pirone, Pascal P. 1978, *Diseases and Pests of Ornamental Plants*, 5<sup>th</sup> Ed., A Publication of the Brooklyn Botanical Garden, John Wiley & Sons. New York, NY.

yellows exhibit a more random growth pattern. Diagnosing ash yellows is often difficult since the witches brooms do not always occur.

Common insect pests of ash include several borers (ash borer and lilac borer), carpenter worm, brown headed ash sawfly, fall webworm, lilac leaf miner, gall-causing mites, and several species of leaf scale. Although these insects can cause serious damage to ash, they do not typically cause the death of the tree.

## **7.0 Management Options**

The difficulty in identifying management objectives is finding a balance between tree removal and treatment. The ideal would be to treat all ash trees, since this would retain the greatest ecological and social benefits; however, this is not a fiscal possibility. A realistic goal for this plan should result in identifying the trees that have the potential to strike a target, and then prioritizing both the high value trees to retain and the potentially hazardous trees to remove. Overall, compared to the entire population of ash trees within the City, a relatively small number of trees will ultimately be selected for removal or treatment.

In order to prevent the development of hazard trees and to preserve a portion of the native ash tree resource, the City will adopt a balanced or “selective” management approach. This approach should allow us to preserve many of the high value trees that provide significant landscape amenities, while preemptively removing lower quality trees that will eventually pose a hazard to the public. A large number of trees located in the watershed parks, those trees that will never become a hazard to the public, will neither be removed nor treated, and will be allowed to die and decay in place. Dead standing trees or “snags” are important to cavity nesting and bark gleaning birds, and as they decay they contribute to soil enrichment.

Healthy individual ash trees located in both the developed parks and the watershed parks will be evaluated for treatment. Trees found in the developed parks most likely provide significant landscape amenities to the site, including beauty, shade, backdrop and historic value. These will be large diameter trees (>12” dbh) that cannot be easily replaced. High value trees in the watershed parks will be large diameter (> 16” dbh) trees in good to excellent health and with good form and no visible significant defects. These will be trees that are highly visible and adjacent to public areas that are heavily used. These may be part of a forest canopy or individuals scattered within a park-like setting.

Ash trees that will be prioritized for initial removal will be those that are unhealthy and/or defective. Defective trees will be ash trees that are leaning or trees with cracks, splits, butt rot, cavities and/or poor form. These trees are not worth saving as they are likely to die or fail in the foreseeable future from causes other than EAB. Unhealthy trees will be those with greater than 30% canopy decline. PP&R will also inventory and locate any obvious hazard trees regardless of species.

Note that in some cases, PP&R may elect to treat certain trees that will be too costly or too dangerous to remove. It has been reported<sup>10</sup> that, “in some situations, treatment for the remaining service life of the tree will cost no more than the cost of the up-front removal.” This means that the environmental functions and services provided by this tree during the treatment period will be available rather than eliminated, for the same cost.

A small number of the native ash in the watershed parks will be selected for long term (10+ years) treatment in order to preserve their local genome and as a seed source. PP&R staff will determine the size and location of these stands. It is estimated that five to seven stands, each represented by 6-12 trees, will be selected with the goal of preserving a total of approximately 50 trees.

## **7.1 Insecticides**

Although long-term/biological control methods are currently ineffective, researchers have found that there are at least three compounds that are effective for controlling EAB on individual trees<sup>11</sup>. In addition, trees can be treated after they have begun to show signs of an attack. However, the general rule is to only treat trees that show less than 30% canopy decline. Trees with more decline than this may not recover.

The three compounds that are working successfully as treatments are each systemic, meaning they must be taken up (absorbed) by the tree. The insect then feeds on either the conductive tissue (larva) or the leaves (beetle) and ingests the pesticide. Treated trees will usually show some additional decline following treatment, but then recover the next year. In fact, the treatments may result in an overall improvement in the appearance and health of the tree since the pesticide protects it from all insect pests. The three compounds currently approved for use to treat ash for EAB are:

