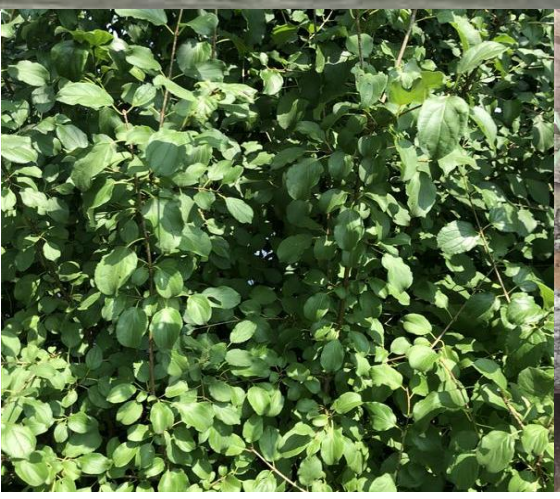
Appendix II

Invasive Species Management:
Priority Species Control Plan

2026



Niagara-on-the-Lake EST.1781

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Introduction

The **Priority Species Control Plan** outlines detailed strategies for the prevention and management of specific invasive species, enabling the Town to respond effectively to both existing and emerging threats. It serves as a supplemental resource to the broader **Invasive Species Management Plan**, translating its overarching strategies into focused actions for individual species. Users should consult this plan alongside the main document and continue to follow the prevention framework, best management practices, and management actions outlined within it.

Each Priority Species Control Plan is informed by **best management practices** developed by the Invasive Species Centre and Ontario Invasive Plant Council, with guidance from provincial and federal agencies. Niagara-on-the-Lake also aligns its approach with the guiding principles of the **Niagara Invasive Species Strategy Advisory Committee (ISSAC)** and the **Niagara Phragmites Management Area Collaborative (PMAC)**, led by the Niagara Peninsula Conservation Authority (NPCA). The Town will continue to review emerging best practices and innovative control methods to ensure these plans remain current, effective, and adaptable to changing conditions. Updates will be made as needed to reflect new information and approaches.

Safety

Whether implementing prevention measures or carrying out active removal, safety is paramount. All control efforts must be conducted with care to protect workers, volunteers, and the surrounding environment. Adhering to general safety and containment guidelines not only ensures well-being but also helps prevent the further spread of invasive species.

Safety and Containment Guidelines

- Consult with an individual experienced in invasive species management when unsure about any aspect of control.
- Always wear protective gloves when handling invasive biomass.
- Check if additional safety precautions are required specific to the species being removed.
- Thoroughly clean personal gear, clothing, vehicles, and equipment to remove any plant material, including seeds and fragments.
- Avoid parking, unloading, or storing equipment in areas known to be infested.
- Securely bag or tarp all roots, rhizomes, and seeds of plants before transporting off-site to prevent spread.
- Species should be removed before seed production or insect activity to prevent further spread.

Site Prioritization

As highlighted in the primary Invasive Species Management Plan, the extensive presence of invasive species requires strategic use of resources. This can be accomplished through both species and site prioritization. The Site Prioritization Tool for Control of Invasive Phragmites will provide the Town guidance on the selection of priority locations and be adapted for all invasive species. Site prioritization will be based on the following factors:

- **Safety**: Species with human safety concerns such as skin irritation/toxins, blockage to roadside/intersection sightlines, fire prone near buildings/homes, obstruction to flood mitigation infrastructure, etc. will be prioritized first.
- **Landownership:** Sites where the Town only owns and manages the area will be given first priority over ones that share landownership or management.
- **Population size**: Isolated and smaller populations (less than 50m^2 with less than 25% density at site) will be given priority over increasingly larger populations, unless deemed a priority for other reasons.
- **Technique**: When managing large populations, working from the perimeter of the site towards the middle is the most effective strategy to not disturb and promote further spread.
- **Shape**: Linear sites will be preferred over non-linear features.
- **Full or partial treatment**: Sites that will be completely treated for removal will be prioritized over ones with partial treatment.
- **Paths of Spread**: Areas that function as pathways for invasive species dispersal, such as roadsides, will be given higher priority for management compared to locations with minimal potential for spread.
- **Accessibility**: Sites with easy access to the entire population of invasive species will be given priority of management over ones that are difficult to access.
- **Habitat Value**: Sites with high habitat quality, significant conservation value, and intact natural features will be given higher priority for management.
- **Sensitive Areas**: Sites near provincial or national parks, crown land, provincially Significant Wetland (PSW), Area of Natural and Scientific Importance (ANSI), or similar areas of local natural history importance will be given higher priority for management.
- **Recreation:** Species severely impacting recreation activity (i.e. obstruction of boat access, restricted use of trails/parks, etc.) will be given priority.
- **Coordination of Sites**: Sites that are neighbouring other confirmed areas to be treated for invasive species will take priority to share resources rather than ones that have neighbouring invasive species with no plan of treatment.
- **Aesthetics:** Species entirely affecting scenic views will be considered over ones partially or not affecting aesthetic views.

