Boulder City Council
STUDY SESSION

Tuesday
September 8, 2015
UPDATED

5:15-6 PM
Boards and Commissions Interviews
1777 West Conference Room

Study Session is Televised
6-8 PM
Review of the 2016 City Manager's Recommended Budget

8-9 PM
Emerald Ash Borer in the City of Boulder
Memo available on Monday

Council Chambers
Municipal Building
1777 Broadway

Submit Comments to City Council
Email: council@bouldercolorado.gov
or
Attention: Alisa Lewis, City Clerk
PO Box 791, Boulder, CO 80306
Fax: 303-441-4478

STUDY SESSION
MEMORANDUM

To: Members of City Council

From: Jane S. Brautigam, City Manager
Yvette Bowden, Director, Parks and Recreation
Therron Dieckmann, Deputy Director, Parks and Recreation
Kathleen Alexander, City Forester
Jeff Haley, Parks Planning Manager
Rella Abernathy, City Integrated Pest Management Coordinator
Brett KenCairn, Senior Environmental Planner
Elizabeth Lokocz, Landscape Architect II

Date: September 8, 2015

Subject: Study Session: Emerald Ash Borer in the City of Boulder

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I. PURPOSE

The purpose of the study session is to discuss and obtain City Council's feedback on anticipated long term impacts of the detected local emerald ash borer (EAB) infestation, city response to date, and recommendations on next steps including, but not limited to, the development of a City of Boulder Urban Forest Strategic Plan.

II. QUESTIONS FOR CITY COUNCIL

1. Does council have any questions or feedback on the Parks and Recreation Forestry Division strategy in response to emerald ash borer?
2. Does council have any feedback on the approach to inform/educate the public

III. EXECUTIVE SUMMARY

In September 2013, City of Boulder Parks and Recreation Department Forestry staff (Forestry staff) discovered an EAB infestation within the city. The inter-agency delimitation survey found EAB within several neighborhoods in central Boulder. Subsequent detection efforts by Forestry staff also found EAB at low levels outside the original detection area.

Forestry staff consulted with leading EAB experts from across the United States and Canada to develop the initial emergency EAB response. An Interdepartmental EAB Strategic Group was

formed and developed the proposed long term strategy for EAB including public education/outreach, tree planting, ash tree removals, limited pesticide applications, release of biocontrols, and collaborative research projects. Both the short term emergency response and the proposed long term strategy are outlined in this memo.

IV. FEEDBACK FROM ADVISORY BOARDS

The EAB impacts and city response to date were presented to three boards providing an opportunity for discussion and feedback prior to this council study session. The following is a brief summary of key points of input from each board:

Downtown Management Commission (8/3/2015)

- Pleased that Forestry staff can take "a negative" such as EAB and turn it into "a positive" with a bigger Urban Forest Strategic Plan.
- The Commission was also pleased with efforts to date to reach out to commercial business owners but recommended a representative from Forestry staff attend an upcoming Downtown Boulder (DBI) meeting to discuss further.
- Asked a question about the support the city has received from other agencies.

Environmental Advisory Board (8/5/2015)

- Support for the comprehensive view taken by the Forestry staff.
- Support for the balanced approach proposed by the Forestry staff.
- Recommendation to increase public awareness; concern that the message to date has been focused on the EAB detection and problem (e.g., ribbons around trees) and not on what residents can do about it.
- Advocate for free tree days (Boulder County program) and distribute trees where residents can pick them up more easily.
- The board had questions about what University of Colorado (CU) was doing for their ash trees and was concerned because the campus has various large ash trees.

Parks and Recreation Advisory Board (4/27/2015)

- Approved the proactive and environmentally sensitive approach to handling wood debris.
- The board had questions related to coordination with CU.
- The board expressed a preference that Forestry staff explore options to better notify neighbors when public trees will be removed in their neighborhood.

V. BACKGROUND

Forestry staff directly maintains a total of 50,725 public trees; 13,013 in city parks and 37,712 in street rights-of-way with a total appraised value of over $110 million[1]. The workgroup administers the following programs for public trees: tree planting, tree safety inspections, commercial tree program, rotational pruning for trees in city parks and in public street rights-of-way, tree removal, integrated pest management, arborist licensing, tree-related emergency response, enforcement for tree protection codes, and development review for park, transportation

[1] Urban Forest Resource Analysis, Boulder, Colorado, 2015; Davey Resource Group

and private projects. The workgroup indirectly manages the estimated 600,000 trees on private property through the enforcement of diseased and dangerous tree codes and the arborist licensing program. Urban foresty staff includes five FTEs: one city forester and four forestry field technicians supplemented by qualified contractors as appropriate.

Boulder's urban forest is a legacy that was largely created by the tree planting and stewardship efforts of previous generations. With the exception of trees native to the streamside corridors, Boulder's trees were planted and tended by residents who valued the trees shade and beauty.

The city's urban forest is one of the few city assets that appreciate in value over time. Trees are not just a luxury for the City of Boulder; they are part of the city infrastructure. Boulder's urban forest provides nearly $5.2 million in annual environmental, economic, and social services benefits ($50.39 per capita, an average of $102.48/tree). These beneficial services include air quality improvements, energy savings, stormwater runoff reduction, atmospheric CO_2 reduction, and aesthetic contributions to the social and economic health of the community. With an established tree population in overall good condition, a high percentage of young trees, and a diverse tree canopy including 237 different species, the community urban forest in Boulder will continue to be a vital asset to the city and neighboring communities.

The community urban forest reduces electric energy consumption by 3,909 MWh and annual natural gas consumption by 137,736 therms, for a combined value of $442,432 annually. In addition, these trees are removing 17.2 tons of pollutants from the air, including ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulates (PM_{10}) for an overall annual air quality benefit of $66,282. The urban tree canopy from the public tree population covers 651 acres. This canopy reduces annual stormwater runoff by more than 30.6 million gallons and protects local water resources by reducing sediment and pollution loading. To date, community trees have sequestered 36,892 tons of carbon (CO_2). They continue to sequester an additional 2,254 tons of CO_2 each year for an annual net benefit valued at $43,084.[2]

The annual investment (cost) to maintain publicly-owned trees is approximately $1.17 million. For every $1 invested in the community urban forest, Boulder receives $4.46 in benefits. The fact that Boulder's benefit–cost ratio of 4.46 exceeds ratios reported for five comparable cities (3.09 in Bismarck, ND, 2.41 in Glendale, AZ, 2.18 in Fort Collins, 2.09 in Cheyenne, WY, and 1.37 in Berkeley, CA) indicates that the program is not only operationally efficient, but capitalizing on the functional services its trees can produce.[3]

Infestation Impacts to the Urban Tree Canopy

One of the largest threats faced by urban forests across the U.S. is from invasive insects and disease pests. The impacts from these pests can be both environmentally and economically devastating. Pests are not the only threat faced by urban forests. Others include climate change and individual severe weather events such as the 2002 drought and the extreme temperature

[2] Urban Forest Resource Analysis, Boulder, Colorado, 2015; Davey Resource Group
[3] City of Boulder, Colorado Municipal Tree Resource Analysis, US Forest Service, 2005

fluctuation experienced in November, 2014, when the temperature dropped from a high of 64 degrees to a low of -11 degrees within 48 hours.

Invasive pests are not new to the Boulder landscape. Dutch elm disease (DED) was introduced into Colorado in the 1970's and first discovered in Boulder in 1978. Over the past 40 years, more than 1,000 American elms have been removed in the city and approximately 30,000 elms across the state have been eradicated due to the disease. The best management practice for DED to prevent spread on a citywide scale has proved to be early detection, prompt tree removal, and proper disposal of wood. This tactic prevents the beetles that vector the DED fungus from breeding and emerging from infested material and vectoring the fungus to nearby healthy elm trees. Several hundred mature American elms remain in Boulder due to proper management through the years.

Other pests that have caused tree mortality in Boulder over the past ten years, or are expected to cause tree mortality, include: thousand cankers disease of walnut, drippy blight of red oak, Japanese beetle, pine wilt nematode, Douglas-fir tussock moth, ips beetle in spruce and mountain pine beetle.

Emerald Ash Borer in Boulder

Emerald ash borer was most likely introduced to the U.S. in the mid to late 1990's through wooden shipping or packaging materials originating in China. It was first detected in 2002 and since then, it has moved across the country to 25 states and two Canadian provinces. Although EAB spreads short distances (.5 to 6 miles) annually through the flight of adult beetles, long distance spread occurs mainly through the movement of infested material. North American ash trees have shown little resistance to EAB and an estimated 50-70 million ash trees across the Midwest have died from this pest since the initial introduction.

It is assumed that EAB was brought to Boulder in infested firewood approximately 6-7 years ago. In late September 2013, City Forestry staff discovered an EAB infestation within the city. The beetles were detected by staff when sampling a dead ash tree prior to its removal. This was the first detection of this insect in Colorado and is the western-most occurrence of this invasive pest in North America. The subsequent delimitation survey showed EAB was well established at the time of discovery within a corridor in central Boulder.

Ash is one of the most abundant tree species in Colorado comprising approximately 15% of all deciduous trees in many urban areas and approximately 12% in the City of Boulder.[4] There are an estimated 1.45 million ash trees in the Denver metro area alone. The 2013 U.S. Forest Service (USFS) Metro Denver Urban Forest Assessment Report estimates there are 656,000 trees in the City of Boulder with an appraised value of $1.2 billion.[5] There are 50,725 total city park and public street rights-of-way trees; 6,016 (11.9%) are either green or white ash trees with an appraised value of $14.6 million. Assuming a similar percent of ash on private property, the estimated number of public, private, and naturalized ash in Boulder is over 70,000 trees.

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[4] Urban Forest Resource Analysis, Boulder, Colorado, 2015; Davey Resource Group
[5] 2013 Metro Denver Urban Forest Assessment Report, US Forest Service

Over the next 15 years, the proposed EAB management, including tree removal, tree replacement, wood disposal, and pesticide treatments is anticipated to have a significant direct budgetary impact to the City of Boulder and private residents. Additionally, the transforming tree canopy will have considerable economic, social, and environmental impacts for decades.