### *Emamectin Benzoate (Tree- Age)*

- Apply with trunk injection – requires drilling 4, 8 or 12 holes in tree base
- Trees less than (<) 8” diameter are too small to inject
- Apply from bud break to mid-June or September (after heat) until leaf drop (late October)
- Works on trees of all sizes, though not tested on trees greater than 25” DBH. Anecdotal evidence suggests that this compound works the best on larger trees
- Is relatively expensive; however one treatment lasts for two (2) years. Some research finds that trees may remain protected for three (3) years
- Application rate can be slow and tedious – requires skilled applicators otherwise tree can be unnecessarily damaged
- Is the most effective compound and can work on trees with up to 50% canopy loss

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<sup>10</sup> Bernick, S. 2010. BMP's for Emerald Ash Borer Insecticide Management of City Trees. Rainbow Tree Care Scientific Advancements - EAB Municipal Initiative

<sup>11</sup> Herms DA, McCullough DG, Smitley DR, Sadof C, Williamson RC, and P.L. Nixon. 2009. Insecticide options for protecting ash trees from emerald ash borer. North Central IPM Center Bulletin. 12pp.

- This compound has a restricted use label and may not be applied by homeowners. It must be administered by licensed professionals.

#### *Imidacloprid (Merit , Xytect)*

- Most effective on trees less than 20" diameter
- Application most effective in Spring (early April to mid May)
- May also be applied in fall (October to November) at 2X standard rate (and 2X the cost)
- Apply as a drench at the base of the tree – apply directly to root collar and flare, or as a soil injection
- It is very toxic to benthic macroinvertebrates – do not use near wetland/rivers/lakes
- Has restriction on lbs/acre annually applied which may mean that not all trees in a given area can be legally treated on an annual basis
- Not as effective as Eamectin benzoate
- This compound may be applied by homeowners

#### *Dinotefuran (Safari)*

- Apply as a basal bark (trunk spray) treatment or soil injection/drench
- Not applicable for trees larger than 12" diameter
- Apply in Spring (early May to mid June)
- It is very water soluble – do not use near wetland/rivers/lakes
- It is rapidly translocated up into the tree – no efficacy beyond the growing season
- Has restriction on lbs/acre annually applied which may mean that not all trees in a given area can be legally treated on an annual basis
- Works well at low to medium insect pressure. Not as effective as Eamectin benzoate.
- This compound may not be applied by homeowners. It must be administered by licensed professionals.

Because the EAB is a relatively recent invader, there is no ability to predict the long term relationship between the EAB, the environment, and the ash tree. We do not know if a balance between predatory insects and the EAB will be established, once the ash population has declined, or if the EAB will maintain high levels of pressure until all ash trees are gone. Treatment with insecticides may be required for many years, or possibly, for the entire lifetime of the tree.

## **7.2 Biological Control**

At the present time, the most promising long-term approach for reducing EAB populations and conserving ash species is through biological control. Biological control (or bio-control) is the practice of importing and releasing natural enemies from a pest's native range to control populations in the area of introduction. Biocontrol has been used for over 100 years in the U.S. and has successfully controlled invasive insect pests such as gypsy moth and ash whitefly as well as introduced weeds including purple loosestrife and mile-a-minute.

The USDA AHPHIS is currently working on a bio-control program<sup>12</sup>. A total of three species of predatory insects have been collected from the EAB's native range (China) and the USDA has begun rearing and releasing these insects at appropriate sites. In addition, researchers have found that a native predatory insect appears to have "learned" or adapted to feeding on the EAB larva. Based on data collected following predatory insect release, the bio-control program has not yet resulted in a reduction in ash mortality. It may take quite a while before predatory insects can effectively control the EAB.

PP&R anticipates working with the Pennsylvania Department of Conservation and Natural Resources (PADCNR) and the US Dept of Agriculture, Animal and Plant Health Inspection Service (APHIS) toward the release of biological control agents in appropriate locations. Should these bio-control agents ultimately become established, ash may return as a component of our future forest.

Based on observations by foresters, a small number of trees (approximately 1%) seem to survive EAB infestation<sup>13</sup>. These trees, if they do survive over the long term, may have some natural resistance to EAB and could provide the genetic material for the next generation of ash trees. If the efficacy of biological controls improves, this too could also provide a long-term benefit. Researchers are not able to predict what the future holds for our native ash species.

