

Emerald Ash Borer
Management Plan for
Boulder County
Managed Ash Trees



August 25, 2015



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we provide the best in public service.”

-Boulder County Mission Statement-

Boulder County
Emerald Ash Borer Management Plan for
Boulder County Managed Ash Trees
August 2015

This management plan provides guidance to Boulder County staff on the approved management options for county-managed ash trees in response to emerald ash borer.

The draft management plan was presented to the public on May 19, 2015 with a public open house on May 28, 2015 and a two-week public comment period from August 10-21, 2015. The final plan was presented to the Board of County Commissioners at a Public Hearing on August 25, 2015 at 9:00 a.m.

For questions about this document or to provide comments, contact Boulder County Parks & Open Space at 5201 St. Vrain Road, Longmont, CO 80503; call 303-678-6200; or email POSinfo@bouldercounty.org.

Boulder County

ADOPTED:


Chair, Board of County Commissioners

8/25/15
Date

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Definitions

Emerald Ash Borer (EAB): a metallic-green of beetle (*Agrilus planipennis*) of Asian origin accidentally introduced into the United States that has destructive larva that bores into the wood of ash trees (of the *Fraxinus* genus) and white fringetree (*Chionanthus virginicus*) eventually causing death of the tree.

Fell: The act of cutting down a tree.

Host Species: all native North American ash trees of the *Fraxinus* genus, and white fringetree (*Chionanthus virginicus*).

Non-host species: all tree species other than ash trees (*Fraxinus* genus) and white fringetree (*Chionanthus virginicus*).

Diameter at breast height (DBH): a common tree metric, measured at the trunk of the tree 4.5' above the ground, used for comparing tree growth, volume, etc.

Fraxinus: A genus of the olive family, including Black, green and white ash, and utilized for its broad adaptability to varying moisture regimes and soil types in landscapes throughout the Front Range.

Survey Grids: A 1x1mile survey grid system, defined by the United States Department of Agriculture, Animal and Plant Health inspection Service (USDA,APHIS) after the initial emerald ash borer detection in 2013, that extends across the front range and plains regions of Colorado and is universally used as a mapping tool for the urban forestry community of Colorado.

Matrix Score: a composite score used to define an individual trees removal priority, determined by the tree health, DBH, tree defects, tree form, proximity to surface water, presence of irrigation, location, presence of overhead utilities, and the energy factor.

Passive Recreation: Outdoor recreational activities, such as nature observation, hiking, mountain biking, or rock climbing; requires a minimum of facilities or development and that have minimal environmental impact on the recreational site.

Right-of-way (ROW): Publicly held land dedicated to public usage for roads, sidewalks, trails, and/or utilities. The width is defined by deed or historic usage.

Quarantine Zone: A boundary of containment defined by the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA, APHIS) for the purpose of restricting the movement of materials that may harbor emerald ash borer and increase the area of infestation.

Unincorporated Boulder County: land located outside the incorporated areas of cities and towns and is under regulatory jurisdiction of Boulder County.

List of Acronyms

<u>Acronym of Abbreviation</u>	<u>Full Phrase</u>
APHIS	Animal and Plant Health Inspection Service
AS	Boulder County Department of Administrative Services
CDA.....	Colorado Department of Agriculture
DBH.....	diameter at breast height
EAB	emerald ash borer
BMP.....	best management practice
BOCC	Board of County Commissioners
GIS.....	geographic information system
HOA	homeowner’s association
HHS	Boulder County Department of Health and Human Services
POS.....	Boulder County Parks and Open Space Department
ROW.....	right-of-way
USDA	United States Department of Agriculture

1. Purpose

Ash trees are not native to Boulder County, but have played a vital role in the establishment of the urban forest. Due to ash species' broad adaptability to varying soils, moisture regimes, and the great shade potential ash trees have been widely planted throughout Boulder County communities.

In 2013, the emerald ash borer (*Agrilus plannipennis*, hereinafter EAB), a small metallic-green beetle, was discovered in the City of Boulder constituting its western-most detection in the United States. Experiences from the Great Lakes States that have dealt with EAB for more than a decade have proven that EAB has the potential to kill all ash trees and forever change the landscape. EAB is widely considered to be the most destructive forest pest in North America, threatening all native ash trees of the *Fraxinus* genus.

The Boulder County Emerald Ash Borer Management Plan will serve as a framework to proactively manage ash trees by reducing the overall ash population throughout county owned and/or managed lands, protecting select high-value ash trees, replanting trees in high public-use areas, and maintaining public safety.

2. Applicability

This plan is only applicable to ash trees located within county owned and/or maintained properties and ROWs managed by the following departments: Administrative Services, Housing and Human Services, Parks and Open Space and Transportation. This plan does not apply to ash trees located on federal, state, municipal and private property within Boulder County.

3. Administration and Advisory

3.1 Plan Management and Implementation

The Boulder County Emerald Ash Borer Management Plan has been adopted by the BOCC after a public hearing process. The Boulder County Emerald Ash Borer Coordinator (EAB Coordinator) will be responsible for developing, implementing, managing and reviewing the Boulder County Emerald Ash Borer Management Plan, with advisement from the BOCC and Boulder County EAB Team. Landscape managers from each department will work with the EAB Coordinator to develop and implement annual budgets and plans for tree removal, stump grinding and tree replacement. Department communication staff and the EAB Coordinator will develop an EAB Communication Plan to define the tools and timeline for public communication.

3.2 Boulder County Emerald Ash Borer Team

The Boulder County EAB Team was created in response to the first detection of EAB in the City of Boulder with the mission to develop a county-wide plan for managing Boulder County's publicly owned and/or managed ash trees and to provide education and outreach to unincorporated Boulder County residents. EAB Team staff meets on a monthly basis to discuss general EAB news in Colorado, communications, project development and management, and public education and outreach. The EAB Team is composed of staff from the following Boulder County departments: AS, BOCC's Office, HHS, Land Use, POS (including the Colorado State University Extension Office) and Transportation.

4. Background

4.1 EAB in North America

EAB, a non-native invasive insect from Asia was first discovered around Detroit, Michigan and Windsor, Ontario in the summer of 2002 and has rapidly spread throughout the eastern half of the United States and Canada. Although EAB was detected for the first time in 2002, scientists suspect EAB was introduced to the United States in 1997. Most likely as a result of human transport of infested wood, EAB has now been detected in 26 states and two Canadian Provinces (see [Appendix 1](#)).

Scientists and forestry practitioners initially worked on eradication efforts that proved unsuccessful. Even two decades since the initial infestation in the North America, detecting EAB is still a difficult task. Low populations of EAB can persist in an area for two to three years before the trees begin to show any visual cues. Current BMPs focus on efforts to keep EAB populations low, reduce the spread of EAB to new areas, and extending the time for management.

4.2 EAB in Boulder, CO

The City of Boulder’s Forestry Division positively identified EAB in September 2013 and this incidence marked the western-most extent of the EAB infestation in North America. Currently, the only sites in Colorado where EAB has been detected is within the city limits of Boulder.

As of November 12, 2013, Boulder County is under a State of Colorado quarantine restricting the movement of all regulated material from the county, including ash logs, lumber, scion wood, nursery stock, bud stock, chips and mulch (including composted chips), stumps, roots and branches. Additionally, all non-conifer firewood is listed as restricted material, as it is difficult to determine the species of firewood with or without the bark. No restricted material may leave the quarantine area without a compliance agreement with the Colorado Department of Agriculture (CDA). Approved wood disposal sites are available within the Boulder County limits as well as two additional sites located in western Weld County and one located in northern Jefferson County (see [Appendix 2](#)).

