



EMERALD ASH BORER MANAGEMENT PLAN

March 2014



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1. Background

The City of Owen Sound is gifted with many wooded areas, parks, green spaces and tree-lined streets, which collectively form the City's "urban forest." The urban forest is a vital component of this City's green infrastructure.

Ash (*Fraxinus* sp.) trees are an important native tree species, which are relatively fast growing and are a significant species in Southern Ontario. Historically Ash has been a dominant species and dominates many woodlots, farm hedge rows, and areas adjacent to rivers and streams. The growth habit and adaptability of the Ash tree made it a popular species for planting in many urban centres across the country, following the decline of American/White Elm (*Ulmus americana*) from Dutch Elm Disease.

The biodiversity of our world is threatened by a number of factors. The most important being the loss of habitat from development, agriculture, and deforestation. The second greatest threat, according to the Ontario Ministry of Natural Resources (OMNR), is from invasive species. Owen Sound faces a threat to its urban forest by the exotic invasive pest Emerald Ash Borer (EAB). EAB, to date, is responsible for the death of tens of millions of Ash trees in the USA and Southern Ontario. EAB is acknowledged to be the single most destructive forest pest in the history of North America, surpassing the devastation resulting from Dutch Elm Disease. In 2012 Time magazine placed the Emerald Ash Borer (EAB) on its "Top10 List of Evil Animals."

EAB, first discovered in Ontario in 2002, in the City of Windsor, has since been positively identified in most other municipalities along the 401 corridor, all the way to Montreal. According to the Canadian Food Inspection Agency, EAB spread through Southern Ontario at an average rate of 40 km per year, from west to east. In 2012, EAB was confirmed in 27 Ontario Counties by the Canadian Food Inspection Agency. In 2013 EAB was confirmed in a rural area of the Municipality of Meaford. This discovery placed a confirmed outbreak within 25 kilometres of Owen Sound's eastern boundary. On April 1, 2014, the Canadian Food Inspection Agency will consolidate most of the regulated areas into one large area in Ontario and Quebec. This large area will include Highways 400, 401, 416 and 417 in Ontario and Highways 15, 20, 40 and 50 in Quebec.

The City of Owen Sound has an estimated 600 Ash trees growing on City streets and right of ways. Additionally, it is estimated that there are in excess of 7500 Ash trees growing in the City's parks and open spaces. Ash represents a large percentage of the City's total urban forest canopy and which, until recently was a popular choice for street plantings and on private properties.

Although, as of the date of this report, EAB has not been detected in Owen Sound, it is likely already here at population levels presently too low to be

detected. The threat to the longevity of Ash trees in the Ontario landscape has been known for a several years and for that reason, the City has suspended the planting of Ash trees since the fall of 2007.



EAB infested Ash tree. Photo courtesy of CFIA.

Since 2007, members of the City of Owen Sound Parks and Open Space Division have, participated in numerous workshops and attended meetings offered by the CFIA and other agencies, regarding the detection of this invasive insect. Staff have gained knowledge on this invasive pest from the experiences of staff from other municipalities that willingly shared their plans and accomplishments on this environmental issue. The lessons learned by municipalities infected with this pest and the development of the Canadian Forest Service Ash Protection Model, support a proactive approach to treating Ash trees as being both economically feasible and the best method for management of EAB. Populations of EAB increase exponentially over time so therefore a proactive plan is recommended, which through a combination of strategies including; monitoring, treatment, removals and replacement will;

1. Ensure selective ash tree protection
2. Preserve environmental benefits and
3. Maintain public safety.

The proposed Emerald Ash Borer Management Plan that will guide the City over the next 10 years includes:

- Inventory, Monitoring and Assessment;
- Treatments;
- Tree Removals;
- Tree Planting;
- Wood Waste Disposal; and
- Public Education and Communication.

The cost for EAB monitoring (including inventory, assessment and public education) is difficult to estimate without an inventory; however \$30,000.00 has been committed to EAB management in the 2014 Capital Budget. Costs will increase significantly over the next 5 – 10 years with the long-term costs estimated to be greater than \$1,000,000.00, based on the experience of Ontario municipalities dealing with infestations.

2. Introduction

Protection of the City's urban forest depends on continued management of the City's tree canopy through maintenance, removal, planting, and pest management programs.

EAB is a non-native, invasive insect, which attacks and eventually kills healthy Ash trees. EAB has no natural predators in Ontario, which places all *Fraxinus* species, at risk. Despite extensive research and implementation of numerous control efforts, EAB continues to spread throughout the province of Ontario and into Quebec. It has been proven that the principal mechanism of the rapid spread of EAB has been through the movement and transport of infested wood materials, the most common source being firewood. Initial efforts to eliminate this pest were not effective. According to the CFIA the only option now is to manage the impact of EAB infestations. EAB's devastation is significantly affecting the health and biodiversity of Ontario's rural and urban forests.

The potential for a large scale loss of Ash trees means Owen Sound will need to carefully consider the environmental and aesthetic impact EAB will have on the City. Replacement of the Ash component of the City's urban forest with alternative species of trees will be critical to maintaining canopy cover and the many environmental, social and economic benefits that trees provide to the City and environs.

2.1 Biology of Pest

Emerald ash borer adults are metallic green, 8.5 to 13.5 mm long, and slender. The head is flattened, with black compound eyes that cover most of the side of the head. Short antennae extend from the face, then curve back