Priority Species

Given the sheer number, abundance, and diversity of invasive species, Niagara-on-the-Lake will prioritize a select few for active management to ensure control efforts are effective and resources are used efficiently. **Priority species** will be chosen based on their current and potential threats to the Town's economy, public health, safety, and natural environments.

Control plans have been developed for several invasive species to build **preparedness** and understanding of potential threats that may become priorities as environmental conditions, land use, and community needs evolve. Additional control plans may continue to be developed over time to maintain readiness for emerging issues.

While these plans will guide future actions, **active management** will typically focus on a limited number of species (e.g., 1–5) at any given time to ensure resources deployed establish meaningful impact. The selection of priority species can be determined through consultation with Town Council, municipal Staff, and community engagement.

This document outlines **twelve invasive species control plans** that may be prioritized for management by the Town of Niagara-on-the-Lake. Further work will be required to confirm which species will be selected as priorities for active control. The species included range from those that are already well-established to others that have only been observed in isolated instances and require prompt action to prevent their establishment.

1. **Invasive phragmites**
2. **Spotted lanternfly**
3. **Oak Wilt**
4. **Tree-of-Heaven**
5. **Emerald Ash Borer**
6. **Spongy Moth**
7. **Knotweed**
8. **Purple loosestrife**
9. **Giant hogweed**
10. **Buckthorn**
11. **Hemlock woolly adelgid**
12. **Flowering rush**

Each species control plan outlines the activities required to achieve the Town's goals for invasive species management. It provides information on the species prevalence in Niagara-on-the-Lake, characteristics for identification, lifecycle, recommended management and removal methods, disposal techniques, and restoration.

Phragmites Control Plan

Phragmites australis

Overview

Invasive phragmites (European or Common Reed) is a tall, perennial aquatic or subaquatic, grass that can grow up to 6 metres high. It thrives in wet areas, often found in roadside ditches or around water bodies and is classified as a **restricted species** under the Ontario Invasive Species Act.

Goal: To control existing populations of invasive phragmites and prevent the spread of new populations that will minimize the adverse impacts, while preserving the native variety.

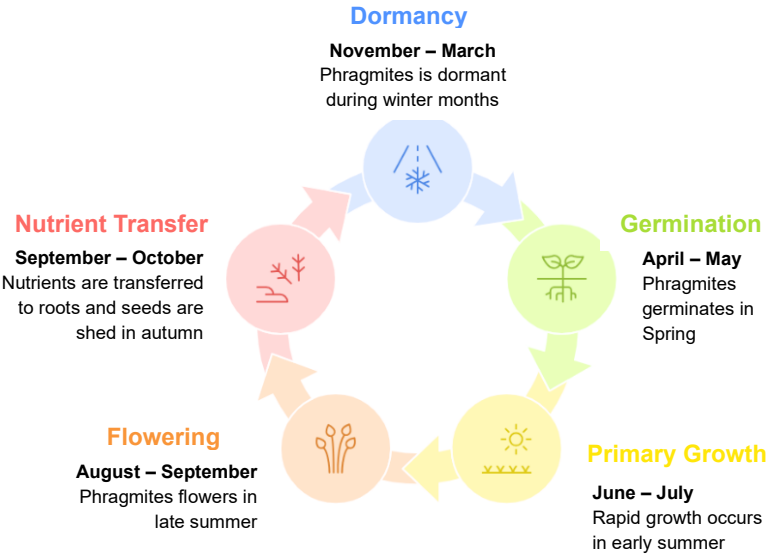
Prevalence: Invasive phragmites are well established in Niagara-on-the-Lake and continue to spread rapidly across Canada. Recognized as one of the country's most damaging invasive species, their expansion costs Ontario municipalities over **$2.8 million annually** in control efforts (Invasive Species Centre, 2019). Several issues such as damaging infrastructure, clogging drains and water management systems, increasing fire hazards, inhibiting accessibility, blocking site lines, reducing agricultural production, decreasing property values, altering hydrology and nutrient cycling are common.