The City of Boulder’s Forestry Division and partner agencies have continually worked on detection methods through visual surveys, traps and destructive sampling to determine and monitor the extent of the EAB infestation. Detection has proven to be difficult throughout North America, but local ash trees provide additional difficulties with slower response times to wounding from EAB larvae feeding. Typical EAB detection lags the initial infestation of a tree by two-to four years. [Appendix 3](#) shows the current known extent of the EAB infestation in Colorado. Additional areas of detection will pop-up throughout Boulder County and the Front Range as the infestation continues.

4.3 EAB Lifecycle

EAB is in a class of wood-boring insects that feeds upon the vascular system of ash trees (in the *Fraxinus* genus) and white fringetree (*Chionanthus virginicus*) disrupting all water and nutrient flows throughout the tree. White fringetree do not play a significant role in the urban forests of the Front Range, but are locally sold in the nursery trade. At lower larval densities ash trees have time to respond to wounding by the creation of callus tissue that eventually covers the wounds. As local populations enter the fourth year post-establishment, EAB larval densities build high enough to cause rapid mortality of ash trees, now widely referred to as the ‘death curve’.

The typical lifecycle of EAB (see [Appendix 4](#)) is complete within one year, but is dependent upon local climate and weather patterns. The City of Boulder has observed a typical one-year lifecycle with adults emerging in early May and feeding upon ash leaves for about one month. Impregnated females will lay 30 to 60 eggs within the bark crevices of ash trees and die shortly afterward. Tiny larvae will emerge from the eggs and chew their way into the phloem (see Figure 1) where they will feed until fall. The larvae will prepare for winter dormancy by feeding deeper into the sapwood of the tree to form a pupal chamber for the winter slumber that provides additional protection from the cold winter temperatures.

Spring larval growth continues as daytime temperatures rise above 50°F with beetle emergence beginning in early May with the peak around late June. Adult beetles emerge from D-shaped exit holes (see Figure 2) and continue the cycle all over again.



FIGURE 1: EAB larva and its serpentine feeding galleries.



FIGURE 2: EAB larva emerging from a characteristic D-shaped exit hole.

4.4 Factors Influencing Population Growth

Factors that influence beetle development and population growth include: availability of sapwood for feeding, winter low temperatures and human intervention. The Front Range of Colorado has the benefit of ash-free zones between the urban cores with minimal naturalized communities other than along irrigation ditches and stream corridors. This will limit the natural expansion of EAB populations. In the native range of Southeast Asia EAB is a benign insect that does not reach the destructive levels observed in North America. Asian ash trees benefit from having natural resistance and biological control organism to keep EAB populations low.

In 2014, research by the United States Forest Service, Northern Research Station studied the cold tolerance of EAB¹ and determined that sustained temperatures below -30°F are required to have substantial impacts on EAB population growth. Boulder County rarely, if ever has temperatures that low.

The largest impacts on the expansion of the EAB population in North America occur through strategic management tactics. Forest managers perform periodic surveys and trapping to detect EAB infested trees, remove infested trees during the non-flight season (typically September – May), perform insecticidal treatments on high-value ash trees in positive survey grids and use biological control agents to slow the expansion of EAB.

The USDA has tested and developed protocols for the introduction of three biological control insects to help slow the population increase of EAB. *Oobius agrili*, *Spathius agrili* and *Tetrastichus plannipennisi*, are insects known to exist in EAB’s native range and parasitize either the EAB eggs or larvae. These tiny insects vary a bit in their efficacy, but complete multiple lifecycles in one year’s time, helping to reduce EAB either during the egg or larval phase of development.

4.5 The Colorado Emerald Ash Borer Response Team

The Colorado Emerald Ash Borer Response Team is a multi-agency collaboration headed by APHIS and the CDA, with the following partner agencies: the Colorado State Forest Service, Colorado State University, University of Colorado-Boulder, and many of the counties and municipalities along the Front Range of Colorado. The group has worked together since the first EAB detection in Colorado to identify the extent of the initial EAB detection and provide a unified message for outreach and education for EAB management on the Front Range. Meetings occur on a monthly basis to discuss general program updates, media relations, outreach, visual inspection, branch sampling, the national survey efforts (led by APHIS), biological control, regulatory compliance and monitoring, and wood utilization efforts.

5. Boulder County Ash Resources

5.1 Tree Survey

Joint survey efforts between Boulder County departments identified approximately 1,500 county-managed ash trees located within county ROWs and other properties (see Table 1). Roughly half of these ash trees are growing within the county road ROWs with the remaining half located at county facilities, Parks and Open Space properties and on residential properties managed by the Boulder County Housing Authority.

Department	Quantity
Administrative Services	217
Housing and Human Services	70
Parks and Open Space	511
Transportation	710

TABLE 1: Ash Distribution by Department

The following attributes and site characteristics were collected for each ash tree: DBH, tree height, canopy spread, damage risk, overhead utility presence, irrigation presence, geographic coordinates (latitude and longitude), site location (responsible department), and the matrix score (more detail provided in section 5.3).

¹ Venette, R. et.al., Cold Snap Is No Snow Day for Emerald Ash Borer Management, Jan. 1, 2014, http://www.nrs.fs.fed.us/disturbance/invasive_species/eab/control_management/cold_hardiness/bp-EAB-and-extreme-cold.pdf

5.2 Tree Size Distribution

Boulder County’s ash population (see Figure 2) is heavily weighted in the smaller size range with trees in the 1-7 inch DBH size class accounting for 40 percent of the total population. An analysis of the size classes from an individual department level shows varied size ranges. Cumulatively, ash trees in the 1-7 and 8-16 inch DBH size classes located on Administrative Services and Parks and Open Space properties are generally young, with respective populations accounting for 91% and 74% (see Table 2). The Housing and Human Services and Transportation Departments have middle-aged ash stands with the majority of trees in the 8-15 and 16-30 inch DBH size classes, 87% and 63% respectively (see table 2).

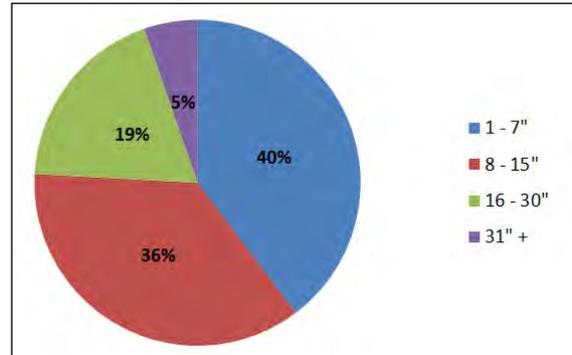


FIGURE 2: Tree Size Distribution for All Boulder County Ash Trees

The size of ash trees is typically dependent upon the site characteristics. Larger county-managed ash trees are located in areas with irrigation, either near county facilities or along ROWs of subdivisions in unincorporated Boulder County. Very few of the ash trees would have achieved their large size without supplemental water.

Department	Size Classes (DBH)			
	1-7"	8-15"	16-30"	31" +
Administrative Services	59%	32%	8%	1%
Housing and Human Services	7%	53%	34%	6%
Parks and Open Space	49%	25%	20%	6%
Transportation	31%	43%	20%	6%

Table 2: Tree size distribution by department

5.3 Matrix Score

The ‘matrix score’ (see [Appendix 5](#)) is a composite score developed by the EAB Coordinator to systematically evaluate individual ash trees along with the related site characteristics to determine the removal priority and possibility of insecticidal treatment. Criteria for the ‘matrix score’ includes: tree health, tree defects, tree form, tree size, location, energy factor, overhead utilities, the proximity to surface water, irrigation and proximity to an infested survey grid. The following list describes the matrix score criteria with an explanation of the associated ratings.