### **7.3 Replanting / Canopy Replacement**

Almost all (>99%) ash trees will be killed by EAB unless they are treated. PP&R will perform replanting to replace both street trees and trees in developed parks, as well as to "jump start" the restoration of the forest canopy within the watershed parks where substantial numbers of ash trees are lost. Replanting along streets and in developed parks will utilize the diversity of non-host species as provided on the PP&R "Recommended Street Tree List" (<http://www.fairmountpark.org/streettree.asp>). Replanting in the watershed parks will be done with Philadelphia native trees and shrubs.

Forest openings that occur in our watershed parks are prone to colonization by non-native/invasive tree species such as ailanthus (*Ailanthus altissima*), Norway maple (*Acer platinoides*), black locust (*Robinia pseudoacacia*), devils walking stick (*Aralia elata*), white mulberry (*Morus alba*); shrubs such as Amur honeysuckle (*Lonicera maackii*) and multiflora rose (*Rosa multiflora*); and woody vines such as Asiatic bittersweet (*Celastrus orbiculatus*) and porcelain berry (*Ampelopsis brevipedunculata*). This problem is exacerbated by an over-population of white-tailed deer which selectively consume native plants and avoid the non-native plants. This has resulted in a forest understory that is largely devoid of tree seedlings/saplings (regeneration) or native shrubs, and which is now colonized by invasive

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<sup>12</sup> USDA-APHIS/ARS/FS. 2010. Emerald Ash Borer, *Agrilus planipennis* (Fairmaire), Biological Control Release Guidelines. USDA-APHIS-ARS-FS, Riverdale, Maryland.

<sup>13</sup> Dept of Forests, Parks and Recreation. 2012. Vermont Forest Health - Ash Management Guidance for Forest Managers. [www.Vtforest.com](http://www.Vtforest.com)



plants. The City and the US Dept of Agriculture (APHIS Wildlife Services) have jointly conducted an annual deer cull since 1999 within select watershed parks. The most recent effort (2012) resulted in removal of 134 deer from West Fairmount Park, Pennypack Creek Park and Wissahickon Valley Park.

Despite these efforts, the forest within our major watershed remains largely devoid of suitable regeneration, and the shrub layer is largely missing. Forest understory replanting will require efforts to protect new plantings (fencing, bark protectors, deer repellents) and to eliminate invasive plant species until the new plantings are well established. The use of tree saplings in #5, #7 or #10 containers, which will be at least 6ft in height, will allow the growing tips to remain above deer browse. Tree bark protectors should prevent buck rub.

The PP&R will develop planting plans for the individual watershed parks as canopy gaps are identified. PP&R will coordinate these efforts with community organizations/friends groups such as the Friends of the Wissahickon, Friends of Carpenters Woods, and the Friends of Pennypack Park. These groups have been responsible for significant replanting efforts throughout the natural areas. PP&R will also utilize the resources offered by PADCNr TreeVitalize program which provides funding for replanting with a focus on riparian areas. Since all of the major parks are considered Watershed Parks, their lands should qualify for Tree Vitalize funding. Planting plans will be developed by PP&R staff once canopy gaps are identified.

## **8.0 Wood Utilization**

The City includes four (4) locations (yards) that are utilized for waste wood and brush disposal, storage and recycling. The primary marshalling yard is the 3850 Ford Road Recycling Center, located in West Fairmount Park. This facility receives the greatest quantity of material and includes a Bandit Beast 3850 horizontal grinder. Three satellite yards are found around the City, and are referred to as the District 1 yard (Krewstown); District 4 yard (Wissahickon); and District 7 yard (FDR Park).

Logs, brush and woodchips are generally collected at all four of the yards and then trucked to the centrally located Recycling Center on Ford Rd. The collected material is then ground for the production of mulch or sold as biomass fuel. PP&R has also contracted with a mill in Bucks County on several occasions for the sale of logs. The yards also retain logs for firewood production which is open to the City residents for personal use.

The scale of the tree removals that are anticipated will be well beyond the capacity of the PP&R arborists. The work will be sub-contracted to local companies. The contracts may require that all waste and wood be the sole responsibility of the contractor to dispose or sell as appropriate or, depending on flow and capacity, the Recycling Center may accept all waste for processing and sale.

## 9.0 Cost/Benefit Analysis

It is accepted that trees provide significant social, ecological and economic value to the community and that these values exceed the life cycle cost of planting, maintenance and ultimately, removal. The National Tree Benefit Calculator (<http://www.treebenefits.com/calculator/>) allows a monetary value to be generated for individual trees based on the functional benefits, such as stormwater management, pollutant removal, energy conservation and increased property values. For instance, a 20 inch diameter white ash tree located in a park setting has been calculated to provide \$121.00 of benefits annually.