EAB Management

In terms of invasive forest pests, EAB may well represent the worst-case scenario. EAB management differs from other invasive tree pest management strategies in four major ways:

1. **Mortality of susceptible hosts**: There is very little resistance to EAB in North American ash species. Researchers have found almost 100% mortality in most species of ash especially green ash which is the prevalent ash species across Colorado. EAB also kills ash trees quickly; at high EAB populations EAB can kill mature trees in 1-2 years.
2. **Scale of infestation**: There are more trees susceptible to EAB than any other invasive pest to date. Dutch elm disease in Colorado killed approximately 30,000 American elm trees over a 40 year period and threatened 200 million elms across the U.S. EAB threatens 1.45 million ash trees in the metro Denver area alone and threatens an estimated 7.5 billion ash trees across the U.S.
3. **Difficulty in detection**: Dendrochronological evidence indicates EAB is typically established in an area for 3-8 years before discovery. The difficulty is because beetles attack in the upper canopies first; at low beetle populations, trees often do not show symptoms until several years after initial infestation; there is no available pheromone for trapping purposes; and EAB symptoms are similar to those of other insect pests and environmental problems.
4. **Speed of infestation within community:** EAB populations expand exponentially. Mated female beetles produce 40-70 eggs on average but can produce more than 200 eggs. Populations can therefore expand quickly before detection. Midwest cities report that without the use of pesticides, all ash within a community are dying after just 10-12 years after introduction.

Before deciding upon an EAB strategy for Boulder, Forestry staff researched and spoke to city foresters across the Midwest and Canada (Attachment A, Municipal Benchmarking). Very few cities opted for one of the extremes of either removing or treating all public ash trees. Most cities across the Midwest opted for a combination approach, treating some percentage of larger diameter ash trees that provide the most community benefit and phasing out declining ash over a longer period of time to slow the spread of EAB and spread out the removal and replacement costs over a longer period of time. The specifics for each city including percent of ash trees treated, pesticides used, tree size limitations for pesticide treatments, and timing of ash removals varied widely.

The Forestry Division has six main themes for EAB management in Boulder:

- Protect public safety and minimize liability;
- Maintain a healthy, diverse and sustainable urban forest;

- Maintain or increase the urban tree canopy to maximize the environmental, social and economic services provided to Boulder;
- Minimize risks to non-target organisms from pesticide applications;
- Minimize costs; and
- Minimize disruption to other forestry operations.

VI. ANALYSIS

Forestry staff collaborated with multiple state and federal agencies and with leading EAB experts from across the U.S. and Canada to develop a short term emergency response to EAB. Informational memos outlining the emergency response were submitted to City Council in February and April, 2014. An Interdepartmental EAB Strategic Team was formed and developed the long term strategies presented in this memo to manage EAB on a citywide scale and ensure consistency across departments.

The strategy includes the following response measures:

A. EAB Multi Agency Response
B. Quarantine
C. Detection Surveys and On-Going Monitoring
D. Public Education / Outreach
E. Tree Plantings
F. Tree Removals
G. Pesticide Applications
H. Biocontrols
I. Wood Utilization
J. Enforcement
K. Collaborative Research Projects
L. Urban Forest Strategic Plan

A. EAB Multi-Agency Response

After the initial discovery of EAB in Boulder, the USDA Animal and Plant Health Inspection Service (APHIS), the agency responsible for the federal EAB quarantine, declared EAB in Colorado as an "incident" similar to a wildfire and instituted the Incident Command System (ICS). The ICS allowed all affected agencies to share communication while developing mitigation and management strategies and outreach materials for EAB in Colorado. The EAB ICS was in place from September, 2013 through April, 2015, when it transitioned to the Colorado EAB Response Team. Agencies participating in the EAB ICS and in the Colorado EAB Response team include: APHIS, Colorado Department of Agriculture (CDA), City of Boulder, Boulder County, University of Colorado (CU), Colorado State Forest Service (CSFS), and Colorado State University (CSU).

To assist staff with EAB monitoring and management in Boulder, forestry staff consulted with two of the leading national EAB researchers and two local experts in entomology and tree pest management: Dr. Deb McCullough, Michigan State University; Dr. Krista Ryall, Canadian

Forest Service (CFS); Dr. Whitney Cranshaw, Colorado State University; and Dr. Sky Stephens, U.S. Forest Service. The group provided research documents, guidance on EAB strategies and information on possible differences in EAB behavior in Colorado.

A city EAB Interdepartmental Strategic Team was formed and developed long term strategies to manage EAB on a citywide scale and to ensure consistency across departments. Core staff included those below, but discussions also included staff from Open Space Mountain Parks, Public Works Transportation, Greenways, Risk Management, the City Attorney's Office, and the Boulder Police Department:

- Kathleen Alexander, City Forester
- Rella Abernathy, City Integrated Pest Management Coordinator
- Jeff Haley, Parks Planning Manager
- Brett KenCairn, Senior Environmental Planner
- Elizabeth Lokocz, Landscape Architect II

B. Quarantine

Exotic and native forest pests such as emerald ash borer, Asian longhorned beetle, and others cause serious damage to urban and natural forests in the U.S. These pests and many others disperse various distances through multiple pathways including movement of nursery stock and firewood. Firewood is a raw forest product that is widely utilized and moved throughout the U.S. with relatively limited consideration of the potential pests within or the associated risks. In an attempt to restrict movement of these pests, state and federal quarantines are established.

EAB is a federally quarantined pest. There are federal and state quarantines in effect that prohibit the movement of firewood and other ash wood materials outside quarantined areas. A map of the current EAB federal quarantine areas can be found in Attachment B.

<u>EAB Response 2013 - 2015</u>
Because EAB is a federally quarantined pest, APHIS works with State cooperators to detect, control, and prevent the human spread of EAB. To restrict intrastate movement of regulated articles including live plants and wood from ash and EAB, the Colorado Department of Agriculture (CDA) has imposed and is enforcing a quarantine on the movement of all ash tree products and hardwood firewood out of Boulder County. After discussions with local trash haulers, CDA also included small portions of Jefferson and Weld Counties to gain access to two landfills within the quarantine area to facilitate movement of flood debris and EAB-infested material. The state quarantine took effect on November 12, 2013 and a federal quarantine was enacted in April, 2014. A map of the Colorado quarantine area can be found in Attachment C.

CDA enforces the quarantine by entering into compliance agreements and inspecting arborists, wood workers, firewood dealers, and others handling regulated articles. Regulated articles include EAB specimens, ash nursery stock, ash logs, branches and chips, green lumber, all hardwood firewood or any other article, product or means of conveyance that may present a risk of spreading EAB. Sale and/or movement of regulated articles out of a quarantined area is

prohibited. Movement of regulated articles, other than nursery stock, is allowed if the regulated material meets certain specifications verified during inspection.

Long Term

The individual county quarantines are expected to expand as EAB progresses through Colorado. Once EAB is detected within the Denver metro area, the entire six county region will most likely be quarantined. CDA will continue to regulate movement of materials between counties through compliance agreements. Eventually, a large enough portion of the state will be considered infested and the entire state will be quarantined and APHIS will then regulate movement of materials between Colorado and other states.

C. Detection Surveys and On-Going Monitoring

Forestry staff conducts periodic risk assessments for high priority tree pest species to determine which ones are at higher risk of introduction into Boulder and prepares on-going monitoring criteria. Monitoring activities include trapping either with or without pheromones, visual surveys, and destructive sampling at time of tree removal. Over the past 10 years, Forestry staff has monitored for the presence of DED, EAB, thousand cankers disease of walnut, Japanese beetle, drippy blight of red oak, ips beetle in spruce, mountain pine beetle, pine wilt nematode, and Douglas-fir tussock moth. Often, the earlier a pest problem is detected, the more management options are available. In 2015, staff detected and will be removing public trees infected with drippy blight of red oak, thousand cankers disease of walnut, and ips beetle in spruce. Staff also responded to many questions from the public in east Boulder about Japanese beetle damage.

While prevention is the first line of defense, even the best prevention efforts will not stop all invasive species' introductions. Early detection and rapid response (EDRR) efforts increase the likelihood that invasions will be halted and eradicated. Once a species becomes widely established, the only action possible is the mitigation of negative impacts.

EAB is very difficult to detect in the early stages and is not typically found until 3-8 years after initial introduction into a location. For example, in 2012, EAB was detected in Kansas City, KS. The detection in a neighboring state led to a change in city Forestry EAB monitoring protocols in late 2012 to improve chances of EAB detection. Forestry staff found it in fall 2013 while sampling a dead public ash tree. There is no effective pheromone to detect EAB and the effectiveness of non-baited traps is low. Forestry staff, in cooperation with APHIS, had placed EAB traps throughout Boulder since 2007 with no positive detections. All early eradication attempts for EAB in the Midwest failed because the pest had already spread beyond the targeted eradication areas.

EAB Response 2013 - 2015

After initial detection in fall 2013, an EAB delimitation survey was conducted to establish the boundaries of the area considered to be infested by EAB. City Forestry staff collaborated with the Canadian Forest Service (CFS), CDA, APHIS, CSU Extension, and forestry staff from nine nearby cities to complete an EAB delimitation survey within the city.

The city was divided into plots or grids that are one square mile each. Crews removed two 3-4" diameter branches from each of 10 public ash trees within each plot. The bark was peeled from the branch samples and the wood examined closely for the presence of EAB larvae. All larvae found were sent to CSU for identification. Branch sampling protocols were developed by CFS staff; they found by performing random branch sampling on asymptomatic trees with this technique, they were able to detect EAB several miles away from the original location before trees become symptomatic. EAB was detected in five of the thirty-eight square mile grids.