- Tree Health: Trees that are declining from EAB or other reasons will be rated lower than healthy trees.
- Tree Defects: Defects are defined as any damage that will prevent the tree from transporting nutrients throughout the tree including: frost cracks, cankers, branch tear-outs, mower damage, etc. Trees with significant defects will be rated lower.
- Tree Form: Ash trees with a single dominant leader and equally spaced scaffold branches will be higher rated trees. Trees with co-dominant leaders, trees with unbalanced canopies, or trees with stem girdling roots will be rated lower.
- Tree size: When considering pesticide treatments, trees between 10-20 inch DBH are the optimal range for treatment. Smaller trees should be replaced and larger trees may be approaching the full maturity. Trees in the 10-20 inch DBH size range will be rated higher.
- Location: Refers to a trees proximity to buildings and the potential for structural damage to the tree or building as a result of the close proximity.
- Energy factor: Refers to a tree’s ability to provide shade or wind-speed reductions to an adjacent building or parking lot. Trees that are near buildings or parking lots and provide significant shade will be rated higher.
- Overhead Utilities: Trees that are located below overhead utilities will mostly likely be pruned for clearance by the local power utility, reducing the vitality of the tree that may cause future harm to the tree.

-
- Proximity to surface water: Trees located within a distance where leaves can blow into surface water will be rated lower. Current pesticide research is inconclusive on the full environmental effects on aquatic inhabitants.
 - Irrigation: Trees on the Front Range may require additional irrigation to fully utilize pesticides, if applied, and will generally have higher vitality with irrigation. Irrigated trees will be rated higher.
 - Proximity to Infested Survey Grids: EAB typically lays eggs near the tree of emergence, effecting trees in close proximity to infested trees first. Ash trees located less than 5 miles away from an infested grid will be rated lower than trees further away from infested grids.

Possible matrix scores range from 10 to 40 points with scores greater than 33 defining higher-value trees. Trees with a low 'matrix score' are lower-value and will be selected first for removal. The 'matrix score' is the primary factor for determining the tree removal priority, but the scores and related tree removal decisions are subjective.

5.4 Maintenance Practices

Current ash tree maintenance practices vary based on the location of the trees. Ash trees growing on public high-use sites are highly managed by county staff with structural and clearance pruning, seasonal irrigation, annual hazard mitigation, and fertilizer/pesticide treatments as needed. Conversely, ash trees that were established by windblown seeds growing on county open-space and along ROWs have little to no routine maintenance. Clearance pruning and hazard mitigation for public safety and traffic flow within ROWs and trail corridors are the only triggers for maintenance of those trees.

Ash trees located within the ROWs of subdivisions within unincorporated Boulder County were typically planted by adjacent property owners or HOAs. Maintenance levels for this group of ash trees varies based on the HOA or adjacent property owner's involvement. Similar to ash trees growing outside of subdivisions within county ROWs Boulder County may only provide right-of-way clearance when public safety or traffic flow is an issue.

6. EAB Response

EAB plans can take many forms and vary by management agency. Local funding, ash tree population dynamics, the date of first detection versus initial infestation and local politics weigh into the decisions for management tactics. The Boulder County Emerald Ash Borer Management Plan provides a strategy to minimize the growth and spread of EAB that extends the management timeline and effectively manages the impact of EAB on county owned and/or managed properties. The plan also aligns with current landscape maintenance practices for the involved county departments.

6.1 EAB Detection Surveys

Emerald ash borer (EAB) detection continues to be a difficult task. Since the introduction of EAB in the mid 1990's, scientists and practitioners have struggled to define the best methods for detection. The current best method for detection was developed by the Canadian Forest Service in 2010 and is simply called branch sampling. The process requires the removal of two live branches (2-6" diameter) from the mid, south side of the crown of an open grown ash tree. The bark is removed from the branches, typically with the use of a draw knife. The practitioner looks for any visible signs of EAB: serpentine feeding galleries, D-shaped exit holes or EAB in the larval or beetle form. Branch sampling is time and labor intensive, but is still the best method for detection.

Boulder County has partnered with the Colorado State Forest Service on a variety of detection methods and is seeking a better method for the Front Range, since the responses in local ash trees to EAB attacks are having varied effects, as compared to observations in Eastern and Midwestern states. Infested Front Range ash trees many times lack vertical bark splits and epicormic shoots that are indicative of an EAB infested tree; rather the ash trees tend to show signs of general decline from the top-down.

Boulder County staff will conduct visual surveys of county-managed ash trees either from the ground or by aerial methods during the non-flight season (typically September through April) of EAB. Staff will conduct branch sampling on trees that are determined to be suspect for EAB. Staff will also conduct occasional surveys during the growing season looking for EAB suspect ash trees.

Private ash trees are useful indicators of new EAB infestations as well. For the purpose of identifying possible new EAB detection grids, the EAB Coordinator or Boulder County staff may request permission to enter private property to inspect a private ash tree, but general requests for inspections inside of known infested grids will be referred to a private tree service for consultation.

6.2 Ash Tree Prioritization and Removals

As mentioned in [Section 5.3](#), Boulder County staff will employ the matrix score table to prioritize ash tree removals during the ash tree management process. Trees that are in poor health, planted in poor locations with limited rooting volume, planted underneath aerial utility lines, have poor form, and/or are located within positive survey grids will score lower points and be higher priorities for removal. Ash trees that are of higher value based on the matrix score will be lower priority for removal, but may be selected within a removal project sooner than later based on a nearby ash tree removal projects. [Section 6.6.1](#) details the situations that may be appropriate for insecticidal treatment of ash trees. The EAB Communications Plan will define the appropriate tools and timeline for public notifications.

6.3 Stump Removals

Not all ash trees that are removed as part of the Emerald Ash Borer Management Plan will have stumps removed. Stump removal will follow current department defined maintenance practices. Stumps located on Housing and Human Services, Administrative Services and Parks and Open Space properties will be removed at the discretion of each county department landscape manager or department directors. Stumps that are located within county ROWs will not be ground unless they pose maintenance problems or are public safety hazards. Homeowner's Associations and adjacent property owners have the option to pay for stump grinding services for an adjacent stump.

6.4 Wood Disposal and Utilization

Wood disposal and utilization are large components in dealing with EAB. Eastern North American communities that have dealt with EAB experienced wide-spread tree mortality in a short duration of time, causing mass build-ups of woody material. A common practice for handling the increased wood supply is the creation of marshalling or sorting yards; a large industrial space used for the sorting and processing of woody material. Per Boulder County Zero Waste goals, composting of woody material is the preferred method for wood disposal that keeps wood out of the landfills. For the immediate tree removal and wood disposal needs of this plan, Boulder County will access current sites within the EAB quarantine for composting (see Appendix 3).

Boulder County's mountain forest and urban forestry operations have the joint need for a location to store, sort and process wood. Boulder County may seek a site for a future sort yard to manage the ash wood from EAB and the wood from mountain forest operations. A sorting yard will enable Boulder County to repurpose raw timber and chunk wood, and process the non-marketable wood into wood chips for composting. Boulder County is also seeking methods for urban wood utilization in areas of urban wood milling and furniture production.

6.5 Replacement Tree Planting

Trees are an important natural resource that provide shade, reduce wind speeds, filter the air, help sequester rainwater, prevent erosion, and provide character to communities. Although planting replacement trees will not match the benefits of a well-established tree, Boulder County is committed to helping revive the character and benefits of shade trees on high-use public properties.

Boulder County does not have a complete inventory of county-managed trees, but ash account for approximately 15 percent of the urban trees in Front Range communities. The replacement trees will be composed of a greater diversity of trees to prevent such widespread tree losses in the future as new invasive species or pathogens are discovered. The Front Range Tree Recommendation List² will serve as a guide for tree selection and diversity for replacing ash trees on Boulder County properties.

² <http://www.ext.colostate.edu/pubs/garden/treereclist.pdf>

The plan seeks to plant replacement trees following current departmental landscaping practices. Tree planting funding for the Administrative Services Department seeks to replace the ash trees at a ratio of 1:1, helping to reestablish the lost shade trees at county government buildings, such as the Clerk and Records Office and the North Broadway Complex. Both facilities observe heavy daily traffic and can benefit from the replaced tree canopy.