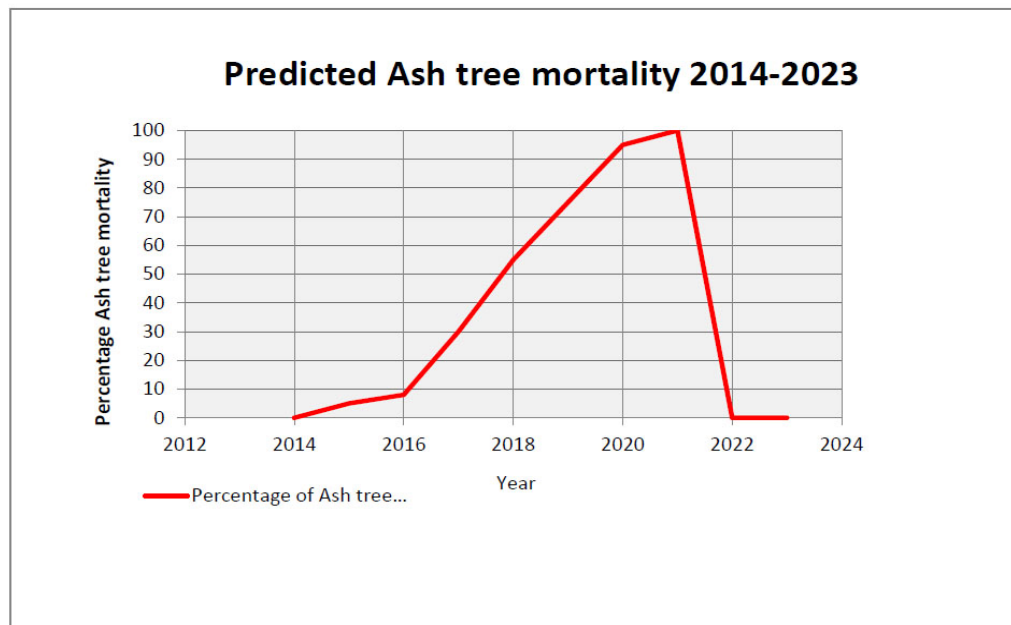
to just past the eyes. The upper side of the abdomen is copper to purplish, and is visible when the wings are open.

Eggs, which are laid on the bark of the tree, are light yellow or cream-coloured, turning yellow-brown prior to hatching. They are approximately 1mm long and 0.6 mm in diameter, and are very difficult to spot on the tree. The larvae bore through the bark and feed on the vascular (inner) tissues, disrupting the flow of moisture and nutrients for approximately a full season.

2.2 Mortality

Experience and research have revealed EAB populations increase exponentially over a 5-10 year period. The rate of dieback is slow in the first 2-3 years with an exponential increase in years 4-8; gradually leveling off as the Ash populations and available food source diminish. The City will need to establish the best way to not only manage, but also compensate for the eventual losses caused by population decreases. Chart 1 represents the estimated rate of decline of Ash trees in Owen Sound, with the assumption the insect is confirmed in the City in 2014.

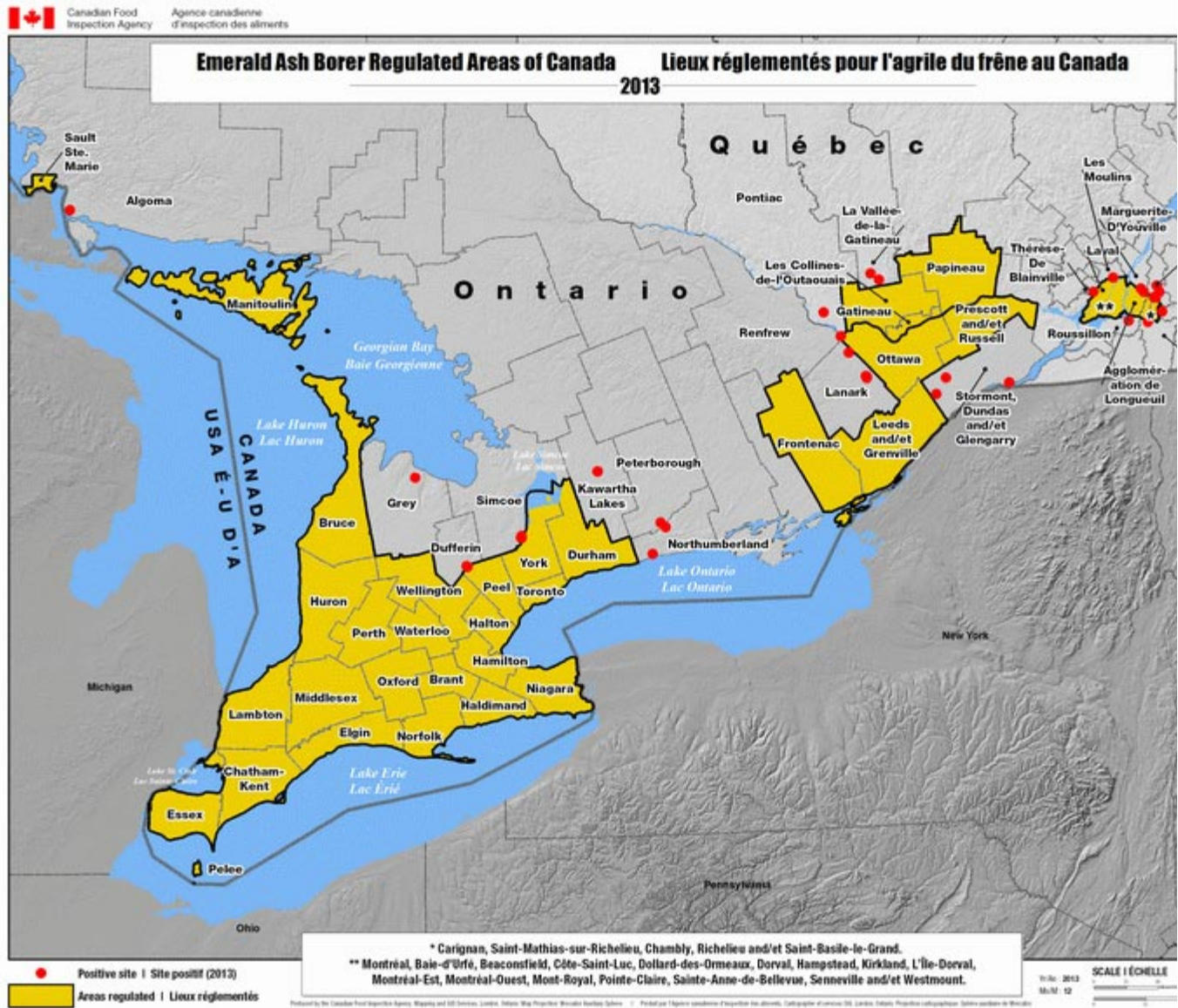
Chart 1: Predicted Ash Tree Mortality Following EAB infection



2.3 Regulation of Pest

The Federal Government's Canadian Food Inspection Agency (CFIA) has been responsible for the regulation of EAB since its detection. CFIA, under the authority of the Plant Protection Act, established regulated areas in those counties and municipalities where EAB has been confirmed in an attempt to stop the spread of this pest. Considering the wide spread of the insect, as of April 2014 CFIA will no longer consider EAB a quarantinable pest in Southern Ontario. (See Appendix B - attached for background on CFIA's proposed changes.)