EAB Monitoring continued through 2014 and summer 2015. By July 2015, detections spread from the initial five square mile grids to sixteen grids within city limit (See Attachment D). Detection efforts included:

- Tree Climbing: Forestry staff inspected symptomatic public ash trees when found during visual surveys or through requests from adjacent property owners.
- Destructive sampling: All declining public ash trees removed in EAB non-detect grids were sampled for the presence of EAB life stages.
- Branch sampling: Additional branch sampling was conducted in fall 2014 and spring 2015 in EAB non-detect grids.
- Trapping: Several types of EAB detection traps were deployed throughout Boulder in 2014 and 2015 in an attempt to detect its presence.
- Rotational pruning: Tree care contractors conducting pruning on city Forestry contracts looked for signs of EAB infestation when working on ash trees.

The city response to initial detection in the five grids included public education / outreach proactive tree planting, pesticide applications, removal of declining public ash trees, and the release of biocontrols. More detail on each of the response measures is included below.

<u>Long Term</u>
Due to the flight ability of the insect, rate of spread, and current detected areas, it is assumed EAB is widespread throughout the city of Boulder and Forestry staff proposes to cease detection efforts at the end of 2015. Colorado Department of Agriculture (CDA) staff, in coordination with city and county foresters, are continuing to trap and sample symptomatic trees in other parts of Boulder County and in other counties along the Front Range.

D. Education/Outreach

Education and outreach are critical components of response to an invasive tree pest. Because Colorado is considered a moderate risk for importation of invasive pests due to the tourist industry, the Emerging Pests in Colorado (EPIC) statewide working group was formed in 2009. Participants included staff from the CDA, CSFS, CSU, APHIS, and foresters from several cities including Boulder, Denver, and Fort Collins. Since 2009, the agencies have collaborated to raise industry and public awareness about the threat of EAB and other invasive pests. Specific activities included:

- Developing pest factsheets for EAB, Thousand Cankers Disease of walnut, and gypsy moth;

- Planning the 2013 and 2015 Invasive Species workshops to educate regional industry professionals;
- Developing the Colorado State Response Plan for EAB;
- Drafting the community response plan template for EAB; and
- Developing general guidelines for wood disposal when dealing with invasive pests.

EAB Response 2013 – 2015

Initial efforts were undertaken through the EAB Incident Command System and subsequently the multi-agency CO EAB Response Team. Efforts since the pest discovery include:

- Initial Meetings: In the weeks after receiving official confirmation of the pest in Boulder, city Forestry staff, CDA, CSFS, and APHIS participated in meetings with pertinent city of Boulder staff, Boulder County personnel, Front Range city foresters, Boulder County tree care companies and local trash haulers to educate about EAB and gather input on the proposed quarantine.
- Websites: CDA has posted educational material about EAB on their website: www.EABColorado.com.
- News Releases: The CO EAB Response Team and City of Boulder have distributed fourteen news releases since the initial detection. All news releases can be found at: www.EABColorado.com.
- Educational material produced included: Emerald Ash Borer Quick Guide, EAB Decision Matrix, Revised Edition of Insecticide Options for Protecting Ash Trees from Emerald Ash Borer, Colorado specific EAB FAQ's, EAB identification cards, utility billing inserts, and RTD bus advertisements.
- EAB Workshops: City Forestry hosted a series of EAB Identification and branch peeling workshops in cooperation with CSU Extension, CDA, and APHIS staff and trained over 350 foresters, arborists, and landscape professionals from six states on EAB symptoms and branch peeling techniques.

Additional efforts by Forestry staff included:

- HOA Meetings: Meeting with 15 local HOA groups to discuss management of public ash;
- Hosting three open houses for the public in 2014 and staffed information tables at Farmers Market and McGuckins through the summer of 2014 and spring of 2015.
- Websites: A website was also created for Boulder specific EAB information at: www.EABBoulder.org.
- News Releases: Collaboration on the fourteen EAB news releases since the initial detection and response to over 50 media requests since the EAB discovery.
- Channel 8: Conducted interviews for four Channel 8 informational videos on EAB since its detection.
- EAB presentations to Parks and Recreation and Environmental Advisory boards and the Downtown Management Commission.
- Reaching out to individual downtown commercial business owners as opportunities arise to replace declining public ash trees.

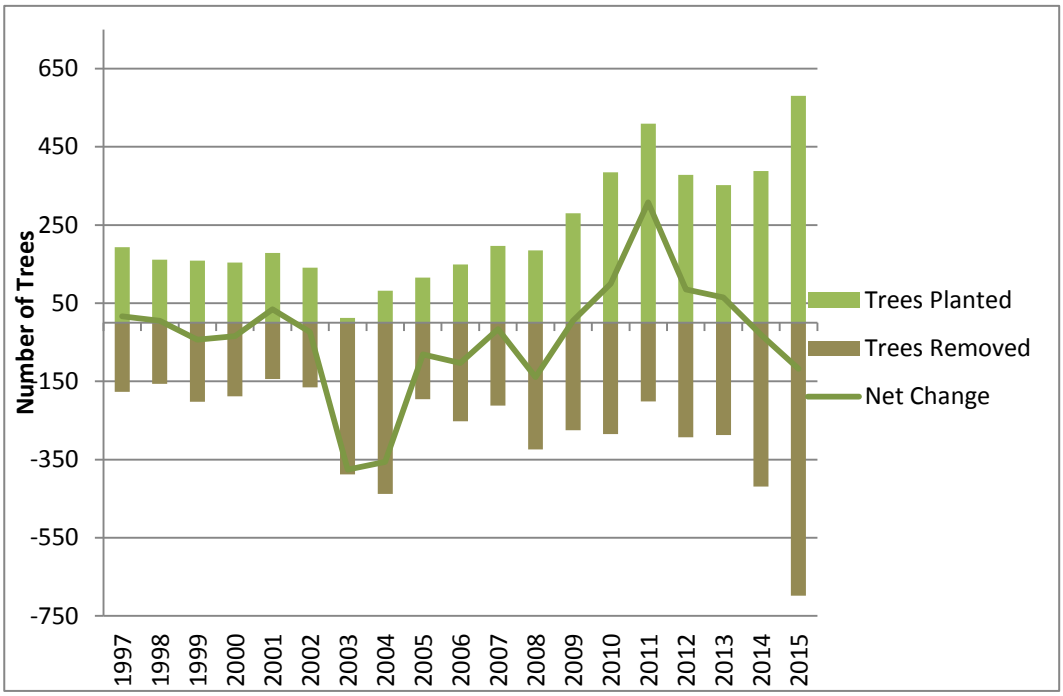
Long Term

Consistent with the Master Plan themes, the department will continue to implement strategies that 'Take Care of What We Have' and proactively engage in 'Community Building' as methods of addressing the sustainability of Boulder's Urban Tree Canopy. Initiatives explored by the department will include additional awareness efforts, community-collaborative tree plantings, environmentally sensitive methods of dealing with wood debris, and efforts that create investments in tree care and/or replacement over time.

E. Tree Planting

It is expected that all untreated ash trees on both public and private property and naturalized areas along the creeks and ditches will die from EAB over time. Ash trees contribute more to the urban tree canopy on an individual tree basis than many other tree species as ash trees are large maturing, long-lived, and have large canopies. These factors combined will lead to a significant decrease to the urban tree canopy and, as such, should be proactively addressed.

To adequately maintain the urban tree canopy, it is imperative to plant trees in anticipation of losses. Newly planted trees are significantly smaller than most removed trees and contribute less environmental services on a per tree basis than mature trees. Therefore, trees should be replaced at a minimum 1:1 ratio (trees planted: trees removed). It has been difficult however to maintain a 1:1 ratio in some years due to a high number of tree removals from various factors and constraints on tree planting due to budget, staffing, and irrigation limitations. The chart below represents only those trees planted through city Forestry and through parks development projects, not those trees planted through development or transportation projects.



Comparison of number of trees planted and trees removed

As pests and severe weather events continue to impact trees, maintaining and increasing tree diversity over time is key to a resilient urban tree canopy. Boulder is fortunate to have better soils than most other Front Range cities and can therefore grow a larger diversity of tree species. The latest tree inventory shows there are 237 distinct tree species on public property.

EAB Response 2013 – 2015

Letters were mailed to property owners within portions of the known infested detailing areas in the public street rights-of way that are good tree planting sites. Good planting sites include those with enough public right-of-way to support a large maturing tree, an irrigation system, and no overhanging private trees. The letter educated residents on the Forestry tree replacement program, the services provided by the urban tree canopy, and offered to plant a tree, free of charge, into the rights-of-way adjacent to their home. Ash trees were replaced with a variety of tree species such as western catalpa, hackberry, swamp white oak, London planetree, English oak and sugar maple among others to ensure diversity in the urban tree population.

In 2014, Forestry staff planted 359 trees into city parks and street rights-of-way including 101 trees into the neighborhoods most heavily impacted by EAB. An additional 106 trees were planted through parks development projects. Thirty-five species were represented with 81% large maturing tree species to maximize environmental services provided.

In 2015, Forestry staff planted 580 trees into city parks and street rights-of-way. This included 225 into Parks and Recreation city parks and facilities with existing ash trees and 260 trees into the neighborhoods most heavily impacted by EAB. Forty-two different species were represented with 89% large maturing species to maximize services provided.

Columbia Cemetery and Flatirons Golf Course will be especially impacted by EAB as both locations have a high number of ash trees. Some large ash trees will be preserved and Forestry staff is planting 25 new trees annually in each location to replace the urban tree canopy that will eventually be lost to EAB.

	Flatirons Golf Course	**Columbia Cemetery**
Total # Ash Trees	121	165
% Ash Trees	9	46
# Ash Trees > 10” Diameter	112	117
# Ash Trees > 20” Diameter	46	75

Long Term

Forestry staff is proposing a goal to plant approximately 500 trees annually. Additional trees will be added to public property annually however through private development projects and capital projects by Transportation, UHGID and Parks and Recreation.