The Housing and Human Services properties affected by this plan are home to many Boulder County residents. The loss of the ash trees to these homes will change the character of the properties, may reduce the shading from the summer sun and be a cause of higher utility bills for cooling. Tree planting funding for the Housing and Human Services Department seeks to replace the ash trees at a ratio of 1:1.

POS manages a wide variety of properties that have ash trees upon them, from properties like the high-use Boulder County Fairgrounds, to agricultural properties and passive recreation areas, like Twin Lakes. Ash trees removed from agricultural properties and passive recreation properties will not be replaced. Many of those ash trees were established via wind-blown seed and may have surrounding trees that will fill the voids.

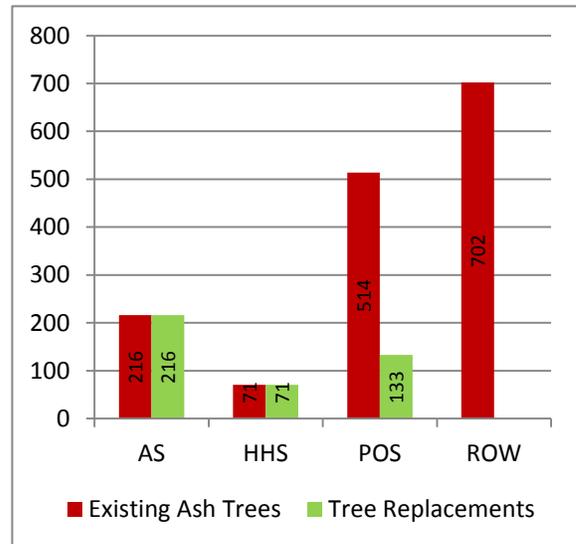


FIGURE 3: Existing Ash Trees vs. Replacement Trees

Ash trees located within Boulder County ROWs account for roughly half the population of county-managed ash trees. These ash trees were either planted by adjacent property owners, homeowner’s associations or established from wind-blown seeds. The Transportation Department will not replant trees in the ROWs, rather it uses its funding to provide safe, unobstructed roadways for access throughout the county. However, the Transportation Department will permit adjacent property owners and HOAs to replant in ROWs designated as Residential Collector and Local or Local(secondary) under the following conditions:

- The new tree is replanted behind the curb line for urban road sections.
- The new tree is replanted at least 10 feet from the edge of the traveled way for rural road sections.
- The location and species of the replanted tree is approved by Boulder County Transportation Department staff prior to placement.
- The person or entity replanting the tree assumes full responsibility for maintenance of the new tree.

6.6 Insecticide Options for EAB Management

Insecticide options for EAB vary greatly in cost, efficacy of the product, the timespan for protection and the environmental effects associated with the use of the chemical. Based on current research, insecticidal treatments are the only method to effectively preserve high-value ash trees.

Boulder County’s current ash tree maintenance practices do not warrant the widespread use of insecticides to preserve county-managed ash trees. Select insecticides may be used on a case-by-case basis to preserve high-value ash trees, but will be based on a joint decision by the BOCC, individual department directors and the EAB Coordinator. Adjacent property owners or homeowner’s associations may choose to pay the treatment cost to preserve ash trees, but must follow the guidelines in section [6.6.1](#).

6.6.1 Guidelines for Ash Tree Treatment in the ROWs By HOAs or Adjacent Property Owners

Homeowner’s Associations or property owners have the option to pay the cost to preserve an adjacent ash tree located in county ROWs in lieu of tree removal by Boulder County. All interested parties must adhere to the protocol below.

- Upon notification for ash tree removal the interested party seeking to preserve ash trees located in the county ROW must contact the Boulder County EAB Coordinator within 30 days of notice of their intent to pursue tree preservation. The EAB Coordinator will help determine if the tree is a suitable candidate for

treatment, based on tree health, vigor, percent of crown dieback (if known to be infested with EAB) and the location. Irrigation is preferable for adequate translocation of the insecticide throughout the tree and protection from EAB. The EAB Coordinator or the Transportation Department Director can choose to deny insecticidal treatment on a tree located in the ROW for any reason.

- The interested party will be required to sign a permit stating they are taking responsibility for all costs associated with tree preservation and future tree removal. The Transportation Department or the EAB Coordinator can order the removal of a treated tree if a tree is found to harbor EAB, the interested party fails to provide routine insecticidal treatment at the labeled frequency, or for any reason that may cause the tree to be considered a hazard to public safety or county facilities.
- The interested party will be required to hire a Boulder County tree service contractor to perform the insecticidal treatment at the labeled frequency and deliver a copy of the treatment record for proof of treatment. Approved insecticides include trunk injections of Tree-age (*Emamectin benzoate*) or TreeAzin (*Azadirachtin*). Both insecticides are labeled for two-years of protection from emerald ash borer. Treatment frequencies will reflect label changes for both insecticides. Foliar sprays, trunk sprays, soil drenches and all methods other than trunk injection are prohibited forms of application for ash trees located within county ROWs. A list of Boulder County tree service contractors can be obtained from the EAB Coordinator. All treatment records shall be submitted within 30 days post treatment to the EAB Coordinator. Per the contract, ash trees that miss a treatment cycle will be added to the annual tree removal list with all associated tree removal costs billed to the contracted party.

7. Communications Plan

The Emerald Ash Borer Management Plan will incorporate a communications plan specific to the county's mitigation efforts. The communications plan will be used to inform and educate both targeted audiences and the general public about how the county's management plan will be incorporated and followed through from start to finish. Specific outreach strategies, tactics, and messaging will be employed at various times throughout each year of the management plan. The communication plan is a living, evolving document that will be adjusted if intended audiences are not receiving and understanding messages regarding the county's plans to mitigate the spread of EAB. The plan will utilize both traditional (news releases & advertisements) and emerging mediums (websites & social media) throughout its duration. All communications channels will be evaluated for their effectiveness at spreading information throughout the county to intended audiences. The communications plan will also track each message's dissemination to determine if information is being received and understood, and to determine if adjustments need to be made in order to reach residents and visitors. The communications plan will be jointly managed by communications specialists from the Parks and Open Space and Transportation departments. Members of the BOCC's communications team will also be included at various times throughout the life of the management plan. The county's communication plan will also seek to incorporate and include plans that have been created by local cities and towns and the State of Colorado's own efforts to ensure message consistency and to help spread information across multiple mediums and through established channels.

8. Public Involvement

During the process of developing the Emerald Ash Borer Management Plan an initial concept for management was presented during a public hearing to the BOCC on May 19, 2015, followed by an open house on May 28. Twenty Boulder County residents attended the open house where details of the management plan were discussed and attendees asked questions about public and private tree management. Three attendees provided comments at the open house.

A second draft of the plan was offered to the public for comment on August 10, 2015. A press release was distributed to local media with coverage in the Longmont Times-Call and Colorado Public Radio. An additional six comments were gathered during the two week period following the release of the second draft.

The following is a categorized list of comments with responses. See [Appendix 6](#) for the full comments.