Map 1: Emerald Ash Borer regulated Areas of Canada (Canadian Food Inspection Agency 2013) Areas regulated by Ministerial Order shown in yellow.



3. Roles and Responsibilities

Every level of government, municipal, county/region, provincial and federal, as well as private property owners, must be responsible for the management of EAB.

3.1 Federal Government

The Canadian Food Inspection Agency (CFIA) is the federal agency responsible for regulating introduced Forestry or Agriculture pests. Federal

regulatory measures prohibit the movement of any Ash tree materials and firewood of all ash species to areas not yet impacted.

CFIA has established a multi-agency approach involving the Ontario Ministry of Natural Resources (OMNR), Canadian Forest Service and the Ontario Ministry of Agriculture and Food and Rural Affairs. Conservation Authorities and many other groups, agencies and associations are also being consulted to ensure an effective, comprehensive approach.

Starting in April 2013, the CFIA commenced a one year transition approach that will lead towards implementation of the selected option by April 1, 2014. For more details please refer to Appendix B attached.

3.2 Provincial Government

The OMNR facilitates research on forest health through the work of scientists at the Ministry's Ontario Forest Research Institute. Forest health management includes control programs, research, expert advice, education and knowledge transfer, development of pest control methods and products, policy development and implementation, development of best practices and their inclusion in forest management activities and interagency collaboration.

3.3 County, Regional and Local Municipalities

Upon detection of EAB it is the responsibility of the municipalities to monitor and manage the pest with their own resources. At the time of this report none of the municipalities within Grey and Bruce Counties have EAB Management Plans in place.

3.4 Private Property Owners

Property owners are responsible for all trees on their own property which includes maintenance, treatment and removal. Costs for removal of Ash on private properties will be expensive, with costs depending on their size and location. The Minimum Property Standards By-Law of the Municipal Code, Chapter 611.3.34 states that property is to be maintained in a safe condition, which includes removal of dead or decayed trees or branches. Ash trees infected by EAB become dry and brittle in a relatively short period of time following death of the trees, making them a liability that needs to be dealt with in a timely manner.

Public education and communication is essential in assisting the public with identification of EAB and recommending actions residents can take, such as treatments and/or the selection and planting of different species of trees before or after ash tree removal. This proactive step for private lands will greatly assist in preserving the City's urban tree canopy.

4. Impacts of EAB

Trees are an important part of the green infrastructure of the City, consequently widespread loss of Ash trees from the urban forests and residential landscapes will have devastating economic, environmental and social impacts. These impacts include the costs of implementing a management plan, the loss of tree canopy and the often overlooked costs associated with the environmental and social value of trees.

The urban forest is an important asset that requires care, preservation, and maintenance. Invasive species like EAB threaten the health of our forests and tree canopy. Retaining and maintaining the existing urban forest maintains property values, has a positive impact on tourism and improves the quality of life within the urban environment.

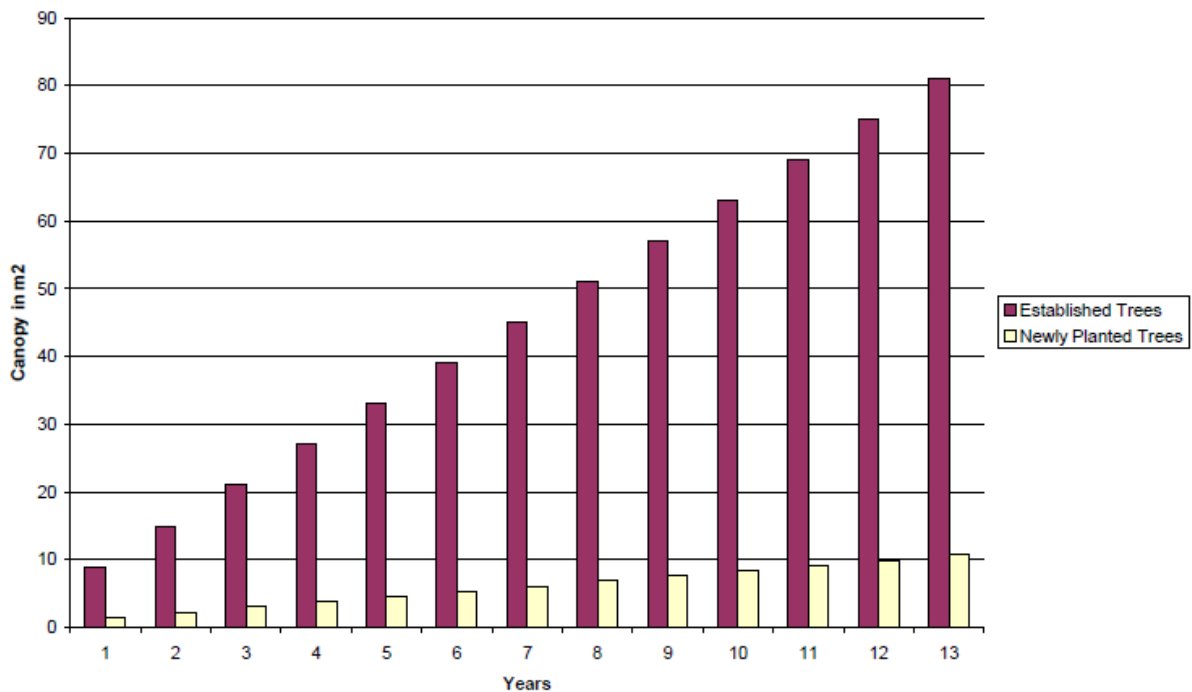
4.1 Environmental Impacts

All trees are beneficial to the environment:

- Trees influence thermal comfort, energy use, and air quality by providing shade, transpiring moisture, and reducing wind speeds.
- Trees improve air quality by lowering air temperatures and removing air pollutants through their leaves.
- Trees and other plants are a valuable supply of oxygen and absorb carbon dioxide and other gases.
- Trees can affect climate change by directly storing carbon within their tissues and by reducing carbon emissions from fossil fuelled power generation plants by lowering building energy use.
- Trees improve water quality and reduce the need for costly storm water treatment by intercepting and retaining or slowing the flows of precipitation.
- Trees and other plants help remediate soils at landfills and other contaminated sites by absorbing, transforming, and containing a number of contaminants.