The current inventory analysis will help identify species distribution across the city and help achieve future diversification goals. One goal of the upcoming urban tree canopy assessment and Urban Forest Strategic Plan is to identify areas in need of additional tree planting to assist in tree planting prioritization.

F. Tree Removals

There are 6,016 ash trees in city parks and in public street rights-of-way in Boulder. Forestry staff is proposing a target of approximately 25% for pesticide application and possible long term future removal; the remaining approximately 4,500 ash will be phased out over a 6-10 year period of time depending upon success of slowing the spread of EAB. Forestry staff is proactively removing ash trees that have been identified as being in poor or very poor condition. Ash trees are also being phased out when possible through private development, and Transportation, Parks and Recreation and UHGID capital improvement projects. The remaining trees will be removed as they become infested.

The proactive ash removal is targeting trees that meet the following criteria:

- High risk ash trees;
- Ash trees in poor condition, those compromised by other insect pests or exhibiting two or more known EAB signs;
- Trees with poor placement (i.e., under power lines);
- Trees with poor structure that will mature into a higher maintenance tree; and/or
- Any topped or improperly pruned ash trees.

Since the initial EAB detection, 192 public ash trees in poor condition have been removed. An additional estimated 50 declining ash trees will be removed in fall 2015 and replaced in 2016. The most heavily EAB impacted areas have few public ash resulting in minimal public property impact to date. Hundreds of private ash trees were symptomatic during surveys in 2014 and 2015; some have been removed but exact numbers are not known.

Because EAB populations expand exponentially, the number of annual public ash tree removals is not expected to remain constant or predictable. In the absence of pesticide use, cities in the Midwest have lost the majority of their ash trees within 5-6 years after detection. If the Boulder strategy is successful, the removals may be spread out over an 8-10 year period of time.

Forestry staff will survey each July and create a list of ash trees to be removed. Larger removals and stump grinding will then be contracted during the winter months when costs are typically lower. Staff is proposing to remove smaller diameter trees with in-house seasonal crews.

G. Pesticide Applications

EAB infestation is almost 100 percent fatal to North American species of ash trees, leaving pesticide application as the only option to save the life of a tree. However, pesticides are only effective against EAB if used before a tree is compromised by damage from EAB larval feeding and the timing for effective pesticide intervention may vary depending on the climate. Early evidence suggests that due to the local arid climate, infested trees in Boulder may decline more rapidly than in other EAB-infested regions of the country.

Pesticides are an important component of EAB management programs for a number of reasons as they can:

- Preserve ash trees long term;
- Reduce community-wide EAB populations and therefore slow the progression of EAB;
- Spread the tree removal and replacement costs over a longer time period;
- Lower the risk and public safety concerns associated with large numbers of dying trees; and
- Spread the loss of the urban tree canopy and the subsequent loss of the environmental and economic services provided by the urban tree canopy over a longer period of time.

EAB researchers have evaluated the effects of treating varying proportions of ash trees with the pesticide, TREE-äge, in residential neighborhoods with simulation models of EAB dispersal and population dynamics developed from numerous field studies in the Midwest. The simulation showed that if 20% of community trees were treated, then 90% of the trees (including untreated trees) will still be alive after ten years due to area-wide reduction in EAB population growth. Results have shown, however, that without any insecticide treatment, within ten years of the initial EAB introduction, all ash trees will die, a pattern consistent with mortality rates observed in many communities in southern Michigan and northern Ohio. Therefore, to confer broad protection not all ash trees require treatment.

Pesticide Evaluation Criteria

The city EAB strategy complies with the city's Integrated Pest Management Policy takes into account non-target effects, environmental impacts, and long-term objectives of any pest management decision. Pesticides are only used if other options are not feasible and must be evaluated prior to use. Forestry staff, using data from the EPA and other regulatory agencies, advice from leading experts in EAB management, and open literature, assessed four of the commonly used pesticides. The decision making process for EAB treatment is complex due to differences between products, different use rates, multiple methods of application, timing of applications, pest control efficacy, and environmental considerations. Pesticide products used for treating EAB include:

- **TREE-äge (emamectin benzoate)** – a "semi-synthetic" product derived from a soil bacterium that is a restricted use pesticide (may only be applied by a certified pesticide applicator). This product is only applied via tree injection.
- **TreeAzin (azadirachtin)** – a natural product derived from the seeds of the neem tree – certified for use under the USDA's National Organic Program. This product is only applied via tree injection.
- **Safari (dinotefuran)** – a neonicotinoid insecticide applied as a low pressure, lower bark spray.
- **Merit (imidacloprid)** – a neonicotinoid insecticide that is commonly used for EAB treatments by trunk injection or soil treatments.

The analysis of EAB pesticide options indicates that imidacloprid, a neonicotinoid insecticide, posed a high risk to pollinators and other non-target organisms while showing inconsistent efficacy for EAB control over only one season. In March 2014, Forestry and Integrated Pest

Management staff recommended that the city manager prohibit the use of imidacloprid for EAB control on city properties, including public street rights-of-way.

In January 2015, Bee Safe Boulder members presented City Council with a proposed resolution pertaining to the use of neonicotinoid pesticides on city owned properties. This resolution was adopted (Resolution 1159) and formalized the city managers earlier ban on imidacloprid use. The resolution also requires a formal exemption process if any neonicotinoid, such as dinotefuran, is used for either research studies or application to control any pest, including EAB.

Of the four products that were evaluated for EAB, only two are currently being used by Forestry staff for EAB treatment: TREE-äge and TreeAzin. There are knowledge gaps about each of these products. The non-target impacts are well-studied for TreeAzin with favorable results, but information about its efficacy is limited. Forestry staff is testing TreeAzin to determine if and how long it is effective (1 vs. 2 year control) for EAB control in the local climate. TREE-äge has demonstrated excellent efficacy in multiple studies. However, studies for impacts to non-target organisms are lacking.

Forestry staff is seeking partnerships and research opportunities to investigate potential environmental impacts from TREE-äge. In 2014 and 2015, TREE-äge was applied to a public ash trees within the known infested areas in a targeted strategy. This product will continue to be evaluated as more information becomes available. As local EAB populations decline due to mortality of untreated ash trees, it is likely that application frequency will be reduced each year for both of these products.

<u>EAB Response 2013 - 2015</u>
Forestry staff, in consultation with the city EAB Strategic Team, made the decision to start EAB treatments of significant ash trees within the original five grids where EAB was detected in spring 2014. The rationale for treatment included:

- Target 25% of the public ash tree population to slow the spread of EAB within Boulder and to other communities;
- Stage removals to spread out costs over a longer period of time;
- Stage the loss of the environmental and economic services provided by the urban tree canopy over a longer period of time; and
- Lower the risk and public safety concerns associated with large numbers of dying trees;
- Potential long term preservation of significant trees.

Forestry staff, in consultation with national EAB researchers, local entomologists from Colorado State University (CSU), the US Forest Service, and the city EAB Strategic Team, developed criteria to determine whether ash trees were candidates for long term preservation. The criteria included:

- **Tree health and condition**: Because EAB larvae feed under the bark, the most effective pesticides are systemic insecticides. Systemic insecticides are transported throughout the tree within its vascular tissues. Feeding by EAB larvae damages the tree's vascular

system, as does damage from wounds and other pests. If the vascular system has been compromised the pesticide will not translocate and be effective.

- **Tree defects**: Ash trees in the Tree Safety Inspection program with poor structure or defects are not feasible for preservation and will be phased out.
- **Tree Size**: The pesticides used are trunk injected. The injection process requires drilling small holes into the lower trunk to inject the product. Larger, healthy ash trees have a better chance to close off wounds long term. Ash trees less than 10" diameter will not be injected and will be phased out as they are infested due to reduced ability to close wounds and the economics favoring planting a replacement tree over treatment with pesticides long term.
- **Location**: If a tree has a poor location (e.g., under power lines, restricted growth, causing significant hardscape damage) it would not be considered for long term preservation.
- **Irrigation**: All systemic pesticides require water to be taken up internally within the tree. Ash trees must be in an irrigated site or the site requires easy access for tank watering prior to the application. Fortunately, due to adequate precipitation in spring 2014 and 2015 tank watering was not necessary.

All public street trees and most city park trees meeting the criteria have been treated with TREE-äge (Attachment E). Those park trees in environmentally sensitive areas (e.g., within 100 feet of a waterway) were treated with TreeAzin. Letters were sent to both property owners and renters of properties with significant ash trees targeted for treatment in the public street right-of-way. The letters explained EAB impact, the pesticide product chosen, the treatment rationale and gave property owners and renters the opportunity to opt-out of treatments for any reason.

2014 and 2015 EAB Treatments

	2014	**2015**
Grids Managed (square miles)	5	12
Total # Public Ash Trees Evaluated	745	2057
Total # Ash Trees Treated	199	573
% Total of Ash Evaluated	27	22
# Notification Letters Sent to Property Owners/Tenants	80	436
# Property Owners Opting Out of Treatment	4	35

<u>Public Feedback on Pesticide Use</u>

Because pesticides are used to treat pests other than just EAB, public input on the broader use of pesticide applications to public trees will be requested through the Urban Forest Strategic Plan process in 2016. General feedback about pesticide use since the Boulder EAB detection includes:

- At the public meeting for the neonicotinoid resolution (Resolution 1159), residents were supportive of city Forestry not using neonicotinoid pesticides for EAB.
- Between fall 2013 and summer 2015, Forestry staff received over 400 calls from residents with questions about EAB and pesticide use. Most callers indicated they were

planning to treat their private trees but had questions about whether their ash trees were worthy of preservation, available pesticide options, effectiveness, and which products were the least impactful to non-target organisms.