It is certain that the EAB is coming to Philadelphia and that the catastrophic destruction of our ash tree population is going to cost society financially as well as result in lost functions and economic benefits. The options available for dealing with EAB are relatively straightforward and include, (1) treatment of trees to prevent their death; (2) preemptive removal before infestation; and (3), replanting of replacement trees. A fourth option of “doing nothing” is also available. This option consists of removal of trees as they die. This is invariably more costly than pre-emptive removal since dead trees are more dangerous and difficult to remove than are live trees. This also creates the potential for hazard trees to develop and is thus neither a responsible nor acceptable option.

Current research<sup>14</sup> suggests that pre-emptive removal of all ash trees before they die is the least costly option; however, this option does not account for the loss of the economic benefits and ecological services provided by the urban forest. Researchers have demonstrated that treating ash trees to prevent their death is an effective option, and that treatment provides the greatest net social and ecological services to society. However, treatment is costly, and it is unknown at this time how many years of treatment will be required. Ultimately, the goals and objectives of the City will determine the balance that must be struck between whether trees are preemptively removed or retained through treatment, and how much replanting will be performed.

Currently, the PP&R is proposing to remove all unhealthy/defective ash trees that might pose a hazard. These trees are not worth treating as they are likely to die or fail in the foreseeable future from causes other than EAB. PP&R is also proposing to treat those high value ash trees that provide significant landscape amenity in our Developed or Watershed Parks. These trees will generally be trees larger than 12 inches DBH since larger trees provide greater net benefits. PP&R may also elect to treat certain trees that would otherwise be difficult or dangerous to remove. Replanting is also proposed to replace trees that will be removed from the developed Parks or along the streets.

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<sup>14</sup> VanNatta, A. and R. Hauer. August 2012. Money and Ash Tree Management: Prioritizing Decisions in the Face of EAB. Arborist News. Pp 42-44

Because we do not have an inventory of our ash tree resource, the PP&R is currently estimating that 5000 trees will be removed, 500 trees will be treated, and 2000 trees will be replanted. A cost estimate is provided for each of these efforts in order to demonstrate an “order of magnitude” cost. These are costs that cannot be avoided since the arrival of the EAB is inevitable. Upon completion of an inventory, PP&R will be able to prepare an accurate cost estimate.

### **9.1 Insecticide Treatment**

The cost for treatment with insecticides totals \$738,595 (Table 3) and includes five treatments over a ten-year time period. The insecticide, emamectin benzoate, has been shown to be effective for at least two years, so treatment can be performed every other year. Ideally, half the trees selected for treatment would be treated each year, which would reduce the number of trees treated annually to a manageable quantity (250/year). It is assumed that the City will prepare a Request for Proposal for sub-contracting the work, and that the work will be competitively bid. PP&R does not have the staff to perform the work in-house, but will be able to monitor the treatment efforts. The cost estimate is based on treating 500 trees having a 20” diameter and that the trees will grow in diameter by 2% per year. The year 2013 unit price cost at \$10/diameter inch has been increased by 2% per year to account for inflation. Some large municipal bids have been reported to be as low as \$6/diameter inch<sup>15</sup> which would substantially lower the cost of treatment.

Because the EAB population dynamics are unknown, the cost of treatment may continue after the estimated 10-year period. Biological controls may begin to affect the insect which may reduce the need for treatment, or the reduced ash population may lead to reduced pest pressure. Another effective insecticide, Imidacloprid, is also currently recommended for use on trees 20” diameter or less. This product is less costly to purchase and apply, but must be applied annually. It is likely that it will be recommended for treating a significant portion of the smaller (less than 20” DBH) trees, and may help reduce overall cost to the City for insecticide treatment.