Characteristics:

- **Stem**: rough texture, tan or beige, tall (up to 5 m)
- **Leaves**: thin, long, blue-green leaves
- **Seed head**: large
- **Stands:** high density as a monoculture (living and dead stems)

Invasive Phragmites Life Cycle:

Phragmites is easiest to identify when its germinating in early spring (April–May) as it's one of the first plants to green, or in September–October when stalks begin to die and leaves remain green longer than other vegetation. The best time for herbicide application is during the nutrient transfer stage (September–October), when the plant moves nutrients to its roots, allowing the herbicide to reach the root system.



Surveillance and Priority Monitoring Schedule

Regular mapping and surveillance of Phragmites are critical for identifying priority control areas, tracking spread, and informing timely management actions. In areas with known infestations, routine site visits by the Climate Change Coordinator or Town Staff, as part of regular inspections and maintenance tasks, will ensure continued monitoring and early detection of growth. These efforts can be supported in partnership with the **Niagara Phragmites Management Area Collaborative (PMAC)** that has developed geospatial detection models to support long-term regional monitoring initiatives.

Phragmites are most easily identified during **early spring and late summer**, when they remain green longer than surrounding vegetation. Visual field surveys should be scheduled during these optimal windows to maximize detection accuracy.

Surveys may be carried out by Town Staff, contractors, volunteers, or community members during organized events. To expand geographic coverage and improve efficiency, an **invasive species monitoring program** may be developed to engage trained volunteers in ongoing data collection.

Field surveys should be conducted **annually**, with a focus on both **known established sites** and **predicted emerging areas** where new growth is likely.

Priority surveillance areas can include:

- Roadsides and drainage ditches
- Trails and parks
- Water-retaining areas such as wetlands, stormwater infrastructure, and low-lying disturbed sites
- Previously treated or controlled sites

Removal of Invasive Phragmites

Pesticide application is the most effective and reliable method for managing and removing invasive phragmites. Within the Town, pesticide-based control will typically be carried out by a qualified third-party contractor in accordance with this control plan, with methods implemented and monitored throughout the process. **Removal will be prioritized in areas where phragmites pose safety risks or threaten municipal infrastructure**, such as road ditches, drains, and stormwater management ponds.

When phragmites obstruct infrastructure or present safety concerns, the Divisional Supervisor and Climate Change Coordinator will be notified. The Climate Change Coordinator will conduct a site visit to collect **pre-removal data**, including photographs and measurements. Following this, the Divisional Supervisor will coordinate removal by Town staff or a contractor, using appropriate herbicide or manual methods based on site conditions, access, and biomass levels.

Glyphosate-based herbicides will be the primary control method due to their effectiveness and relatively low environmental impact when used in accordance with product labels. Where glyphosate products are not approved for use in or near water, alternative products may be required for well-established infestations, subject to regulatory approval. All pesticide applications must strictly follow label directions, with treatment typically most effective between **August and October**. Foliar spraying should begin at the perimeter of the infestation and progress inward, and herbicide rotation should be implemented where possible as a best management practice.

In **large, dense monocultures**, herbicide treatment should be staged to avoid cutting live phragmites, which stimulates regrowth and requires repeated treatments over multiple years. Where herbicide use is restricted or impractical, manual cutting may be necessary but is labour intensive and must be repeated throughout the growing season.

Manual removal using Town equipment, such as the Green Machine or phragmites tractor, may be used for immediate access or safety needs but is not considered an ideal long-term management approach, as mechanical cutting can contribute to spread through plant fragmentation. Where required, standing, herbicide-treated stalks that restrict access or pose safety concerns may be cleared using brush cutters or specialized tracked equipment designed to break down dead stems.

Following treatment, the Climate Change Coordinator will document **post-treatment conditions** and collect monitoring data. Treated sites and areas of concern will be mapped, with management actions and key performance indicators tracked in the Town's GIS database to support ongoing invasive species management and adaptive decision-making.

Removal of Invasive Phragmites

When planning Phragmites removal, it is important to consider its ecological role, such as stabilizing soil, reducing wave action, or lowering water levels, and the potential impacts of its absence. To mitigate erosion on exposed soils or slopes, deep-rooted native species (e.g., tall-grass prairie species) can be planted where appropriate. While herbicide is considered the most effective management approach to phragmites, there is considerable amount of work and research being done to control the species. Their abundance and adverse impacts have created funding opportunities to be available that can make it an ideal species to **pilot innovative approaches** and expand management or removal operations.

Where appropriate, **prescribed burning and grazing** can be considered. However, these approaches are minimally used. Grazing can be favored in large, open areas where no endangered species are present. Whereas prescribed burning is only recommended to be used when combined with herbicide treatment or cutting to reduce standing dead biomass and support native vegetation recovery. Prescribed burning alone does not impact phragmites' extensive rhizome network underground and can enable rapid regrowth making it not suited as the only control measure to the site. In areas with restrictions on herbicide or other methods, cutting will be the primary control technique.