- Requests to preserve existing ash trees in three specific locations in Boulder County. (3 comments)

- Two of the three comments address locations that are outside the scope of this management plan; trees managed by the cities of Longmont and Boulder.
- Ash trees at the third location are at the Iris Ballfields, adjacent to the North Broadway Complex. Administrative Services staff recommends the removal of the ash trees, despite the requests from the North Boulder Little League.
- Preserve all public ash trees with the use of insecticide treatments and encourage all property owners to preserve their trees. (1 comment)
 - Preservation of all county-managed trees is possible, but requires injections every other year for the life of the trees. Based on records from the Great Lakes States, EAB will persist as long as ash trees remain in the landscape.
 - As far as spreading a message of treatment for all private property owners, the decisions about removal versus treatment is an emotional and subjective decision that is addressed on a case-by-case basis. The plan addresses private property issues by funding an EAB outreach and education staff person to help property owners sort through the decision making process.
- Let the all ash trees naturally die without intervention. Removal of any trees will disrupt wildlife behavior and reduce habitat. (3 comments)
 - Boulder County will allow ash trees to naturally die in open space areas where tree failure has no potential for damaging county facilities or causing harm to open space users. These trees will provide habitat for local bird and insect populations. However, allowing ash trees that are within the ROW or near county facilities to stand that have died from EAB is a negligent proposal. Observations from the Great Lake States has shown that ash trees that have died from EAB have a greater risk for sudden failure potentially causing harm to public and private property, and harm to pedestrians. Research by the Davey Resource Group³, a private urban forestry consultant, reported reduced structural stability at the base and branch unions on trees during independent research. Although controversial, pre-emptive removal of living ash trees is the preferable method for reducing the potential risks associated with ash trees dying from EAB.
- The EAB management agencies are not effectively tracking public reports of EAB sightings or using the sightings to predict future EAB detections. (1 comment)
 - Public reports of EAB sightings are tracked both at the state level and by the management agency in the reporting areas. All agencies involved in EAB management are eager to locate early EAB detections.
 - APHIS and the CSFS are actively monitoring a variety of EAB traps within Boulder County for the purpose of defining EAB detections.
- The plan does not address private ash trees or provide financial assistance for private ash tree management. (1 comment)
 - The purpose of this plan is to address management tactics for Boulder County managed ash trees. Addressing private property ash tree management is beyond the scope of this plan.
 - However, the plan does mention assessing the need for a future marshalling yard or sort yard for ash wood disposal for unincorporated Boulder County residents.
- Boulder County should take an integrated approach to EAB management by preserving high-value ash trees with Imidacloprid soil-drench applications. Imidacloprid soil-drench applications are inexpensive and much cheaper than tree removal. (1 comment)
 - It is true that Imidacloprid soil-drench is inexpensive and effective, but the chemical is in the class of neonicotinoids that is a contributing factor to colony collapse disorder (CCD) in honeybees. The chemical industry as a whole is diverting products to injectable formulations that are fully contained in the target tree and has little to no risk for drift to ponds, streams, and non-target plants. This plan proposes the use of injectable non-neonicotinoids for instances where treatment is considered.

³ Persad, Anand B., et. al. Effects of Emerald Ash Borer Infestation on the Structure and Material Properties of Ash Trees. *Arboriculture & Urban Forestry* 2013. 39(1): 11-16.

9. Summary of Costs

The Emerald Ash Borer Management Plan will encompass a variety of tasks implemented by county staff and tree service contractors starting in 2016, with an approximate completion date in 2023. Although four county departments are involved in the management of ash trees, all ash trees will be uniformly assessed and prioritized for removal and replacement. The summary of costs for the plan include contractor tree removal costs, traffic control signage contracting, tree removal and disposal by county staff, and tree replacement costs. The plan utilizes county staff where skillsets and equipment are appropriate for the job and will utilize tree service contractors for larger or technical tree removals.

9.1 The Division of Tree Work

HHS will contract all tree felling, stump grinding and tree replacement work. AS and POS have skilled staff with equipment capable of felling trees that are generally 15 inches DBH and smaller. Large and technical trees will be felled by tree service contractors. POS staff will perform all stump grinding operations, while AS will contract stump grinding services. The Transportation Department will contract most of the tree felling and stump grinding operations.

9.2 Implementation and Annual Budget Requests

Generally speaking, the Emerald Ash Borer Management Plan will be implemented beginning in 2016. However, many of the buildings and grounds managed by AS are located within positive survey grids that required prompt action. As approved by the BOCC starting in 2015 AS was allotted \$15,000 per year, for three years to remove and replace all ash trees on department properties. Table 3 reflects the remaining two years of EAB allotment for AS. Table 4 reflects the annual budget request for years 2018-2023. By 2018 AS will have removed and replaced all existing ash trees, requiring no additional funding for EAB Management Plan operations.

Department	Contractor			In-house			Replacement Trees		Subtotal
	Removal Cost	Qty.	Traffic Control	Staff	Disposal Cost	Qty.	Cost	Qty.	
HHS	\$ 5,645	9	\$ -	\$ -	\$ -	0	\$ 3,500	9	\$ 9,145
AS	\$ 15,000	7				23			\$ 15,000
POS	\$ 15,615	14	\$ -	\$ 16,640	\$ 3,143	51	\$ 6,400	16	\$ 41,798
ROW	\$ 44,177	89	\$ 13,168	\$ -	\$ -	0	\$ -	0	\$ 57,346
BOCO Ext.				\$ 18,000					\$ 18,000
Total	\$ 80,437	119	\$ 13,168	\$ 34,640	\$ 3,143	74	\$ 9,900	25	\$ 141,288

Table 3: Annual County-wide EAB Budget (Years 2016-2017)

Department	Contractor			In-house			Replacement Trees		Subtotal
	Removal Cost	Qty.	Traffic Control	Staff	Disposal Cost	Qty.	Cost	Qty.	
HHS	\$ 5,645	9	\$ -	\$ -	\$ -	0	\$ 3,500	9	\$ 9,145
AS	\$ -	0				0			\$ -
POS	\$ 15,615	14	\$ -	\$ 16,640	\$ 3,143	51	\$ 6,400	16	\$ 41,798
ROW	\$ 44,177	89	\$ 13,168	\$ -	\$ -	0	\$ -	0	\$ 57,346
BOCO Ext.				\$ 18,000					\$ 18,000
Total	\$ 65,437	112	\$ 13,168	\$ 34,640	\$ 3,143	51	\$ 9,900	25	\$ 126,288

Table 4: Annual County-wide EAB Budget (Years 2018-2023)

POS is requesting funding for one seasonal Resource Technician position that will assist with the tree removal, stump grinding, hauling and tree planting operations on POS properties.

The Boulder County-Colorado State University Extension is requesting funding for one half-time position to assist the Horticultural Entomologist/Colorado Master Gardener Volunteer Program Coordinator with EAB education and outreach to property owners in unincorporated Boulder County. As the EAB infestation continues to spread unincorporated Boulder County residents are increasingly requesting assistance on EAB detection assistance and help with developing a plan for privately owned ash trees. Through continued education and outreach Boulder County residents will better understand the options for EAB management and help reduce the spread of the insect to EAB-free areas of the county.

The EAB Coordinator position that directs interdepartmental coordination of EAB programming is currently funded until the end of 2016. As this program continues Boulder County may need to increase staff funding to prolong this position.