The loss of Ash species will negatively affect the environment through the reduction of the urban tree canopy.

Chart 3: Tree Canopy Area
for Established Trees vs Newly Planted Trees



4.2 Economic Impacts

Trees in the urban environment increase property values and have important commercial benefits including tourism.

Two recent studies completed by Natural Resources Canada, Canadian Forest Service and Great Lakes Forestry Centre, used current data to summarize the costs associated with EAB and developed an economic model that supports a proactive management approach to EAB.

“Estimates of the Potential Cost of Emerald Ash Borer in Canadian Municipalities,” (McKenney, D.W., Pedlar, J.H., Lyons, D.B., Campbell, K., and Lawrence, K. 2012. *Journal of Arboriculture and Urban Forestry*) estimated EAB will cause an economic impact between \$0.5 and \$1 billion over the next 30 years through the loss of street trees in Canadian municipalities alone. The study estimated costs for EAB pesticide treatments at \$138 per tree together with community overhead costs of \$0.40 per household for activities related to increased staffing, public education and communication, wood waste, etc. Based on the preceding information treatment of Ash trees on City of Owen Sound roadways could equal \$83,800.00 and for parks \$1,035,000.00 per treatment.

The study shows that slowing the spread through treatments reduces the overall costs.

“To Treat or Remove: an Economic Model to Assist in Deciding the Fate of Ash Trees Threatened by Emerald Ash Borer”

(2012, McKenney, D.W., and Pedlar, J.H. *Journal of Arboriculture & Urban Forestry*, 38(4):121-129) concluded it would take 10 years of EAB treatment to equal the cost to remove and replace a medium-sized ash tree. However when including all the benefits of a medium-sized ash tree it would take 20 years of EAB treatment to equal the cost to remove and replace that tree.

These numbers do not take into consideration recognized tree benefits such as increased property values, energy savings, carbon sequestration and pollution and runoff reduction gained with maintaining the existing tree canopy.

The significance of the overall economic impact has been recognized by a growing number of municipalities and non-governmental organizations. A resolution, forwarded to the Association of Municipalities of Ontario, seeks funding support from both provincial and federal sources. The intent is for the upper levels of government to establish an urban forestry mandate, which would assist municipalities in dealing with EAB and other invasive pests, such as the Asian Long Horned Beetle. To date no provincial or federal funding is available to cover the costs associated with EAB management and control. Canadian Forest Service (CFS) scientists estimate that costs for treatment, removal and replacement of trees affected by emerald ash borer in Canadian municipalities may reach \$2 billion over a 30-year period.

4.3 Social Impacts

The social impacts of EAB will be measured primarily in the loss of environmental benefits and aesthetics to the community. Impacts will be greater in some areas as trees quickly die and are removed. A decline in property values could also result in areas that high numbers of Ash are removed.

Kuo, F.E., and W.C. Sullivan. 2001. “Environment and Crime in the Inner City: Does Vegetation Reduce Crime?” *Environment and Behavior* 33, 3:343-367 states a direct correlation between the decline in the quality of life and increases in crime in communities with fewer trees. A recent observational study in the United States indicated tree loss from the spread of the Emerald Ash Borer was associated with increased mortality related to cardiovascular and lower-respiratory systems.

Established benefits attributed to trees, such as carbon sequestration and storage, air filtering, cooling/shading, storm water interception and increases in property values related to the Ash tree population of the urban forest are calculable. Based on the “National Tree Benefit Calculator” developed in the

United States, (<http://www.itreetools.org/>) the approximate **annual** benefit derived from each 35cm diameter (14 inch) Ash street tree is approximately \$138 per year. A park tree of the same size contributes approximately \$110 in benefits per year. Therefore, in Owen Sound, the estimated economic benefit of all of the ash trees in the right-of-way alone is likely to be around \$82,800.00 per year. Combined with the estimated numbers of trees in parks and open spaces the total **annual** benefit of ash trees to the City based on an average diameter of 35 cm is estimated to be \$907,800.00.

4.4 Wood Utilization and Disposal

With the brush and wood generated as a result of the EAB infestations, there will be a need for an increase in the number of wood waste disposal options, for both public and private properties. Plans need to be made, based on the impending increased needs of residents, to ensure every disposal option available is explored.

The City of Owen Sound does not provide curb side collection of leaf and yard waste for its residents. Residents and contractors are expected to drop off garden and yard waste, including brush and branches, at the City's Compost Yard located on 28th Avenue East. Loads delivered to the Miller Waste Transfer Depot will be subject to waste disposal charges based on the weight of the material disposed. Neither of these programs is intended to deal with the volume of wood waste that will result from tree removal as a result of EAB infestations. As part of the EAB management plan, staff will investigate possible use of the wood waste as a commodity.

The tree inventory will include a condition assessment and will identify trees which are in poor health or condition. They may have areas of decay, diseased or dead wood, or poor branch or trunk structure. There is also a danger that some may contain metal hardware such as screws, nails or hooks, making them unacceptable for milling into lumber. However, logging potential should be considered. The primary use for the Ash wood will probably be as firewood, which could lead to infested wood being transported to uninfested areas outside those presently under regulation, and therefore not an ideal option. Grinding and/or chipping of wood unsuitable for milling should be considered.

Chatham-Kent was one of the first municipalities, east of Windsor, to see the results of the EAB in Ontario. In partnership with an architectural firm they incorporated salvaged local Ash into the redesign of the Kingston Park Pavilion, which won a Wood Works Award for excellence in wood building in 2011. In Kingston Park, Ash wood, instead of going to an Ontario landfill, through this innovative approach was given a second life.

There are opportunities for homeowners and businesses to start using the fallen trees as an economic resource. The City of Toronto's Economic

Development and Culture Department has implemented an initiative, "Neighbourhood Wood," to encourage homeowners and commercial enterprise to salvage and re-use Toronto's valued local trees. A directory has been established to link homeowners and commercial enterprise to the companies that can provide services and make products from the urban wood when the need arises to remove a local tree.