In **controlled aquatic environments**, flooding may be considered as a potential control method; however, opportunities for its application within the Town are limited, and the level of expertise required would likely restrict its use to a measure of last resort. Where pesticide use is permitted, herbicide application may be considered for infestations on a case-by-case basis at aquatic sites.

Management Timing Summary: The table below outlines management techniques associated with phragmites and when to act based on activity. The darker shading indicates the most optimal timing, lighter shading identifies suboptimal periods, and white cells indicate periods during which action is not recommended.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Field Survey												
Cutting												
Foliar Herbicide												
Prescribed burns												
Flooding												
Grazing												

Management Considerations

Phragmites' preference for wet areas can limit herbicide application and may require alternative control methods. Site-specific plans will be developed for each priority location to identify the most appropriate phragmites management practices. The following tables provide more detail on each management technique.

Cutting	
Location:	Terrestrial and aquatic sites
Infestation Size:	Isolated to Medium
Treatment Frequency:	As needed
Timing:	June to July for live stems (primary growth stage) February to March for dead stalks
Comments:	Cutting will occur if the phragmites patch is not accessible to apply herbicides safely or for removing dead stalks. If cutting is used as the only control of untreated living plants all cuts should be made at ground or substrate level and is optimal to have several removal timings throughout the growing season to reduce the stalk density.

Prescribed Burn	
Location:	Open area on dry land
Infestation Size:	Large monoculture or residual biomass
Treatment Frequency:	Once per year (subsequent years as needed)
Timing:	November to March (dormancy stage)
Comments:	Burning is an effective way to remove dead Phragmites biomass before or after other treatments, such as herbicide application, but should not be used alone. If herbicide is applied in the fall, wait at least three weeks before burning to allow full translocation. Cut or roll biomass beforehand for better combustion.

Flooding	
Location:	Flood prone areas or sites that can control water levels
Infestation Size:	Small to large
Treatment Frequency:	Once per year (subsequent years as needed)
Timing:	June to July (primary growth stage)
Comments:	A minimum water depth of 30 cm (ideally more) is needed to limit phragmites' oxygen access. Deeper water increases effectiveness. In natural systems, remove dead stems before flooding or rising water levels (e.g., late winter or early spring) to improve results.

Chemical Treatment

Currently, nine pesticides are registered in Canada for phragmites control, including six glyphosate-based products. The Town of Niagara-on-the-Lake (NOTL) will continue to update its control plan to ensure treatments remain effective, cost-efficient, and environmentally appropriate.

Currently, the most commonly used products are Roundup WeatherMAX, Vision Max, and Habitat Aqua, with costs ranging from about $100 per 10 litres for Roundup to $4,000 per 10 litres for Habitat Aqua. The higher cost reflects site-specific restrictions, particularly the requirement for products approved for use in aquatic environments. At present, **Habitat Aqua is the only pesticide registered for phragmites management in and around Canadian water bodies** and must be used when chemical treatment occurs at these sites. For terrestrial areas away from water, best management practices recommend **rotating products annually** (e.g., Year 1: Roundup; Year 2: Vision Max) to maintain effectiveness and reduce the risk of resistance.

For a full list of pesticides currently registered for use on phragmites under the Pest Control Products Act and regulated by Health Canada's Pest Management Regulatory Agency (PMRA), please refer to the PMRA's online product label search before selecting or applying any product.

Registration Number	Registrant Name	Product Name
27487	Bayer Cropscience Inc.	Roundup Weathermax with Transorb 2 Technology Liquid Herbicide
27736	Bayer Cropscience Inc.	Visionmax Silviculture Herbicide
32374	BASF Agricultural Solutions Canada Inc.	Habitat Aqua*
29190	G.D.G. Environnement LTEE	Ragweed Off
30203	BASF Agricultural Solutions Canada Inc.	Arsenal Powerline Herbicide
33456	Albaugh LLC	Timberline Herbicide
33653	Bayer Cropscience Inc.	Roundup Weatherpro
34209	Albaugh Llc	Timberline 360
34320	Teragro Inc	Weed-Master Glyphosate 540 Ultra Herbicide

Note: Habitat Aqua labelled with an asterisk (*) indicates suitability for use in or around specified aquatic sites.

Chemical Treatment

Example products commonly used to control phragmites, along with the necessary details for reviewing each product label, are listed below.