10. Summary

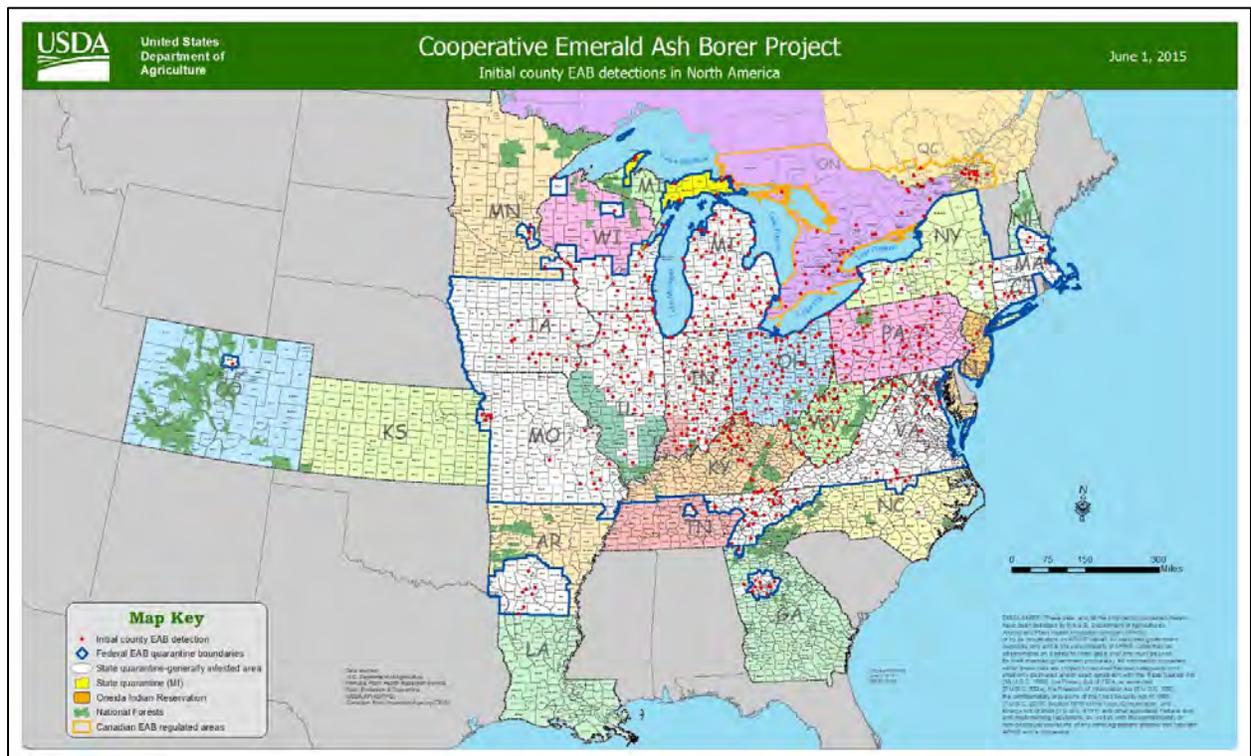
The introduction of EAB to Colorado will have wide-spread, damaging impacts to Boulder County and other Front Range communities. EAB is a notoriously difficult insect to detect and eradication efforts in Eastern North America have continually failed resulting in wide-spread losses of individual ash trees, native forests and urban forests.

Boulder County has identified all county-managed ash trees and has outlined the details to remove substantially all ash trees over an eight-year period and replace the ash with a diverse set of trees to revive the character of the high-use public facilities. Although the ash trees are located on a variety of county owned and/or managed land with varying maintenance practices, the plan will assess all trees in a unified approach to prioritize the removals. EAB management plans can take on many forms depending upon the local funding, ash tree population dynamics, the date of first detection versus initial infestation and local politics. The Boulder County Emerald Ash Borer Management Plan provides a strategy to minimize the growth and spread of EAB that extends the management timeline and effectively manages the impact of EAB on county owned and/or managed properties.