Geoffrey Gibson, Green Sector Research Coordinator for the City of Toronto's Economic Development Department has stated; " The on-going devastation of the GTA's Ash trees is tragic, yet through salvaging and re-use, this part of our natural heritage can be saved and incorporated into buildings throughout the region to give us a stronger sense of place, to prevent our forests from going to landfill, and to bring us closer to our trees upon which we depend for a healthy and green urban environment."

Wood waste that is not suitable for other uses can be ground into landscape mulch using tub grinders that create a variety of mulch textures or wood fibres that can be added to other organics to create compost. The grinding and composting processes would destroy any EAB larvae under the bark of waste material. The City's composting program is not presently set up to handle this additional wood waste load. In fact, it is highly unlikely that the City would be able to compost the additional volume of EAB wood waste at the present Compost site.

A comprehensive disposal plan that includes Grey County as a minimum, and potentially neighbouring municipalities, should be considered to deal with the increasing volume of material.

4.5 Research

For the past few years' research has continued into a variety of chemical and biological treatments to assist in controlling EAB. Currently, one insecticide (a bio-pesticide), TreeAzin™ has gained full registration in Canada and has been proven effective for protection and treatment of the EAB larvae. The product is owned by the Canadian Forest Service and was developed in collaboration with BioForest Technologies Inc. It is a class 4 pesticide (least hazardous commercial class). The chemical is injected into the tree and distributed throughout the canopy, where it is claimed to provide up to 2 years protection from EAB.

Natural predators have recently been released in the United States and will likely spread into Ontario over the coming years. These natural predators take many years to assert themselves and will have no effect in Owen Sound within the 10 year period of the EAB management plan. Biological control is seen as the most effective longer-term solution to EAB. It is projected to take many years for predator populations to grow to significant levels to control EAB and will not prevent the loss of trees in Owen Sound in the short term.

The City of Owen Sound is in an excellent position to undertake strategic EAB management by drawing on current research and the experience of other municipalities. With developing research into biological control of EAB and the TreeAzin™ treated registration of more effective and cheaper chemicals, there is a good chance that the City of Owen Sound will be able to affordably protect and retain a significant percentage of its ash tree inventory.

4.6 Lessons Learned

When EAB was first detected in Windsor in 2002, it was hoped that by removing large swathes of trees, the insect would be contained. This strategy did not work, and EAB continued to spread easterly through Ontario. Windsor has stated that just a few Ash trees have survived the first wave of EAB.

Monitoring has been determined to be beneficial in identifying hot spots and the rate at which EAB is progressing within the municipality. Once these areas are found, a combination of treatments and removals reduce the spread of EAB by suppressing populations of the insect.

Photo 8: Left: Comparison of untreated (foreground vs. treated (background)



Photo courtesy of BioForest Technologies Inc.

Experience has proven that once visual symptoms are observed in the tree it is already heavily infested. The vascular system of heavily infested trees will be damaged to the extent they will not be able to move chemical treatments throughout the tree and will not adequately control the infestations. City of Windsor staff noted that trees, which showed minimal visual symptoms of EAB, treated with TreeAzin™, were able to recover with continued treatment. Municipalities that have treated with TreeAzin™, such as Oakville (from 2008 onwards), Toronto and Ottawa have had good results from the treatments.

5. EAB Management Plan

5.1 Purpose

The City of Owen Sound needs to develop an effective, responsible and financially viable approach to managing the spread of EAB. The development of any such plan should be directed by the following guiding principles:

- Ensure Public Safety and Minimize Liability
- Mitigate the Loss of Significant Ash Trees
- Maintain the City's Tree Canopy
- Provide Public Education and Awareness

This detailed EAB Management Plan is structured to preserve the City's urban forest, slow down the spread of EAB where possible and allow for the preservation of high value trees in order to allow more time for improved and/or other control measures to be introduced in the future.

An effective and efficient EAB Management Plan will include the following elements:

- Inventory, Monitoring and Assessment
- Treatments
- Tree and Stump Removal
- Tree Replacement (with a different species of tree)
- Wood Waste Disposal
- Public Education and Communication

5.2 Inventory, Monitoring & Assessment

Developing a tree inventory is the critical first step towards effectively managing EAB. Without an inventory of publicly-owned Ash trees in the right-of-way, public parks, open spaces, woodlots and forested areas, we will not know their location, distribution, size and condition. Without this information we will not know the City's potential risk exposure or be able to strategically manage the EAB outbreak. The work done to date involves limited sampling of Ash trees in sections of the right-of-way and some minimal sampling of Ash trees in parks and open spaces, allowing a valid but restricted appraisal of EAB impacts in the City. It will not, however, enable

selection of significant or high value Ash trees for preservation or prioritize removals or identify the geographic areas for particular focus.

Using the "Suitability Criteria for Treatment of Ash Trees" described in Appendix 'A' will help identify high value or significant trees that should be protected through treatment.

Another significant activity of this element is to undertake regular assessment and review of information gathered from monitoring, branch sampling, trapping and tree inventory to validate and amend further management actions.

Branch sampling involves the collection of branch samples within the Ash canopy and examination by removal of the bark. Once the bark is removed, EAB feeding galleries will be detected if the insect is, or has been present. This is a cost-effective early-warning detection system to identify and monitor the EAB infestation. Knowing the progress of infestation will assist in strategically managing EAB. Very limited branch sampling was undertaken, in Owen Sound to date.

Photos: Branch sampling for detection of EAB



An EAB trapping program is a basic way to determine if EAB adult beetles are in various areas of the City. In 2012 and 2013 the CFIA provided one trap each year to monitor for EAB in Harrison Park Campground, with no positive find of EAB. Traps were installed in a number of neighbouring areas. The limited resources of the CFIA mean that the City will have to supply and monitor many more additional traps to produce a reliable detection system.

Photos: EAB Trap and installation within Ash tree



Monitoring and assessment must also include a discussion on the strategy for managing trees on private property.