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<sup>15</sup> Hauer, Richard T. August 2012. EAB Economics, Management Approaches and Decision Making. Tree Care Industry Magazine. Pp 14-17

Table 3: Cost of insecticide (emamectin benzoate) treatment of 500 trees over a 10 year period

Year	No. Trees	Total DBH (inches)	Unit Price	Cost
2013	500	10,000	10	\$ 100,000
2014	0	10200	10.2	\$ -
2015	500	10404	10.40	\$ 108,243
2016	0	10612	10.61	\$ -
2017	500	10824	10.82	\$ 117,165
2018	0	11040	11.04	\$ -
2019	500	11261	11.26	\$ 126,824
2020	0	11486	11.49	\$ -
2021	500	11716	11.72	\$ 137,278
2022	0	11950	11.95	\$ -
2023	500	12189	12.19	\$ 148,594

**\$ 738,106**

Assumes 2% annual increase in material and labor cost

Assumes 2% annual increase in tree diameter

## 9.2 Tree Removal

The cost for tree removal totals \$3,923,194 and includes removing a total of 500 trees annually over a ten-year time period. The year 2013 unit price cost at \$32.24/diameter inch is based on the cost from 2012 City tree removal contract and includes the removal of the stump as well. The cost estimate is based on removing trees having a 20" diameter and that the cost of tree removal will increase with inflation at 2% per year. The typical "death curve" or death rate for ash, once the EAB infestation is detected, usually takes between 6-8 years for all trees in a community to be killed or infested. Therefore, the annual rate of tree removal may be compressed, depending on the rate at which the EAB spreads. For instance, the City of Fort Wayne, Indiana which first detected the EAB in 2006 found it necessary to remove over 3,600 trees in 2011 and estimates the loss of 5000 ash trees during 2012. Fort Wayne has reported a lack of in-house labor and a limited number of available contractors to perform tree removals<sup>16</sup>. Once EAB infests the Philadelphia area, there will be competition for the services of tree removal contractors from other municipalities as well as residential property owners. The cost of removal may be impacted by these factors.

<sup>16</sup> Fact Sheet, 2012 - Emerald Ash Borer: City Under Attack, Fort Wayne, Indiana

Table 4: Cost of removing 5000 trees over a 10 year period

Year	No. Trees	Total Diameter (inches)	Unit Price per diameter inch	Cost
2013	500	10,000	32.24	\$ 322,400
2014	500	10,000	32.88	\$ 328,848
2015	500	10,000	33.54	\$ 335,424
2016	500	10,000	34.21	\$ 342,133
2017	500	10,000	34.90	\$ 348,976
2018	500	10,000	35.60	\$ 355,956
2019	500	10,000	36.31	\$ 363,075
2020	500	10,000	37.03	\$ 370,336
2021	500	10,000	37.77	\$ 377,743
2022	500	10,000	38.53	\$ 385,298
2023	500	10,000	39.30	\$ 393,004

**\$ 3,923,194**

Assumes 500 trees removed annually, with avg 20" diameter

Assumes 2% annual cost increase to remove trees

### 9.3 Tree planting

The cost for tree planting totals \$669,279 and includes planting a total of 2000 trees over a ten-year time period. The unit price cost at \$275.00 per tree was obtained from the 2012 City tree planting contract and includes planting, staking and mulching a 2-2.5" caliper B&B tree. The cost also includes one year of maintenance. As previously mentioned in this report, an initiative (Target 11) of the Greenworks Philadelphia Plan<sup>17</sup> is to increase tree coverage in all neighborhoods. Replacing ash trees lost to EAB is consistent with this goal.

<sup>17</sup> Mayor Michael A Nutter. 2009. Greenworks Philadelphia – Executive Summary

Table 5: Cost of planting 2000 replacement trees over a 10 year period

Year	No. Trees	Cost per tree	Cost
2013	200	275	\$ 55,000
2014	200	280.5	\$ 56,100
2015	200	286.11	\$ 57,222
2016	200	291.8	\$ 58,366
2017	200	297.7	\$ 59,533
2018	200	303.6	\$ 60,724
2019	200	309.7	\$ 61,938
2020	200	315.9	\$ 63,177
2021	200	322.2	\$ 64,441
2022	200	328.7	\$ 65,730
2023	200	335.2	\$ 67,044
			<b>\$ 669,279</b>

Assumes 2% annual increase in material and labor cost

## 9.4 Summary

The cost estimates at this time are based solely on best professional judgment and PP&R staff knowledge and assumptions of the City's park properties. A more accurate cost analysis will be performed following completion of the inventory of ash trees within the Developed Parks and Watershed Parks. Data generated from the inventory will allow us to better estimate funding necessary to implement the EAB Management Plan for Philadelphia.