- In 2014, of the 80 pesticide notification letters sent, four property owners chose to opt out of the treatment; three were due to a concern over pesticide use.
- In 2015, of the 436 pesticide notification letters sent, 35 of the property owners who received a letter chose to opt out of treatment; ten were due to a concern over pesticide use.
- Forestry staff held three EAB open houses in 2014; individual resident responses were not tracked but generally most were supportive of the emergency response to EAB.
- Forestry staff met with fifteen HOA groups in 2014 and 2015 to discuss management of public ash trees; generally most HOAs were supportive of the proposed plan to treat only 25% of public ash trees and only those significant trees worthy of preservation and to phase out the remaining ash over time.

Long Term

Research has shown that TREE-äge provides for multi-year EAB control. Twenty-five percent of public ash trees will be treated on a three year rotation; approximately eight percent of trees each year. After the initial wave of EAB mortality, and as replacement trees become established, the number of ash treated during each rotation will decrease. The percent decrease will depend upon the rate of mortality and available budget.

Based on the criteria for treatment, ash trees on the Pearl Street Mall are not good candidates for treatment. A long term phased replacement plan is in place. Ash on the mall will be removed and replaced with public safety as a priority.

More than 25% of Boulder's public ash trees meet the criteria for EAB treatment. Some property owners have requested to treat public street right-of-way ash trees not treated by the city. Per B.R.C. Chapter 6 Protection of Trees and Plants, 6-6-5 Spraying and Pruning, homeowners are only allowed to treat public street right-of-way trees adjacent to their property with the permission of the City Manager. This authority has been delegated to Forestry staff. Permission shall be granted if the same criteria are met:

- Public ash tree is worthy of long term preservation;
- Applicator is a state licensed pesticide applicator;
- Tree care company is a city licensed certified arborist; and
- Only TREE-äge or TreeAzin is applied.

All requests for pesticide applications are being tracked by Forestry staff.

H. Biocontrols

EAB's native range is Asia where several predators, pathogens, and host tree defenses keep it from becoming a major pest such as it has become in North America. Although the ability of Asian trees to resist infestation provides protection from EAB, there are numerous natural

enemies, notably various species of parasitic wasps, and together this combination effectively limits EAB so that it rarely causes serious damage in Asia.

Host plant resistance is largely absent from the native North American species of ash that greatly limits the potential of natural controls. However, current research is being conducted by federal agencies to identify Asian parasites of the EAB. Some of these have been found suitable for introduction and release into North America. Four of these introduced natural enemies have been released in EAB outbreak areas in the Midwest and in some cases have proven capable of establishing and reproducing.

The work with natural EAB enemies is ongoing. The long term goal for natural enemies is to suppress EAB populations in the post-outbreak phase. If effective, this could result in a reduction of the need for pesticide treatments in the future and possibly allow some ash to survive without treatment.

Local Response

The USDA Animal and Plant Health Inspection Service (APHIS) rears the EAB biocontrols at their Michigan facility and provides the biocontrols at no cost to cities. Local APHIS staff applied for the permits necessary to release four biocontrols in Boulder. The tiny, non-stinging parasitic wasp species *(Tetrastichus planipennisi*) was released in September 2014, the egg parasitoid, *Oobius agrili*, was released over a six week period in spring, 2015, and the two remaining species, *Spathius agrili and Spathius galinae* were released in August, 2015. The release site for all four biocontrol wasp species was along Boulder Creek Path, on CU Boulder property near the CU East Campus, and was approved by APHIS through the permitting process. The biocontrol releases are a cooperative project utilizing staff from city Forestry, CU, CDA and APHIS.

The Colorado EAB Response Team sent out a news release after the first and second wasp releases. Public response was positive; several community members requested an expanded release to include west Boulder and several community members asked if they could purchase and release the wasps on their own property.

The City of Boulder, along with Syracuse, NY and Naperville, IL was invited to participate in a six year research study involving EAB biocontrols. The research question centers on the effectiveness of the combination of insecticide plus biocontrol release to assess if chemical treatment will protect the ash long enough for the parasitoids to build in population sufficiently in the environment and protect larger diameter ash trees. The proposed study is a multi-year project and will require monitoring of sentinel trees over time to evaluate their health under different treatments. The monitoring is conducted by seasonal staff hired by the Colorado Department of Agriculture (CDA).

Long Term

Additional biocontrol releases of all four species are planned for 2016 and early 2017. If by the end of this pilot period, the biocontrols have not become established, the releases could be stopped.

I. Wood Utilization

Throughout the U.S. large amounts of urban forest residues (UFR) including wood chips, brush, logs and leaves, are generated by homeowners, municipal tree care operations, landscape maintenance, and tree care companies as a result of managing urban forests. A 2008 Colorado State University (CSU) study found that 60% of UFR from Fort Collins, Greeley, and Loveland was used to create mulch while the remaining 40% was most likely deposited into landfills.[6] With a resource that is 100% recoverable if markets are established, there is great potential to utilize UFR in a more sustainable manner and to extend the life of nearby landfills.

The utilization and/or disposal or UFRs has been problematic across the country even prior to the introduction of EAB. There are obstacles to the utilization of UFRs including wood quality, wood quantity, utilization plans, and community support. Within urban settings, trees tend to grow around nails, fences, and cables, potentially decreasing the wood quality and damaging wood processing equipment. Many urban trees also lean over homes and other hardscapes, posing safety concerns during tree removal operations prompting tree care companies to remove smaller (and less marketable) sections of wood.

Proper utilization and safe disposal of woody biomass from trees infected with invasive pests - or within areas under quarantines due to invasive pests - presents additional challenges to cities. Urban forestry professionals are increasingly faced with the task of selecting appropriate utilization options for the materials and locating the necessary technical information for making such decisions.

All UFRs generated from Boulder Forestry operations are brought back to the city's Forestry log yard. Through spring 2014, all the logs were tub ground biennially into mulch. The mulch from tub grinding, as well as all mulch generated and dropped off by contractors, was either utilized within the city's parks system or moved offsite for composting by an outside vendor (A-1 Organics in 2014).

In 2014, the City of Boulder entered into an agreement with Boulder County to utilize chips from whole trees as a quality heating fuel. Boulder County owns and operates two heating systems (biomass fueled boilers) at the Boulder County Parks and Open Space facility in Longmont, and the Boulder County Jail in the City of Boulder that burn woody biomass to heat their buildings. It is mutually beneficial for the city and the county to collaborate in this manner as the county is supplied with a source of locally generated biomass and the city has a more sustainable use of the UFRs.

Forestry staff has also been working collaboratively with the Colorado State Forest Service to identify markets for all urban wood, not just for ash. Potential markets include:

- Mulch

[6] Quantifying and Utilizing Urban Forest Residues within Fort Collins, Loveland and Greeley, Colorado, 2008. Kendra Nash, CSU

- Chips for biomass fueled boilers for heating facilities
- BioChar
- Slabs
- Rough cut lumber
- Hardwood flooring
- Landscape timbers
- Blanks
- Wood stakes
- Wood pellets

The feasibility for each option will be explored in more depth during the Urban Forest Strategic Plan process.

J. Private Tree Enforcement

Existing city code, B.R.C. Chapter 6 Protection of Trees and Plants, 6-6-2 Removal of Dead, Diseased or Dangerous Trees, allows city staff to conduct enforcement efforts on private property regarding infested, diseased and/or dangerous trees. In the summer, Forestry staff surveys all city parks, streets, and alleys to identify diseased and dangerous trees on both public and private property. Over the past five years, staff has cited an average of 20 property owners for diseased trees and 25 property owners for dangerous trees threatening public property. In these instances, Forestry staff initiates the compliance case and makes the first notification via certified letter. For non-compliance cases, Forestry staff works with Boulder Police Department (BPD) and the City Attorney's Office (CAO) to obtain an administrative warrant from the court before a tree care contractor may enter onto private property to remove the diseased or dangerous tree. Tree removal costs are then charged back to the property owner.

<u>Current Response</u>
Research from the Midwest indicates that active enforcement for EAB infested trees does not substantially slow the progression of the pest due to the inability to keep up with progressively larger numbers of dying ash trees as the EAB population grows. Due to this research and the growing number of infested ash trees, Forestry staff has not conducted enforcement activities for EAB infested trees on private property.

<u>Long Term</u>
Research indicates that ash trees killed by EAB dry out and start to fail within a few years after tree mortality posing a public safety risk. Discussions with the City Attorney's office (CAO), Risk Management, and Boulder Police Department (BPD), indicate the city has a duty to enforce city regulations for dead ash trees located on private property but have the potential to threaten public property. Forestry staff, in cooperation with BPD and CAO, proposes to enforce removal of dead ash trees as needed. It is anticipated that current staffing levels will not be sufficient to support enforcement efforts as EAB reaches its peak. The city is not proposing to implement enforce efforts on private property where the trees only pose a threat to neighboring private property.

K. Collaborative Research Projects

Colorado is the westernmost state with EAB. Here, the weather patterns and ash tree growth differ from the Midwest where most EAB research has occurred to date. Several research projects are underway in Boulder. Some were initiated by Forestry staff while others are in collaboration with CSU, APHIS or the CFS. Current and past EAB projects include:

- In 2014, assisted the CFS with a project to test a new EAB pheromone.
- In 2014, assisted APHIS with testing new EAB trapping protocols.
- In 2014 and 2015, Forestry staff tested the viability of insect degree day models to predict emergence of EAB in Colorado.
- Research into effects of wounding from trunk injected pesticides on ash trees in Colorado at Columbia Cemetery (ash trees grow more slowly in Colorado and receive less rainfall than in Midwest so wounding may have bigger impact than elsewhere in US).
- Research to determine feasibility of multi-year control with TreeAzin.
- Research to determine feasibility of longer term control with different formulations of emamectin benzoate pesticide products (at Flatirons Golf Course).
- CSU plans to measure amounts of certain pesticide products in ash leaves and pollen to determine potential impacts to non-target organisms.

L. Urban Forest Strategic Plan

EAB is anticipated to cause a loss of approximately 15% of Boulder's urban tree canopy over the next 5-15 years and will have a significant impact on the many environmental, aesthetic, and economic benefits provided by the urban tree canopy. However, EAB is not the only threat to Boulder's urban forest. Other invasive insect and disease pests threaten the urban tree canopy as do individual severe weather events and overall climate change.