5.3 Treatment

High value and/or significant Ash trees can receive injections of TreeAzin™ (or other tested and approved pesticide treatments when available) for protection against EAB. TreeAzin™, a bio-pesticide derived from plant extracts, is the chemical used almost exclusively by municipalities to control EAB. To date it has proven 95-97% effective when injected before the tree reaches pre-determined levels of infestation and when followed by repeat injections every two years until the threat of EAB has passed or alternative controls are available. Treatment usually focuses on street trees, and high profile specimen trees in parks or where there is a large ash tree population and therefore greater impact with their decline. Treatments are valuable in managing the outbreak and spread of EAB to other areas by suppressing local populations of the insect.

5.4 Tree Removal

Based on the degree of infestation and health, ash trees need to be removed to limit hazardous conditions and minimize the safety risk associated with dead and declining trees. Ash wood is brittle by nature requiring removals to be carried out within a short period of time after the death of the tree.

Recent research has shown that ash trees that die as a result of EAB infestation are extremely dry and brittle and require removal within a 12 to

18 month period after death to avoid the risk of catastrophic failure. It is anticipated that a significant number of ash trees on private property will need removal and this is likely to require the City to issue a high volume of notices to remove trees under the minimum property standards by-law.

The removal of dead ash trees in parks and open spaces is proposed to be done on a risk management basis. Those trees in parks and open spaces that are adjacent public areas will be removed first following death. Ash trees that are growing in unmaintained or natural woodlots, away from areas of higher human activity will be left to fall on their own, or be dropped if and when staff time is available.

5.5 Tree Replacement & Planting

To maintain the current numbers of trees in the right-of-way, the replacement of Ash trees (with a different species of tree) will be needed on a minimum one-for-one basis. Replacement planting within parks and open spaces will be dependent upon the results of the tree inventory and site analysis. It may be possible to replace the canopy from lost Ash trees more quickly and efficiently by utilizing and promoting the growth of existing non-Ash species through strategic forestry management practices. These practices will include identifying and promoting the growth of desirable existing young and medium-sized non-Ash species trees, within or adjacent to groupings of Ash trees. This has the advantage of promoting naturally-seeded and established trees. Resources will be required to maintain these areas in order to select and promote the growth of these desirable species, primarily by removing invasive plants and other competition. All of the EAB management options presented further on in this report assume implementation of these forestry management practices and thereby propose no wholesale replanting of lost trees in parks and open spaces.

Notwithstanding the above, it is likely that to sustain the present urban tree canopy, additional tree planting initiatives within parks and open spaces will also be required. However, the placement and species composition of any new planting will again require data from an inventory of all tree species in order to be in accord with the objectives of a strategic plan. It should be noted that it can take as much as 30 years for a newly planted tree to begin providing maximum benefits to the urban forest.

5.6 Wood Waste Disposal

Following a confirmed outbreak of EAB in Owen Sound (or other area within Grey County) it is assumed that Grey County will be designated as an EAB regulated area (dependent upon CFIA future decisions on regulation in Southern Ontario). Staff will work with the County to determine the best way to dispose of Ash wood waste. Alternative uses for Ash wood waste will be researched.

5.6 Public Education and Communication

A program of public education and outreach is an essential part of the EAB management plan. A significant number of Ash trees exist on lands under private ownership and their management during the EAB outbreak will impact upon the strategy employed by the City.

Use of local media and communication tools such as social media and the City's website along with door hangers and posters will be used to keep the public informed, particularly in high risk areas. To assist property owners, the City can also provide information using the growing number of leaflets and brochures available from sources such as the CFIA, OMNR, Ontario Commercial Arborist Association and the Invasive Species Centre. It is assumed that a greater effort of education and communications will be required initially, with progressively less expense for this component occurring over time.

It is suggested that a working group comprised of upper and lower tier municipalities and larger stakeholders within the local area (south central Ontario) be formed to discuss strategy and management options for EAB. This group would represent the areas as yet unaffected by EAB to encourage co-operation and assistance with each other in response to EAB and its management. A group organized through the Grey Sauble Conservation Authority, consisting of representatives from the City of Owen Sound, GSCA, Bruce County, Saugeen Conservation Authority and the MNR.

6. Management Plan Options

A number of options are available when considering the development of an EAB Management Plan. Three such options are presented below.

Regardless of the option selected, almost all elements of the management plan discussed in Section 5 are required. Full scale Monitoring & Assessment (including an inventory), together with Public Education and Communication must form integral parts of any Management Plan. Treatment, Removal, Replacement and Disposal will all vary according to the Management Plan option selected.

6.1 Option 1: Status quo

This option would adopt a "do nothing" approach, allowing nature to take its course without any intervention on the part of the City. The Ash tree mortality in this option is expected to reach 100%. The exponential nature of the tree losses would concentrate the work load of removal and waste disposal over a very short, unrealistic, period of time as it relates to labour and equipment availability. City staff would have to ignore all of their existing workload, which includes removal of dangerous trees, pruning and replanting, and, even then, would still not be able to keep up with a fraction

of the removals needed when the highest number of tree losses occur. Staging removals will not be possible if no treatments are conducted.

Although from the tenth year onward there would be no, or minimal, costs associated with this option, it is likely there would also be few, if any, Ash trees left in the City. Certain streets in the City might be devastated by the loss of all Ash trees. It is anticipated that there would be a total loss of the economic, environmental and social benefits provided by Ash trees.

6.2 Option 2: Treat All Ash Trees

Under this option, based on the inventory, every structurally sound Ash tree in the City would be treated. Based on Ash tree sampling, this option could result in the treatment of 96% of the existing Ash tree canopy (within the right-of-way, parks and open spaces), with removals and replacements of the remaining 4% as they die.

Treatment will be on a 2-year rotating basis so that half of the tree canopy attempted to be saved is treated each year. It is assumed that treatment costs are on-going beyond the 10-year period. Retained Ash trees will continue to provide benefits throughout the period and beyond (if treatment continues). There would be a significant commitment to continue treatment and if not, removal and replacement costs similar to Option 1 would then apply.

6.3 Option 3: Hybrid Plan

In the hybrid plan a strategy incorporating a combination of treatment and removals would be used to manage the EAB infestation. In this option about 65% of Ash trees in the right-of-way and 10% of the park and open space Ash trees will be treated.