## 10.0 Fiscal Planning

Tree removal and replanting will incur a one-time cost; whereas retaining trees through treatment will require a long-term (10 year+) commitment. City urban foresters will develop plans, contracts and specifications to perform the initial inventory. The results of the inventory will allow the city to identify individual trees for removal, trees to be retained and treated, and recommendations for replanting.

The City identifies spending goals and new initiatives based on a strategic plan and vision. The City of Philadelphia Strategic Plan ([http://www.phila.gov/pdfs/citizensGuideToBudget\\_08.pdf](http://www.phila.gov/pdfs/citizensGuideToBudget_08.pdf)) includes the following mission statement, "To provide quality leadership, partnership and

services to improve public health and safety, economic vitality, education, neighborhood livability and civic engagement.” The Strategic Plan further states that in order to ensure healthy and sustainable communities we must work to create neighborhoods that are vibrant and livable. Specific goals outlined to create vibrant and livable neighborhoods emphasize the need to, “Increase Urban Greening;” “Implement GreenPlan Philadelphia;” and to, “Reinvigorate Fairmount Park.” It is understood that the arrival of the EAB will impact the goals and vision of the strategic plan and will place an additional burden on city resources, including staff and finances. Our effort to forecast the costs should assist the City in planning for the fiscal impact of this pest.

Because we do not have an inventory of our ash resource, the cost to manage EAB over a ten (10) year time frame was based on our best professional judgment. This cost estimate includes the removal of 5000 trees along with a modest amount of both treatment with insecticides and replanting. The suggested approach will result in the removal of hazardous trees (which should be removed regardless), and saving the highest value trees that provide landscape amenities and benefits to society. This possible scenario has been estimated to cost the City \$5,352,778 over a ten-year period, beginning 2013 and ending 2023 (Table 6).

Table 6: Cost of EAB management over a 10 year period

Year	Treatment	Removal	Planting	Annual Total
2013	\$100,000	\$322,400	\$55,000	\$479,413
2014		\$328,848	\$56,100	\$386,962
2015	\$108,243	\$335,425	\$57,222	\$502,905
2016		\$342,133	\$58,366	\$402,516
2017	\$117,166	\$348,976	\$59,534	\$527,693
2018		\$355,956	\$60,724	\$418,698
2019	\$126,824	\$363,075	\$61,939	\$553,857
2020		\$370,336	\$63,178	\$435,534
2021	\$137,279	\$377,743	\$64,441	\$581,484
2022		\$385,298	\$65,730	\$453,050
2023	\$148,595	\$393,004	\$67,045	\$610,666

**\$5,352,778**

Upon the completion of the ash inventory, PP&R will prepare detailed contracts that outline the tree removals, treatments and replanting that will have to be performed to keep our neighborhoods vibrant, livable and safe. It is understood that the cost to implement this plan will be reduced, and worker safety increased, if the plan is implemented prior to arrival of the EAB, and not developed in reaction to its arrival. Ash wood loses structural strength and becomes “brittle” within 1-2 years following the death of the tree. It is far safer to remove a live tree than a dead tree as dead wood is less predictable. Dead ash trees will begin to shed large limbs and leaders within this time period.

It is likely that the EAB has already arrived to Philadelphia, and that ash mortality will begin to occur in the next several years. PP&R will present this management plan to City Council with a request for annual funding for the 10 year period during which it is anticipated that the bulk of the infestation and tree mortality will occur.

## **11.0 Schedule**

PP&R will work toward following a schedule, however this schedule will likely be modified based on conditions as they develop. PP&R intends to work with the PADCNr and USDA APHIS to identify appropriate locations for predatory insect release. This will require that we wait until EAB infestation is identified within the City. The predatory insects will only survive if they have hosts available to feed on. PP&R will provide public outreach to the extent possible at any time during an EAB infestation. A suggested general schedule is as follows:

### **2013**

#### January - February

Meet with City officials and identify funding sources for performing inventory. Identify potential grant funding opportunities and prepare grant applications if available. Identify potential interns/internships.

#### January – December

Continue to perform inspection of dying or dead ash trees

#### April –September

Obtain services of outside contractor or hire interns to perform ash tree inventory within Watershed Parks and Developed Parks. Provide training as required to promote consistent and reliable results while performing field inventory. Provide PP&R oversight and assist with evaluation of certain trees.