The inevitable loss of ash trees also provides an opportunity to replace impacted trees with species that will be well suited to the hotter local conditions now expected as a result of climate change. Many EAB-related factors such as tree diversity, pesticide use, and wood utilization are also not unique to EAB and are applicable for other tree species and pests. Therefore, instead of developing an EAB-specific Management Plan for the city, over the next year, Forestry staff will work with a consultant to develop a broader Urban Forest Strategic Plan that will include long term management for invasive pests including EAB.

The Urban Forest Strategic Plan will also allow for a more comprehensive community-wide discussion of the following topics:

- Establishment of a baseline figure for urban tree canopy and long term canopy goals;
- Tree diversification goals;
- Urban heat island mitigation;
- Prioritization of tree planting activities;
- Pesticide use guidelines for public trees;

- Appropriate pesticide use guidelines for private property owners treating public street trees;
- Placement and selection of tree species that are compatible with optimizing rooftop solar capture capacity;
- Coordination with vegetation management for municipalization of the electric utility;
- Public outreach and education regarding the benefits of the urban canopy; and
- Reforestation of creek corridors with native species.

Tree Inventory

The first step towards an Urban Forest Strategic Plan is to identify the existing public tree resource. In winter 2014 -2015, Forestry staff contracted with Davey Resource Group to update the tree inventory. The data was then imported into tree inventory and asset management software to track not only EAB related maintenance but all tree maintenance for public trees in city parks and in street rights-of-way. Tree benefit and value information in the background section of this memo is from the draft 2015 Urban Forest Resource Analysis report from Davey Resource Group.

Urban Tree Canopy Assessment

To establish baseline figures for urban tree canopy and assist in long term planning, the city is participating in a collaborative Urban Tree Analysis project with Digital Globe and Trimble, partners of the Rockefeller Foundation's 100 Resilient Cities (100RC) initiative.

This project includes two tiers:

1. The first is an effort to understand the nature of the urban tree canopy through the use of Digital Globe (DG) and Trimble's 100RC Platform Partner services offerings. DG will provide high resolution satellite imagery to feed into Trimble's eCognition Essentials software to yield information about urban tree canopy and land use. The software will help map urban tree cover: where it is, where it is damaged and where it can be strengthened, and is a critical step towards the development of an Urban Forest Strategic Plan. Additional benefits may accrue from multi-spectral imagery that will assess individual tree species and health, providing additional forest management opportunities.
2. The second is more experimental and involves exporting the urban canopy assessment data into a 'Resilience Dashboard' pilot project in collaborative development between Trimble, the City of Boulder, 100RC and Socrata, a Seattle-based company that provides on-line solutions to local governments. The Dashboard as conceived is a highly interactive, continuously updated visual display of trends and metrics, many of which can be user driven. The metrics and trends developed through the pilot project can be used in the city's current dashboard effort, or the opportunity may exist to expand the pilot effort in conjunction with other city departments.

VII. BUDGET AND STAFFING

The Parks and Recreation Department's approved 2015 CIP Budget included $230,000 for EAB response. Additionally, the Parks and Recreation Department's proposed 2016-2018 CIP Budget includes $220,000 annually for EAB response.

Planting

The Forestry Division's goal is to plant 500 trees annually. Some trees will be planted by in-house Forestry staff and the remaining trees by contracted services. This year, 300 trees have been planted by in-house staff and 280 via contracted services but as the number of EAB contracted removals increases, the number of trees planted by contracted services is also expected to increase. In 2014, the costs to plant 580 trees (300 with in-house staff and 280 via contractor) was $169,897. Funding for tree plantings is allocated from three sources:

- Tree Planting account
- Tree Mitigation Funding
- EAB Parks and Recreation CIP

Tree Removals

Using tree removal cost averages from the past 10 years, the estimated contracted removal costs for the 4,500 untreated public ash trees is expected to equal approximately $1.64 million. Costs may be reduced if private property owners choose to treat additional significant public trees and/or an additional Forestry seasonal crew is hired to remove smaller diameter (trees <8" diameter). Depending upon how successful the city strategy is to slow EAB spread, the costs may be distributed as follows:

- $274,000/year over 6 years
- $205,000/year over 8 years
- $164,000/year over 10 years

Pesticide Applications

Pesticide applications are only needed every three years; the strategy is to treat 1/3 of the 25% of public trees annually with TREE-äge:

Total cost = $150,000
Annual cost $50,000

Wood Disposal

Wood disposal costs are variable depending upon success of the existing biomass agreement with Boulder County and viability of other utilization options.

Forestry Staff Resources

Discussions with staff from cities in the Midwest indicate a need to prioritize EAB over other forestry related work, due to the large number of trees that will be impacted over the next decade, the documented rate at which EAB populations build and kill trees, and the potential liability from the large number of standing dead ash trees. It is expected that over the next decade, city Forestry services will be impacted and deferred maintenance will become an issue as staff time is directed to EAB management and control. The department will continue to evaluate Forestry Division staffing levels and supplement resources over time to ensure continuation of existing city forestry-related service levels.

VIII. CONCLUSION

Ash is one of the most abundant tree species in urban areas across Colorado including 12% of the city's park and street rights-of-way trees.[7] Assuming a similar percent of ash on private property, the estimated number of public, private and naturalized ash in Boulder is over 70,000 trees. Over the next 15 years, proposed EAB management will have a significant direct budgetary impact, especially to city residents as the majority of ash trees are located on private property. The loss of approximately 15% of the urban tree canopy will have considerable long term economic, social, and environmental impacts.

EAB may well represent the worst-case scenario in terms of invasive forest insect pests for Colorado communities due to the mortality of susceptible hosts, the scale of infestation, the difficulty in detection, and the speed of infestation within the community. Management of EAB on a citywide scale therefore requires an aggressive yet balanced approach. The proposed Parks and Recreation Forestry EAB long term plan includes proactive, continuous community outreach and a balance between tree removal and replacement and pesticide treatments to significant ash trees. If the Boulder strategy is successful, the tree removals and associated costs may be spread out over a longer period of time. Forestry staff will also continue to study the most environmentally sustainable options for urban wood utilization.

EAB and the inevitable loss of many of the community's ash trees has provided the city with an opportunity to create a more diverse urban forest over the long term through the development of a broader scope Urban Forest Strategic Plan.

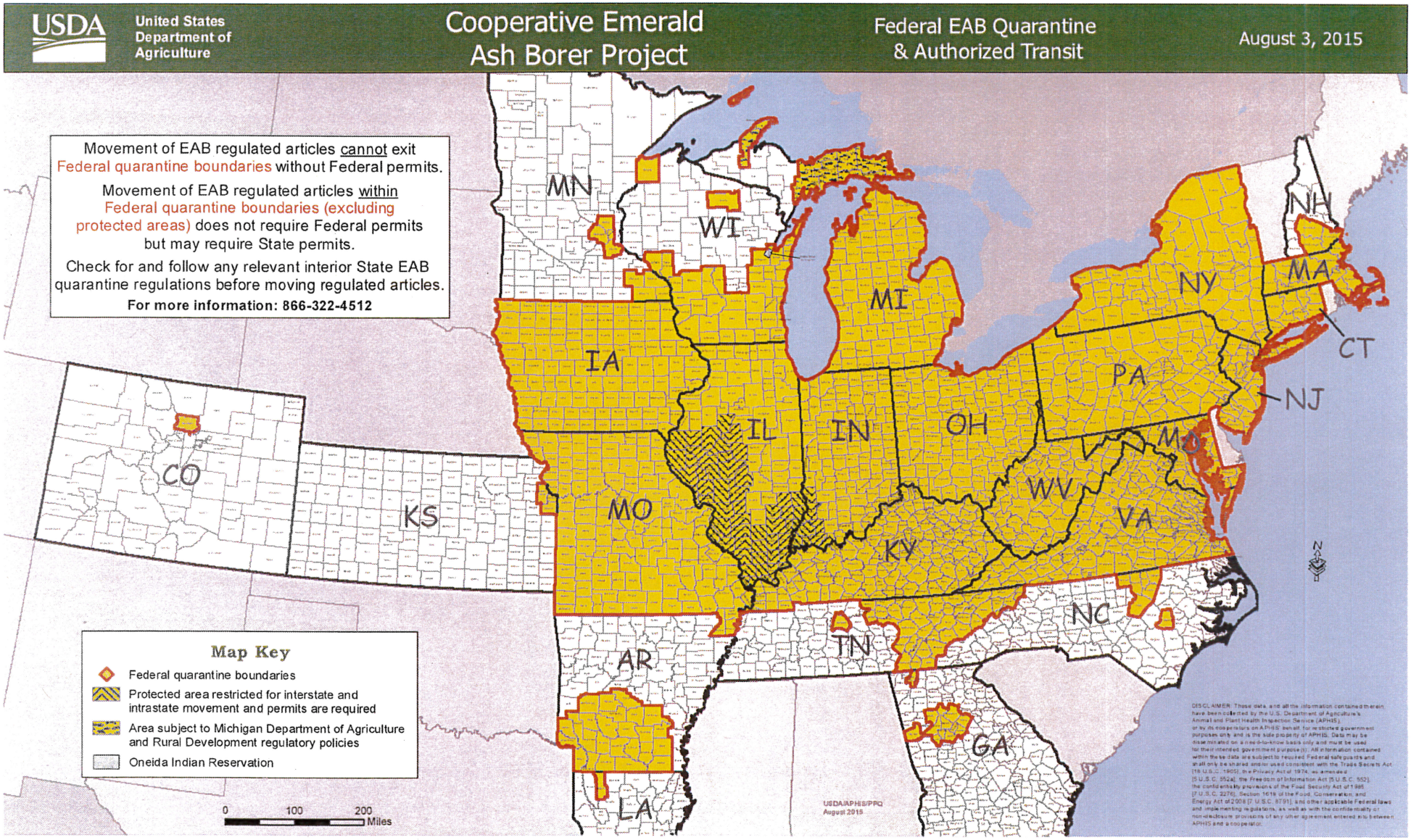
Attachments:
Attachment A – Municipal Emerald Ash Borer Benchmark Chart
Attachment B – Cooperative Emerald Ash Borer Project - Federal EAB Quarantine and Authorized Transit
Attachment C – Colorado Department of Agriculture Emerald Ash Borer Quarantine
Attachment D – City of Boulder Emerald Ash Borer Detection
Attachment E – City of Boulder Public Ash Tree Treatments 2014-2015
Attachment F – Links for additional information on Emerald Ash Borer