This option seeks to preserve a significant proportion of Ash tree benefits by targeting treatments based on the condition assessment details included in the recommended inventory. The option utilizes treatment as a tool to preserve the best quality trees and assist in managing the outbreak through staged removals, while adopting the longer-term view of the gradual transitioning of Ash from the urban forest.

This option also slows the onset of EAB infestation and population build up through selective treatments and removals of the poorest quality trees, making the problem more manageable. It preserves a proportion of Ash tree benefits and attempts to apportion the likely costs over the 10-year period. Treatment of preserved trees would need to continue beyond the 10-year management period in combination with a program of further removals and replacements merged into the existing forestry programs.

Trees in the right-of-way present the highest risk to the public following death and give the greatest environmental benefit to the community when they are living, so accordingly, they are the most desirable to retain. Although Ash trees in the parks and open spaces are generally in better condition, in many cases they present a significantly lower level of risk when dead. The loss of untreated parks and open space trees is therefore more manageable with staged removals over the 10-year period.

Option 3 is promoted by The Society of Municipal Arborists latest position paper on EAB which states that; "an integrated approach that utilizes treatment along with removal of low-grade Ash trees is the best management option".

This plan assumes existing staff will be involved in the EAB Management Plan to the greatest extent possible to help reduce costs. Cost calculations will be based upon data obtained from the information provided by the Tree Inventory. A 10-year plan is proposed based on the latest research on EAB, which suggests infestation of the insect is likely to pass through an area in a 10-year wave with significant declines as the host trees succumb and/or are protected through treatments, and the insect populations decline. It is also expected over the long-term (10+ years) that natural predators and other biological controls will begin to take control of EAB, further reducing and suppressing populations.

It is hoped that the treatment of Ash trees will become more effective in the future, with a broader range of less expensive chemicals with extended treatment intervals. Regardless of this, the City needs to make decisions on a management plan that is based on the best data presently available (as presented in this document).

7. Review of Options

Three possible options for the management of EAB have been considered;

Option 1; provides no control over the rate of infestation and death of the trees and preserves none of the present benefits provided by the trees. Management of the EAB outbreak is not possible with current resources without jeopardizing public safety and ignoring the present reactive and safety-driven forestry workload. If this option is chosen there is no going back, since all management options, other than reactive removals, are lost once the outbreak takes hold.

Option 2; provides for the protection of all treatable ash trees including those that may otherwise be better removed and replaced for other reasons, including the treatment of smaller trees whose loss could be replaced quickly with newly planted trees of another species. This option requires a considerable on-going commitment to treat high numbers of trees past the 10-year period. This option does not allow for the gradual transition of Ash

trees from the urban forest which is regarded by many arborists and urban foresters as an inevitable outcome of EAB.

Option 3; provides a middle ground where a combination of treatments, removals and replanting are used to manage the short and longer-term effects of EAB. Treatments target and retain the best ash trees, preserving their benefits and allowing staged removals of poor quality, undesirable, smaller and dead or dying trees. The removal and replanting of poor quality ash trees with a different species allows the transition of much of the ash tree component from the urban forest and reduces future treatment commitment.

Over a 10 year period, Options 1 and 3 have broadly similar costs, with Option 3 costing the least and Option 2 costing the most when only the “hard costs” associated with managing EAB over a 10-year period, such as treatments, removals and replanting are considered.

When the economic benefits of trees are considered, the following observations can be made:

- The break even period between removals and treatments extends to approximately 20 years and longer for larger diameter trees.
- Under Option 1, the recognized benefits that the Ash tree component of the urban forest provides will be completely lost at the end of the 10-year period.
- Under Option 2, costs beyond the initial 10-year management period are offset by the annual benefits from retained Ash trees.
- Option 3 is likely to optimize the retention of tree benefits, albeit at a lower number than Option 2, by preserving a higher number of Ash trees in the right-of-way where environmental and social benefits can be up to 20% greater compared to that of parks and open space trees. The on-going annual benefits of the treated Ash trees in Option 2 will cover the costs of future treatments.

8. Recommended Option

As an EAB management plan, **Option 3** provides the best combination of costs and benefits. The best quality Ash trees in the right-of-way together with significant and/or specimen Ash trees in the parks and open spaces will be treated. Right-of-way trees that need to be removed will be replaced with a different species of tree and good forestry practices will be exercised in dealing with the parks and open spaces Ash trees.

Future treatment costs related to **Option 2** and **Option 3** could be reduced with the possibility of increased control through higher than anticipated activity by natural predators feeding on the EAB.

9. Plan Implementation

Implementation of the EAB management plan will commence in 2014 with an inventory of trees (including the grading of treatable Ash trees). At the same time branch sampling, trapping and public education and outreach would commence. Based on its detection in neighbouring municipalities in 2012 & 2013, EAB in Owen Sound is expected to be found, either during the summer of 2014 or early in 2015, using the afore mentioned detection methods. Confirmation of EAB may subsequently result in revised treatment approach, with removal strategies aimed at containing the outbreak and suppressing local populations.

In 2014-2015, using data from the inventory, a re-appraisal of numbers and therefore costs can be undertaken together with a review of strategy and operational planning. With the benefit of inventory data, during 2014-2015, prioritized removals of low grade, poorly structured and dead or dying trees (which present the highest potential risk) would be carried out. A street tree replanting program in the road allowances would be phased in with the existing tree replacement program.

Replanting in parks and open spaces would be determined based on inventory data that would investigate options such as promoting natural regeneration of other species and/or promoting the growth of existing non-Ash species through accepted management practices. This strategy has the potential to quickly (and less expensively) replace lost canopy leaf area and thus an inventory of all species becomes a fundamental component of the entire EAB management plan. One risk of naturalization is the growth and infiltration of invasive species such as Common Buckthorn (*Rhamnus cathartica*), so even this approach requires management.

In subsequent years through 2024 the plan continues with removals prioritized and guided by public safety and operational issues. Review of the plan throughout implementation, particularly following inventory, is essential to ensure the best use of in-house and contracted resources and any potential returns from removed trees. Replanting species, sizes, number and location will be guided by the inventory of all tree species to reduce costs and optimize canopy replacement and sustainability.