#### May – October

Download and compile inventory data and develop appropriate mapping for contract development. Prioritize management activities. Determine the most cost effective method for providing insecticide treatment.

#### June – November

Develop contract specifications for hazard tree removal and ash tree treatment within Watershed Parks and Developed Parks. Based on results of inventory, contracts will be separated into manageable work efforts and by park districts.

#### November –December



Advertise a Request for Proposal (RFP) for providing hazard tree removal and ash tree treatment on City Procurement Department website. Perform pre-bid and contract award meetings.

## **2014**

### January

Award contract to low bidder(s) and initiate project tasks

### January – December

Initiate and perform hazard tree removal.

### April - June

Initial insecticide injection/root drenches on all trees specified to be treated

Identify locations within Watershed Parks that are appropriate for replanting with native trees/shrubs. Identify select stands of healthy ash trees within the Pennypack and Wissahickon Valley Watershed Parks for long term (10+ years) insecticide treatment. It is anticipated that five to seven stands, each represented by 6-12 trees, will be selected.

### December

Submit “planting plans” to PADCNr Tree Vitalize program for review and funding.

## **2015- 2024**

### January

Renew contract or re-bid based on contractor progress, efficiency and quality of service.

### January – December

Continue to perform hazard tree removal. Number of trees requiring removal may increase dramatically depending on pest pressure and death rate. Death rate typically increases exponentially following arrival and establishment of pest.

### April - June

Continue insecticide injection/root drenches on all trees specified to be treated.

Identify locations within Watershed Parks that are appropriate for replanting with native trees/shrubs. Perform re-planting in selected Watershed Park location based on prior year Tree Vitalize funding.

### December

Evaluate contractor progress and revise contracts as appropriate to meet project goals. Submit “planting plans” to PADCNr Tree Vitalize program for review and funding.

## **12.0 Data Collection and Reporting**

Field data is to be collected according to established guidelines and stored electronically in a centralized database. Progress reports will be prepared on a monthly basis. A comprehensive annual report by the end of each year will help document accomplishments. Necessary adjustments based on changing circumstances will be applied at the beginning of each year

Sub- contractors or PP&R trained interns will perform the inventory of the Watershed and Developed Parks. During the inventory period, data will be collected on a daily basis; however, data will likely be downloaded on a weekly basis. Data will be downloaded to a single central storage location. This information will be backed up on a regular basis. Inventory data will be analyzed and separated as appropriate in order to develop contract documents and prioritize tree removals and treatments. Mapping will be prepared that shows locations of all proposed removals and treatment trees.

PP&R will assist the sub contractors or interns during the inventory period in order to ensure consistency among field workers. A report will be prepared annually that documents progress and identifies priorities for the upcoming year. It can be expected that circumstances will change annually, especially once the trajectory of the death rate accelerates.

## **Appendix A**

### **Inventory Protocol Watershed Parks**

Ash wood loses structural strength and becomes “brittle” within 1-2 years following the death of the tree. It is safer to remove a live tree than a dead tree as dead wood is less predictable. Dead ash trees will begin to shed large limbs and leaders within 1-2 years following their death.

Inventory only ash trees that have the potential to strike a target. These are “hazard” trees. Trees that will never strike a target are not considered a hazard.

Inventory any non- ash trees that are considered to be a hazard tree. These are non-ash trees with significant defects that have the potential to strike a target.

A target may include the following:

- Public Roads and Sidewalks
- Multi Use Trails
- Parking Lots and Public Assembly Areas
- Structures (buildings, sheds, benches, fences, etc)
- Utility Poles, Lines and Wires
- Railroad Tracks

Inventory only trees that are greater than (>) 6” diameter at breast height.

Inventory only trees within the 100-buffer that are tall enough to strike the target. It is anticipated that ash trees will be killed in the next few years, before they are able to grow to a height that would reach a target in the immediate future.

Assess the branching habit and lean of the tree. Trees that are leaning away and with branches that cannot drop on a target will eventually fall in the direction of lean. They pose little hazard. Do not inventory these trees.

Once it has been determined that the tree is a hazard (can strike a target), each tree will have to be assessed to determine if it should be removed, felled, or treated.