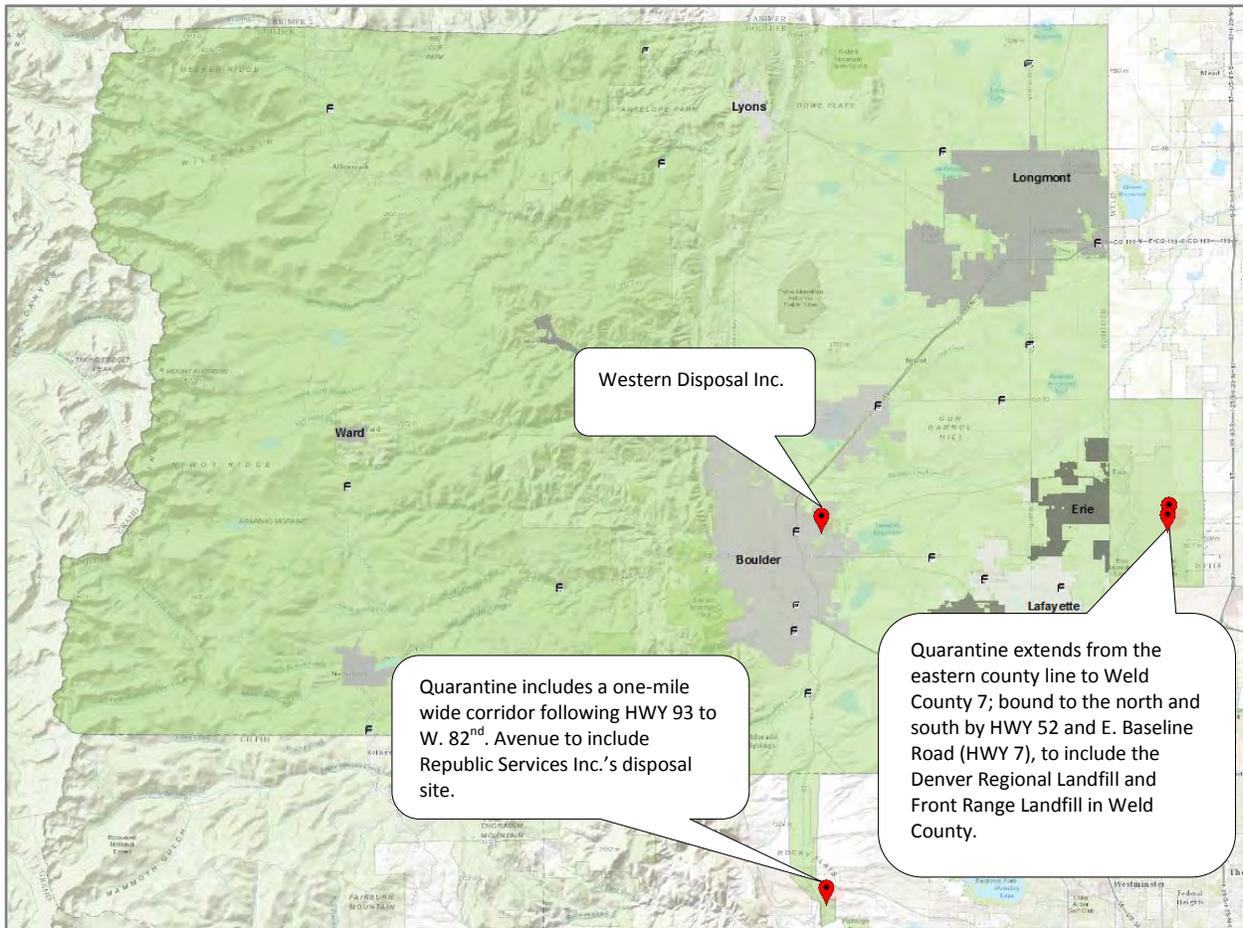
11. Appendices

APPENDIX 1: DISTRIBUTION OF EAB IN NORTH AMERICA

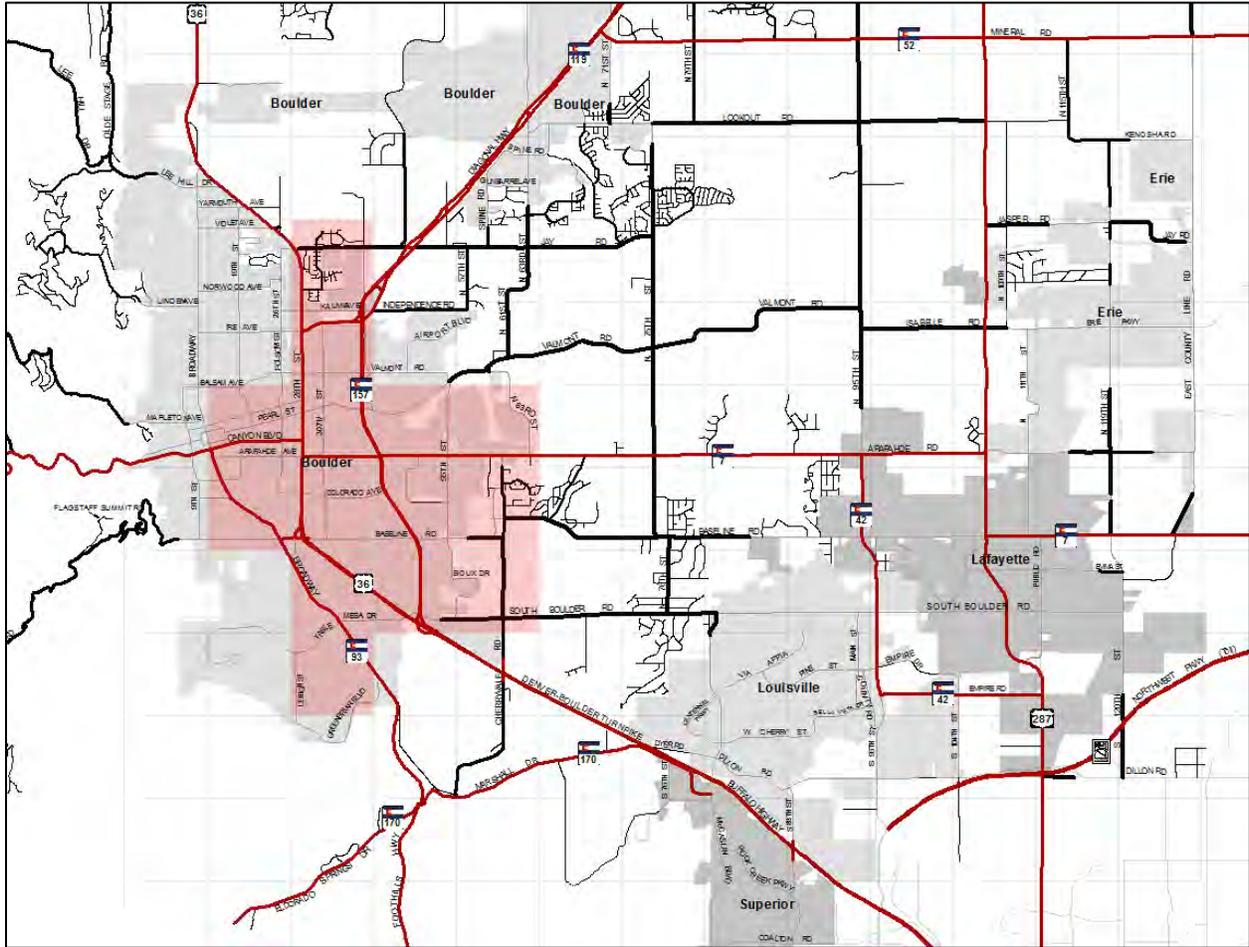
Courtesy: United States Department of Agriculture and Michigan State University, June 1, 2015, <http://www.emeraldashborer.info/>.



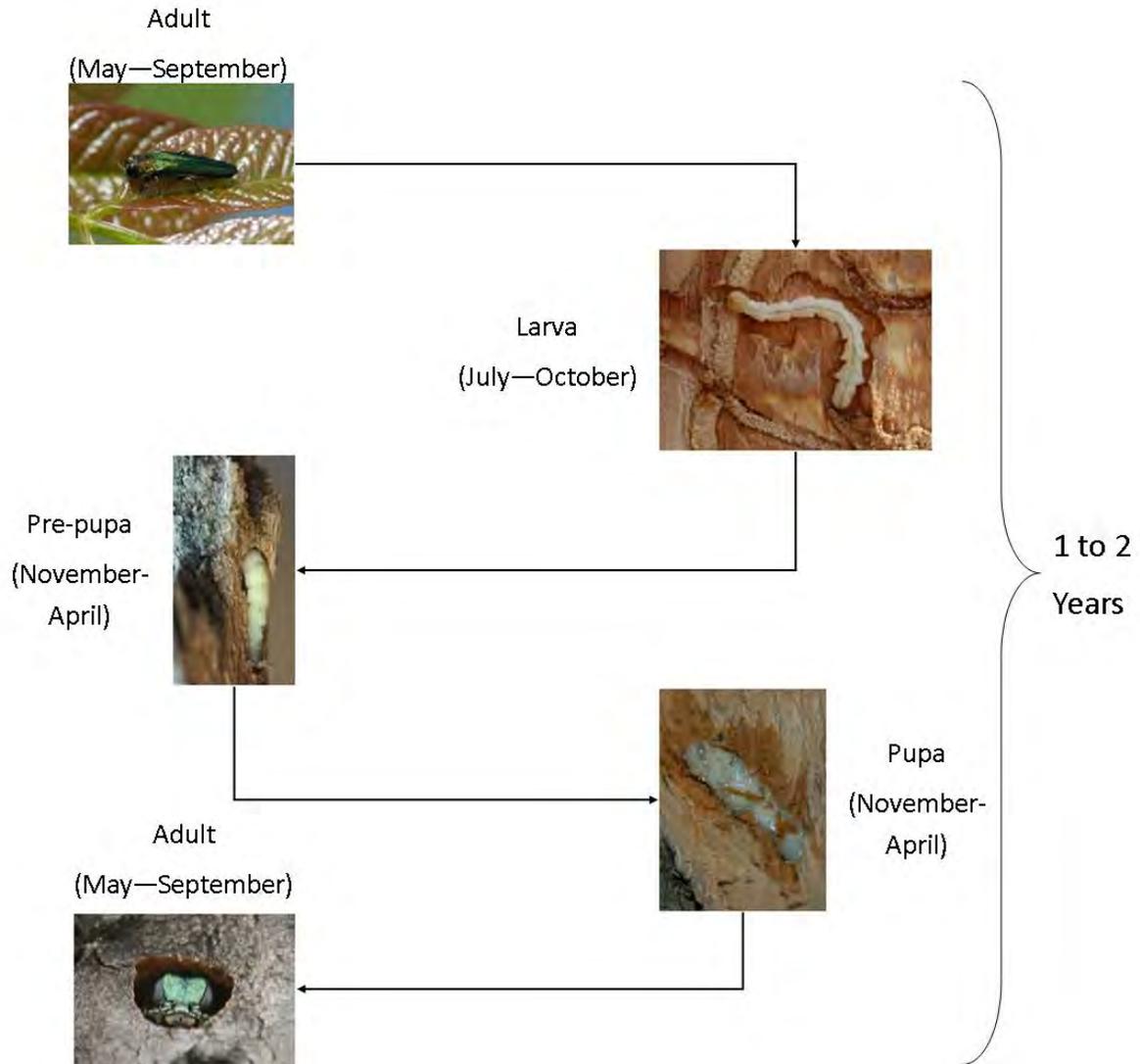
APPENDIX 2: BOULDER COUNTY EAB QUARANTINE MAP



APPENDIX 3: EXTENT OF EAB DETECTION (AUGUST 1, 2015)



APPENDIX 4: EAB LIFECYCLE



APPENDIX 5: MATRIX SCORE

	Points			
Criteria	1	2	3	4
Tree Health	Poor	Fair	Good	Very Good
Tree Defects (% girdled)	>50%	10-50%	5-10%	0-5%
Tree Form	Poor	Fair	Good	Very Good
Tree Size*	DBH of 1 to 10" or >20" (1 point)		*high value ash	Recommended
Location	Poor	Fair	Good	Very Good
Energy Factor	Low			High
Proximity to surface water	Within range for prevailing winds to blow leaves in surface water (1 point)			No threats to surface water
Utilities	Overhead (1 point)			None
Irrigation	Not present (1 point)			Present
Proximity to infested grids	within infested grid	<2 miles	2-5miles	>5miles

Individual tree scores range from 10 to 40 total points, with scores higher than 33 considered higher-value trees. The green highlighted cells are required scores for a high-value tree.

Appendix 6: Public Comments

The following comments were collected during two public comment periods during the development of the management plan. The first set of comments was collected during the two week period following the first public hearing on May 19, 2015, and the second set of comments was collected during the two week period following the web posting and press-release of the second draft of the management plan.