10. Conclusions

The City of Owen Sound as a responsible steward of its urban forest plays a key role in maintaining the City's urban forest through maintenance, plantings, removals, and pest management programs of all publicly-owned trees. City staff are also often called upon to provide advice and recommendations on trees growing on private property. The urban forest is an important part of the City's "green infrastructure" and Ash trees are a significant component of that urban forest. Considering the consequences of EAB and the potential loss of all its Ash trees as a result, the City of Owen

Sound needs to consider carefully the value of the urban tree canopy and determine how best to manage and compensate for the loss due to EAB.

Option 3 is the recommended option as it provides a proactive and comprehensive approach to managing EAB within the City. The option includes inventory and monitoring, the treatment of high value trees, removal of infested trees for public safety and replacement and planting of trees; which is critical to maintaining the City's urban forest canopy. Without the benefit of a full inventory, the location, size, condition and distribution of ash trees will remain unknown and the EAB outbreak cannot be managed strategically.

This report is based upon limited data, with only estimates of numbers of trees, sizes and condition and has not provided a picture of the geographic distribution or density of Ash trees throughout the City. The estimation of the quantity and quality of the Ash tree component of the urban forest has many shortcomings such as:

- Strategic monitoring using branch sampling and trap placement has not be undertaken;
- Estimates of the total number of Ash trees may impact significantly on costs;
- The locations of all Ash trees have not been identified and so the potential exposure to risk;
- Sampling not available to allow grading of trees both suitable and unsuitable for treatment;
- Groupings and site conditions of trees will impact significantly on removal costs; and
- Location and setting of trees will impact the need and/or the desirability for removal and replacement.

Data collected during the inventory, monitoring and assessment will be key to refining the costs and the implementation of the chosen option, and potentially producing greater efficiencies in the management of this insect pest.

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City of Owen Sound, Community Services Department*

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Government of Canada, Canadian Food Inspection Agency; RMD-13-01: Regulated Areas for Emerald Ash Borer (EAB) (*Agrilus planipennis*)

Government of Canada, Natural Resources Canada website;
<https://www.nrcan.gc.ca/forests/insects-diseases/13377>

Dr. Anand Persad, Davey Tree Institute; *The Biomechanics of EAB Infested Trees and Associated Risks.*

BioForest Technologies Inc. website; www.bioforest.ca

Town of Oakville; <http://www.oakville.ca/residents/emerald-ash-borer.html>

Appendix A Suitability Criteria for Treatment of Ash Trees

Category 1: Good condition, safe useful life expectancy in excess of 20 years, visual importance, forming component part of significant Ash species cluster/group/avenue/feature, few adjacent trees, pruning intervention unlikely, few or no above/below ground conflicts, 'heritage' candidate tree, providing significant environmental and other benefits and/or high cost to remove if tree dies. (In sample inventory 68% of ash trees in this category)

Category 2: Moderate condition, pruning intervention likely to remediate defects/conflicts, less suitable location, conflicts probable within life expectancy. (In sample inventory 23% of ash trees in this category)

Category 3: Moderate or poor condition, short safe useful life expectancy, pruning required to retain safely, significant present or future conflicts, tree less than 15cm diameter at breast height (DBH*) suppressing growth of better quality trees of other species, loss has little visual/environmental impact. (In sample inventory 9% of ash trees in this category)

Not suitable for treatment Trees less than 15cm DBH, dead/dying/decayed/dangerous, likely to require removal within 5 years for other reasons. (In sample inventory 6% of ash trees assessed were not suitable for treatment in Categories 1-3)

*DBH = Diameter of trunk measured at 1.3m above highest grade at base of tree (diameter breast height).

Appendix B

CFIA's Pest Risk Management Options:

Maintaining the previous emergency response approach on an ongoing basis has been determined not to be feasible, given continued pest-spread and limited resources and, therefore, is not presented as an option. The three options considered were as follows:

Option 1: Expansion of the regulated areas to include high risk corridors and represent more accurately the expected distribution of the pest (Appendix 2, map 1):

The existing regulated area will be expanded and consolidated to include highway corridors, which are the primary pathways of pest-spread. Highways 400, 401, 416 and 417 in Ontario and Highways 15, 20, 40 and 50 in Quebec are included, with additional counties not directly covered by these highways included to include expected distribution of EAB. This option reflects optimal resource usage for the CFIA and is based on the protection of areas in which there is a high degree of confidence that EAB is absent

Option 2: Expansion of regulated area to include all current regulated areas and buffers (Appendix 2, map 2):

This option includes merging all existing regulated areas and including a larger area than that proposed in Option 1, in order to take into account ash tree distribution and the likely long term extent of the spread of EAB.

Option 3: Creation of a Collaborative Management Zone based on partnership approach (Appendix 2, map 3):

Maintain the existing regulated zone, with continued regulation of new detections at the county level, but rely on significant activities led by partners (provinces and municipalities) within a new collaborative management zone.

With any of these three options, the CFIA would continue surveillance activities at the perimeter of the regulated area to monitor pest spread, taking into consideration the distribution of ash, risk factors, etc. The CFIA will also maintain regulatory oversight on product movement out of each regulated area, provide electronic communications materials, and, based on resource availability, support research on tools for management of this pest (biological and chemical controls, etc.)

These options will provide a greater level of protection for the rest of Canada as it will result in a lower risk associated with ash material moving from areas that are currently not regulated, but in which there is a high probability that EAB populations have established.

9.0 Pest Risk Management Decision:

The CFIA has consulted with affected provinces and municipalities, and has not received any support for Option 2.

The CFIA received some letters of support for Option 3 from a limited number of stakeholders willing to contribute to a collaborative management zone. However, combined federal, provincial and municipal resources would be required to allow Option 3 to be pursued and a commitment from all partners to providing those resources has not been forthcoming.

Therefore, through the circulation of this RMD, the CFIA is informing stakeholders on its decision to modify the regulated areas for EAB as per Option 1.

Starting in April 2013, the CFIA will commence the one year transition approach that will lead towards implementation of the selected option by April 1, 2014. The CFIA will orient its available resources during the transition period to continue offering training and communications materials.

All pest situations are subject to periodic review based on pest distribution and resource availability. If federal, provincial and municipal resources were to become available at some point in the future, the CFIA could consider revising its approach for the management of EAB.