#### **REMOVE/FELL**

Hazard trees should be REMOVED or FELLED if they possess one or more of the following characteristics:

- They provide little or no landscape benefit.
- They have a canopy that is judged to be declining or unhealthy. Trees with canopies rated as “fair” or “poor” (>30% canopy decline), or which are dying cannot be saved and should be removed.
- They have significant structural defects such as heavy lean, butt/trunk rot, cavities, splits, cracks, included bark, and/or lightning strikes.

PP&R prefers that trees be felled and left in place whenever possible. Assess tree and target and determine potential for felling or if removal is required.

### TREAT

Trees should be TREATED if they are greater than (>) 16” DBH and possess all of the following characteristics:

- They provide a significant landscape amenity meaning that they benefit the landscape, provide shade, backdrop, or historic value. Visualize the site without the tree.
- They have a canopy that is judged to be in “good” to “excellent” (<30% canopy decline) health.
- They do not exhibit any significant structural defects. Small cavities in a healthy tree are not a problem and provide wildlife habitat.

Trees should also be considered for TREATMENT if they pose a risk and are in locations where they are inaccessible or will be extremely difficult or dangerous to remove or fell.

### DOCUMENTATION

Required for all trees that will be REMOVED, FELLED, TREATED, or if you are UNCERTAIN

1. Enter GPS Location and complete required data fields.
2. Install numbered tags sequentially.
3. Paint tree with an “F” (Fell); “R” (Remove) or a “T” (Treat), at 4 ft height on most visible side of tree (facing target).
4. If you are UNCERTAIN of a recommendation, enter GPS location, install numbered tag and paint trees with a white “dot”. These trees will be reviewed by PP&R staff.
5. Identify any hazard tree of any species if encountered during inventory work. Provide all standard information and tag and mark tree for removal or felling.

## **Appendix B**

### **Inventory Protocol Developed Parks**

Ash wood loses structural strength and becomes “brittle” within 1-2 years following the death of the tree. It is safer to remove a live tree than a dead tree as dead wood is less predictable. Dead ash trees will begin to shed large limbs and leaders within 1-2 years following their death.

Inventory all ash trees, regardless of their potential to strike a target. However, use Best Professional Judgment since some trees in wooded portions of developed parks may not need to be inventoried. Refer to Inventory Protocol - Watershed Parks.

Inventory any non- ash trees that are considered to be a hazard tree. These are non-ash trees with significant defects that have the potential to strike a target.

A target may include the following:

- Roads, Sidewalks and Parking Areas
- Structures (buildings, sheds, benches, fences, etc)
- Utility Poles, Lines and Wires

Inventory all ash trees greater than 4” diameter that are not along the street. Inventory all ash trees that are also street trees regardless of size.

Each tree will have to be assessed to determine if it should be removed or treated (saved)

#### **REMOVE**

Trees should be REMOVED if they are greater than (>)4” DBH and possess one or more of the following characteristics:

- They provide little or no landscape benefit.
- They have a canopy that is judged to be are declining or unhealthy. Trees with canopies rated as “fair” or “poor” (>30% canopy decline), or which are dying cannot be saved and should be removed.
- They have significant structural defects such as heavy lean, butt/trunk rot, cavities, splits, cracks, included bark, and/or lightning strikes.

#### **TREAT**

Trees should be TREATED if they are greater than (>) 12” DBH and possess all of the following characteristics:

- They provide a significant landscape amenity meaning that they benefit the landscape, provide shade, backdrop, or historic value. Visualize the site without the tree.
- They have a canopy that is judged to be in “good” to “excellent” (<30% canopy decline) health.
- They do not exhibit any structural defects. Small cavities in a healthy tree are not a problem and provide wildlife habitat.

Trees should also be considered for TREATMENT if they are in locations where they are inaccessible or will be extremely difficult or dangerous to remove.

## **DOCUMENTATION**

Required for all ash trees within developed parks

1. Enter GPS Location and complete required data fields.
2. Install numbered tags sequentially.
3. Paint tree with an “R” (Remove) or a “T” (Treat), at 4 ft height on most visible side of tree (facing target).
4. If you are UNCERTAIN of a recommendation, enter GPS location, install numbered tag and paint trees with a “dot”. These trees will be reviewed by PP&R staff.
5. Identify any hazard tree of any species if encountered during inventory work. Provide all standard information and tag and mark tree for removal.