Comments from the open house:

- Statement paraphrased from a phone conversation: Representatives of the North Boulder Little League voiced their concerns regarding the Boulder County- managed ash trees located at Iris Fields. The trees provide shade and great character for the spectators during baseball games. They would like the option to use funds from the North Boulder Little League to systemically inject and prolong the life of the trees at Iris Field.
- Do something (many things) to save the trees rather than just giving up. There are treatments out there –even if chemicals. Use them. Do a better job (via the media + county/city) telling private homeowners that they can treat their ash trees. Contain this scourge Now – don't wait!
- Nice meeting you last night, and thanks for refreshing my memory about these two excellent publications. They pretty much summarize what I thought I had remembered -- that there are many (chemical! gasp!) treatments that protect the trees, and that have negligible impacts to bees and other beneficial insects. Most important, the multiple benefits of keeping the trees, as well as the costs of removal of the trees, far exceed the cost of treating the trees.

There's a lot of emotional rhetoric rattling around that has no basis in facts, just generalized fears. Please do your best to stop these irrational rants and help to spread the word of a science-based approach to successful forest management. It would be helpful if you would create a user-friendly summary handout of the potential treatments available, especially for private homeowners to use.

So I would appreciate your enhanced efforts at educating the County Commissioners specifically of these facts. I urge you to work with them and staff and the citizens of Boulder County to protect our ash trees rather than just condemning them all to certain death.

And for the trees that are already too far gone to save, I support a county-sponsored burn site or other facility where people could take the wood -- at no cost to them -- as an incentive to dispose of it properly (the alternative, making people pay to do the right thing, is a disincentive and I do not support that alternative).

Please keep me in the loop about this topic, whenever it comes up and if there are new developments I should know about. Also, let me know if there's anything I can do to advance the cause.

Comments from the public comment period from August 10-21:

- Calls from folks who believe they've seen borers should be tracked. When I reported seeing them last year after noticing a lot more woodpeckers and flickers in my ash trees and actually seeing the bug, I was told it could not be reported as a sighting unless I caught one of the damned things and brought it to be verified. I decided to go with my sighting and had my trees treated but the result of this "prove it" attitude means a lot more trees get affected before action is taken. If calls are logged and a pattern emerges there's a much better chance of early detection and certain areas can be identified and folks can be asked to watch for them and try to catch some. They are grossly easy to ID.... very few bugs are dayglow teal blue green and they stick out like a sore thumb which makes the extra requirement illogical.

-
- I don't agree with the rationale and plan of removing trees before they get the disease or insect. This makes no sense and is so contrary to the ecosystem of creatures dependent on those trees - birds and such. This is like deforestation of pine trees because they "might" get the dreaded pine beetle. Why not wait to see if trees get the insect?

It shouldn't be the county's responsibility to spend tax payer money to try and prevent a non human or animal life threatening insect. This is way too much government control determining preventative measures that could set precedence for future county plans.

- Don't do it.

The management plan to eliminate ash trees in Boulder county will not halt the spread of Emerald Ash Borers (ELB). On the contrary, it will cost money, ecologically degrade the landscape, and do little or nothing to slow the spread of ELB.

As the management plan itself states, "...eradication efforts in Eastern North America have continually failed." Unless Boulder County is prepared to fell all ash trees throughout the county, on both public and private land, as well as felling all ash trees on adjoining counties along Colorado's Front Range, the effort will be a waste of time and money.

Boulder County's resources would be better spent on replacing ash trees [with other species] only as they are affected, rather than proactively cutting everything down.

- While the plan addresses tress on county property, it does nothing to assist property owners where the vast majority of infected tress are located. I have two dead tress on a right of way that threaten a neighbors house. Apparently given the cost of removing them in a confined area, my only option is to wait for them to fall on his house as insurance will pay for repairs, but nor removal. Given the scale of this attack some sort of general help in removing all infected trees would be helpful.
- I wanted to present my comments in a way that may help preserve some of the beauty and timelessness of our city of Longmont that is present because of our Ash trees. My husband and I paid to have the Ash trees in our yard and the one on the boulevard in front of our house injected this year as we were not sure of the plan the city had at the time. We recently moved to Longmont and love the shady canopy provided by the Ash trees that line our street.

As the green ribbons stating that each tree on our street was at risk from the EAB were placed on our trees I wondered what they were for. Additionally, when I asked our neighbors if they knew why the green label was placed on the tree they didn't know. One of them thought the city was planning to inject the trees and would strive to protect them. The other one assumed the city would manage their tree well. My point is that neither my neighbors or I had any idea of the plan to systematically remove the trees.

These are the things I would like to see in addition to my thoughts on this matter:

1) A written posted notice on the door of each property with an ash tree on public space that there is plan for removal of the ash tree in front of each home. People must know this! They maintain the boulevard (public space) with mowing, watering, planting flowers etc. While some may choose not to inject their trees, some MAY choose this if only they knew the options in front of them.

a) On this notice there should be information about EAB, as well as options for treatment such as injection to protect the tree.

b) There should be a timeline posted-as people need to take action immediately.

2) Has there been any discussion of gathering a contracting company to offer a discount for Tree-age injection if say 5 or more homes on a block decide to pay to inject their trees?

3) What about offering a tax deduction or offering to pay for half of the cost of injection by the city in order to provide collaboration of the home owners in the EAB plan.

3) In the documented plan, it says that if we choose to inject we are then responsible for the cost of tree removal should the tree die. I would like to see this changed. I believe we are paying to maintain the beauty of the city by the only means available with known efficacy of saving the trees. We should not be penalized for our investment! What if the tree dies from other causes at a later date?

4) Another suggestion is to remove trees in an every-other pattern on city blocks and then plant a new tree in its place such that it creates space for the new tree to thrive before ultimately removing all ash trees. While this would require 2 passes in order cut all trees down, for a period of time we would get to continue enjoying the shade and beauty of our trees while allowing replacement trees to start growing.

- Having extensive tree care experience, I'd like to propose an alternative solution to the ash borer epidemic Boulder County is facing. I suggest that, rather than removing trees, the county treat its ash trees with Imidacloprid, such as Merit 2F or Criterion 2F, through soil drench or soil injection. This approach would be preferable for a number of reasons:
 1. First, it would allow the county to refrain from removing its ash trees--a course of action many citizens are opposed to.
 2. The solution would avoid the substantial cost associated with removing such an enormous number of trees along with problems associated with the quarantined wood.
 3. An Imidacloprid soil drench is inexpensive— a 16" DBH Ash, less than \$3 per tree per treatment or a 24" DBH Ash, less \$ 4.50 per tree per treatment—and only need be applied annually. Even after several decades, this treatment would not equal the cost of removing trees.
 4. The solution I propose would be instructive for Boulder County citizens, demonstrating an affordable, safe, and environmentally friendly means by which to protect against the ash borer and keep their trees.
 5. Imidacloprid will kill ash borer, while removing trees will merely send them elsewhere. So, if the county removes its ash trees, it seems that this heightens the threat to private citizens' ash trees.
 6. The use of Imidacloprid could be selective, or supplemental. Presumably, there are some trees that are more important to the county than others. The more important trees could be treated, while the less important ones could be removed.
 7. When used at the proper rate (i.e. no more than 1.6 pts. or 0.4 lbs of active ingredient per acre, per year), Imidacloprid will have no negative impact on the environment.
 8. New methods and technologies in the prevention and treatment of EAB are advancing rapidly. It would be a terrible loss to remove healthy trees with a possible cure for Emerald Ash Borer around the corner.

I'll close by saying that I am the owner of Forestry Distributing—a tree care products company in Longmont. As a company, we have attempted to promote ash borer awareness and preparedness, and so, would be pleased to partner with the county in any way they deem fit.
- The current management options to deal with the ash beetle such as insecticide treatment and preemptive tree removal have failed in other states. Preemptive tree removal does not work; it also may disrupt current bird populations. It's important to stay focused on the big picture and around attempts at mitigation are both doomed to fail and could have detrimental (applying insecticides) effects on the health of our communities.