[7] Urban Forest Resource Analysis, Boulder, Colorado, 2015; Davey Resource Group

Municipal Emerald Ash Borer Benchmark Chart

Attachment A

City	Scale	Treatment Plan (public trees)	Public Awareness Efforts					Disposal practices
			City Website	Public Service announcemets & Media Releases	Door Hangings/Fliers/Signage in town	Toll-free phone line	Informational workshops	
Milwaukee, Wisconsin (detected in July, 2012)	•~ 33,000 ash on public streets •~587,000 ash trees at risk in Milwaukee (17% of all trees in state)	• Treat 80% (27,000 trees) of public ash street trees • Only treat trees > 8" diameter (2 yr rotation - 50% annually) while transitioning to alternative species		✓	✓			• No public information
Kansas City, Missouri (detected in July, 2012)	• ~20,000 public ash • 400,000 private ash • 4.6 million+ ash in Greater Kansas City's nine county region	• Partial treatment and removal • Continued monitoring • Replace lost tree canopy	✓	✓	✓	✓	✓	• Two disposal sites for residents and local businesses • Develop new disposal site, operated as public/private partnership
Des Moines, Iowa (detected in November, 2013)	• 47,000 public ash • ~ 100k-120k private ash	• Treat 45% (14,000 trees) of 'high impact' public street and park ash trees • Removal of large ash w/ poor structure and most small ash • Remove 6,000 public ash not suitable for treatment over next 6 years • Plant replacement trees	✓	✓	✓		✓	• Temporarily disposing at city marshalling yards • Final solution uses MWA Compost Center and/or landfill
Madison, Wisconsin (detected in November, 2013)	• 21,700 ash street trees, estimated 30,000 ash in parks and many thousands more on private property	• Treat 50% (10,000 trees) of public ash street trees • Only treat trees >10" diameter in good condition • Preemptively remove street trees in poor condition or under power lines • Replace removed trees	✓ very extensive 'Homeowner's toolkit online	✓	✓			• Residents have option of free wood drop off at city recycling center; keeping wood at home for wood or mulch or work with certified arborist to properly dispose of material • The Sawmill Project: The Streets Division received grant from the Wisconsin Department of Natural Resources to lease portable sawmill – for two years, the City of Madison will work with Dane County and other interested municipalities on testing market for lumber made from urban trees, including those that are removed due to the EAB
Loveland, Colorado (not offically detected yet)	• 800 city park ash trees	• Preemptively remove very young and old ash • Identify heritage trees to treat and preserve • Removal and replacement are one process; if they can't replace they won't remove		✓				N/A
Boulder, Colorado (detected in September, 2013)	• 6,000 public ash street and park trees • Estimated 70,000+ private and naturalized ash • More than 1.45 million ash in metro Denver area	• Treat 25% (1500 trees) of significant public ash; 500/year on 3 yr rotation) • Only treat ash > 10" diameter • Proactively removing ash in poor condition • Remove remaining 4,500 public ash as they get infested • Plant replacement trees	✓	✓	✓		✓	• All chips and logs from public trees brought back to city Forestry wood lot; desirable species milled or chipped and utilized for biomass via Boulder County MOU; larger stumps tub ground into mulch for city use • For private tree removals, residents have option of keeping wood or mulch at home or work with licensed certified arborists to properly dispose of material (each company different); residents may also bundle branches for curbside compost or particpate in yard waste drop off for wood < 6" diameter


USDA
United States Department of Agriculture
Cooperative Emerald Ash Borer Project
Federal EAB Quarantine & Authorized Transit
August 3, 2015
Movement of EAB regulated articles cannot exit Federal quarantine boundaries without Federal permits.
Movement of EAB regulated articles within Federal quarantine boundaries (excluding protected areas) does not require Federal permits but may require State permits.
Check for and follow any relevant interior State EAB quarantine regulations before moving regulated articles.
For more information: 866-322-4512
MN
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KY
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CO
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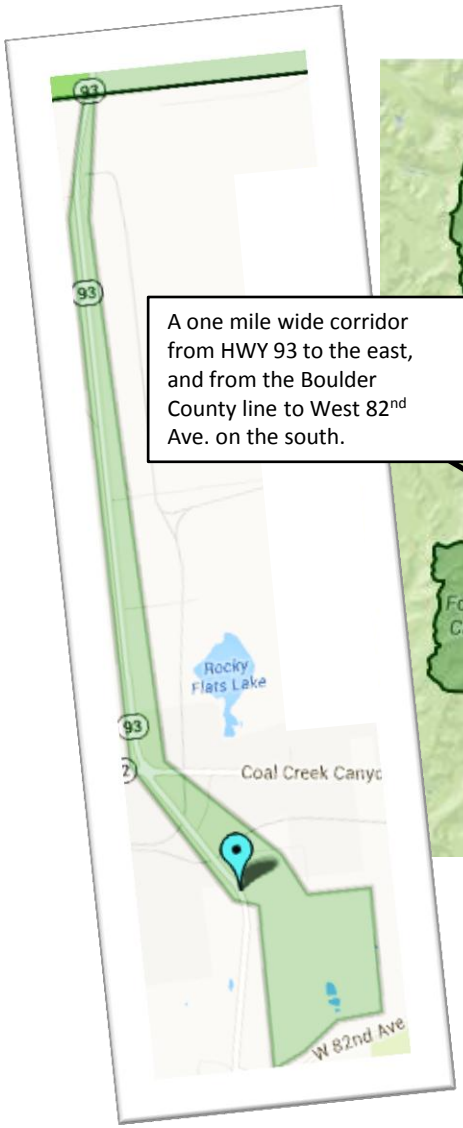
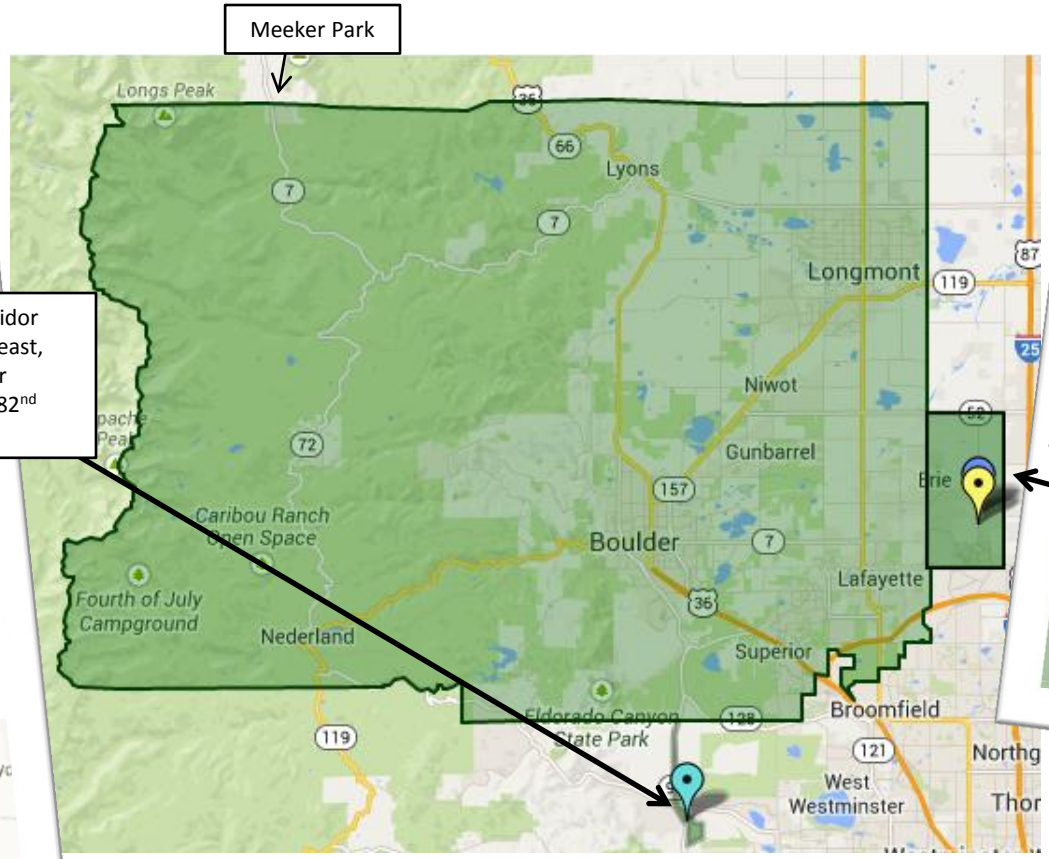
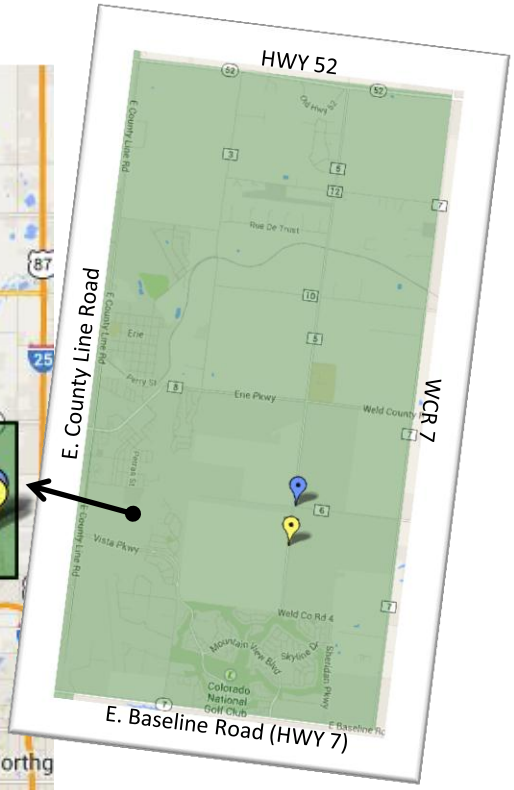
Map Key
Federal quarantine boundaries
Protected area restricted for interstate and intrastate movement and permits are required
Area subject to Michigan Department of Agriculture and Rural Development regulatory policies
Oneida Indian Reservation
0 100 200 Miles
USDA/APHIS/PPQ August 2015

Emerald Ash Borer Quarantine



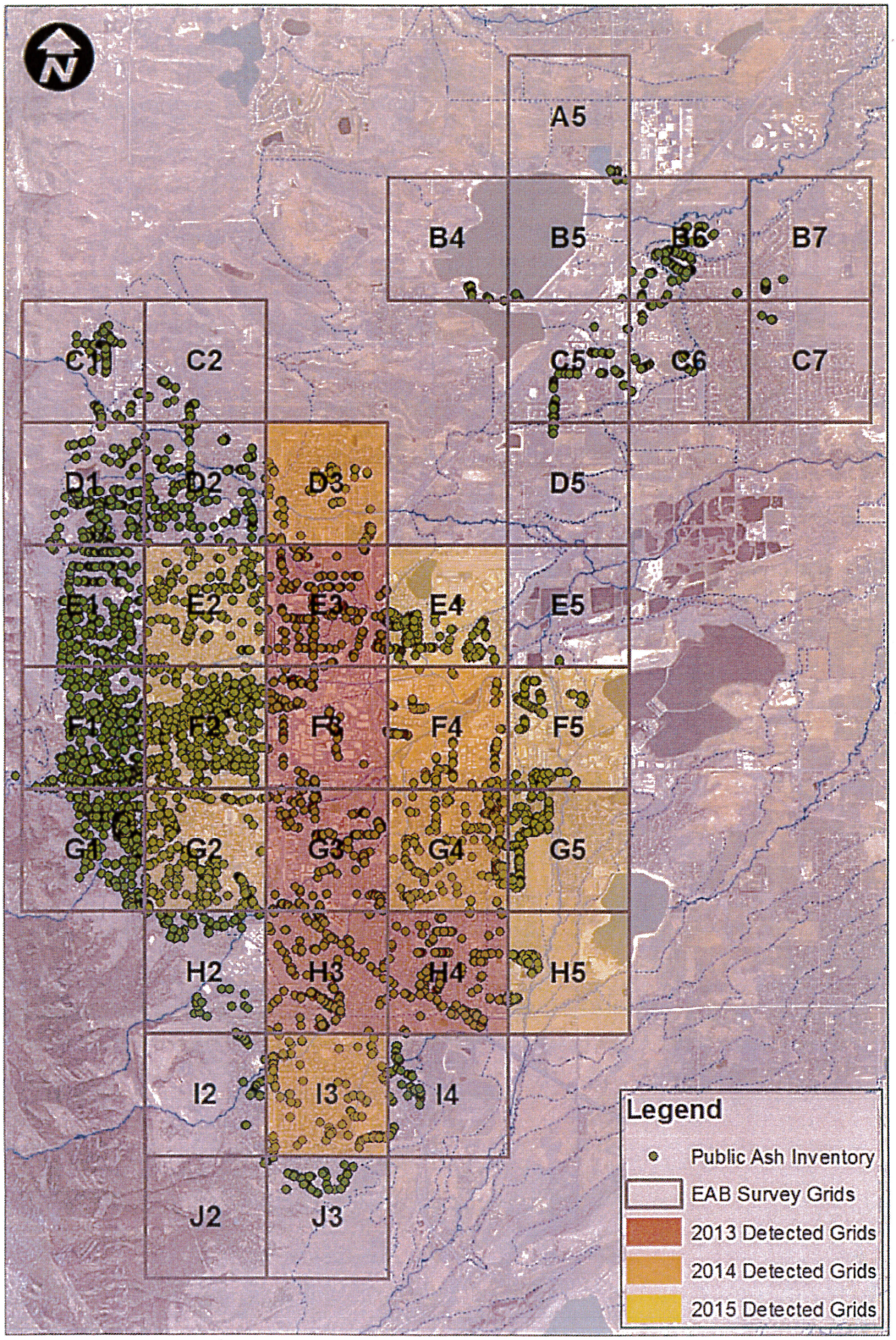
A one mile wide corridor from HWY 93 to the east, and from the Boulder County line to West 82nd Ave. on the south.





- Quarantine Area
- Denver Regional Landfill
- Republic Services Inc
- Front Range Landfill

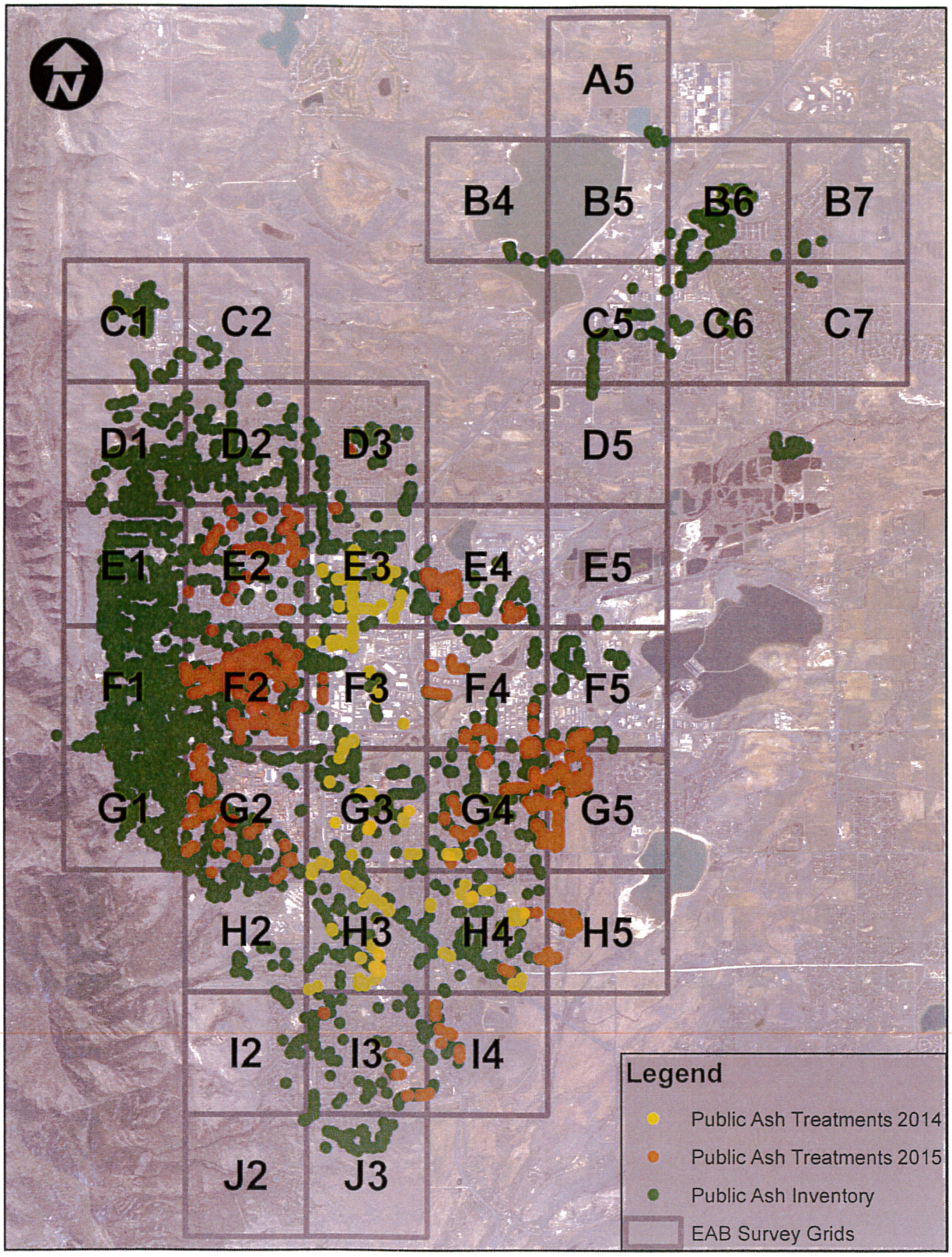
City of Boulder
Emerald Ash Borer Detection



City of Boulder, Forestry Division
5200 Pearl St
Boulder, CO 80301
Author: Kendra Nash
August 3, 2015

0 0.325 0.65 1.3 1.95 2.6 Miles

City of Boulder Public Ash Tree Treatments 2014-2015



City of Boulder, Forestry Division
Boulder, Colorado
Author: Kendra Nash
August 27, 2015

0 0.5 1 2 3 4 Miles

Links for additional information on Emerald Ash Borer

City of Boulder EAB website:
www.EABBoulder.org

Colorado EAB Response Team website (hosted by Colorado Department of Agriculture):
www.EABColorado.com

National EAB website:
www.emeraldashborer.info

Detection of emerald ash borer in urban environments using branch sampling. Canadian Forest Service - Sault Ste. Marie Technical Note No. 111. K.L. Ryall, J.G. Fidgen, J.J. Turgeon
http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/32127.pdf

Questions and Answers: USDA's Emerald Ash Borer Biocontrol Program
http://www.aphis.usda.gov/publications/plant_health/2014/faq_eab_biocontrol.pdf