Product: Vision Max (Glyphosate)	
Location:	Terrestrial sites
Product Name:	VisionMAX Silviculture Herbicide
Registrant Name:	Bayer Cropscience Inc.
Active Ingredient:	Glyphosate
Registration Number:	27736
Application Placement:	Applied directly to leaves (foliage); absorbed systemically to target roots
Application Rate:	0.67 – 1.34 percent solution
Treatment Frequency:	Apply maximum of 2 treatments per year as needed annually
Timing:	Late-August to End of September (late summer to early fall)
Comments:	Do not treat directly over water. Targets plant enzymes that are not found in animals and has low toxicity to humans. It is rapidly broken down by soil microorganisms and binds tightly to clay or organic matter in soil. There is low potential for groundwater leaching and affect to human and wildlife.

Chemical: Roundup WeatherMAX (Glyphosate)	
Location:	Terrestrial sites
Product Name:	Roundup WeatherMAX® With Transorb 2 Technology Liquid Herbicide
Registrant Name:	Bayer Cropscience Inc.
Active Ingredient:	Glyphosate
Registration Number:	27487, Pest Control Products Act
Application Placement:	Applied directly to leaves (foliage); absorbed systemically to target roots
Application Rate:	2.0 –8.0 L/ha 1.34 percent solution (1.34 litres of this product in 100 litres of water)
Treatment Frequency:	Apply maximum of 2 treatments per year as needed annually
Timing:	Mid-August to early November
Comments:	Do not treat directly over water. Visual effects will occur within 7-10 days of application slowly wilting and yellowing the plant.

Chemical Treatment

Chemical: Habitat Aqua (Imazapyr)	
Location:	Terrestrial and aquatic sites (lakes, ponds, ditches, etc.)
Product Name:	Habitat Aqua
Registrant Name:	BASF Agricultural Solutions Canada Inc.
Active Ingredient:	Imazapyr
Registration Number:	32374, Pest Control Products Act
Application Placement:	Applied directly to leaves (foliage); absorbed systemically to target roots
Application Rate:	3.0–7.0 L/ha Use at least 100 L/ha of water
Treatment Frequency:	Apply once per year (and subsequent years as needed)
Timing:	Mid-August to Mid-October
Comments:	A Restricted Class Aquatic Application may be required for irrigation ditches and irrigation drains should be shut off prior to application. Caution around adjacent trees, as it can cause serious damage or death. Affects emergent plants but not submerged vegetation. Visible results are slow and often only apparent the following year.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for invasive phragmites are provided below.

KPI	Description	Target/Benchmark
Species Early Detection Reports	Number of early detections of new phragmites sites submitted through internal or public reporting	≥ 2 verified early detection submissions annually
Rapid Response Time	Time from detection to management action for new phragmites invasions	≤ 2 weeks from verified detection to action plan initiation
Infestation Area (ha or m²)	Total area affected by phragmites	Annual reduction in total infestation zone
Number of Priority Sites Treated	Total number of identified priority sites where phragmites management occurred	Annual increase; e.g., 1+ sites treated per year
% Reduction in Invasive Cover	Percentage decrease in area cover of phragmites at treated sites	≥ 60% reduction in invasive cover within 1 year
Infrastructure Recovery Rate	Number of sites with impaired infrastructure returning to normal levels of service	≥ 2 sites annually
Restored Area (in hectares or m²)	Total area restored with native planting, soil rehab, and other actions post-treatment	≥ 500 m² restored per year
Number of Educational Campaigns on Phragmites	Social media posts, workshops, newsletters, etc. focused on phragmites prevention and ID	≥ 1 campaign annually (seasonal focus)
Volunteer/Community Participation Rate	Number of community members involved in phragmites work (events, monitoring, etc.)	≥ 20 participants annually

Disposal

Uncut phragmites, consisting of standing dead stalks from herbicide, may be left to naturally decompose. However, if plant material needs to be moved or if cut residues are present, solarization is recommended. It is essential to keep seed heads and rhizomes away from moist soil. Store them in bags or place them on an elevated, tarped surface exposed to full sun for 1 to 3 weeks (depending on weather conditions) to ensure complete drying. Once fully dried, the material may be disposed of at a landfill or composted at approved municipal facilities. Burning phragmites biomass is possible, however, rhizomes and root fragments typically remain because they require higher temperatures to be fully incinerated. Dried stems can also be left on site as wildlife habitat or repurposed.

Restoration

Restoration efforts are best begun after at least 85% of phragmites has been effectively removed and regrowth is minimal. This helps prevent unintentional damage to newly introduced native plants during ongoing control efforts and maximizes their chances of establishment. However, consideration needs to be given to soil stability and erosion if on sloped sites and contains bare soil. Restoration timing and activities are dependent on the site and needs of the area that require approaches to be adapted to its conditions.

In general, choosing **fast-growing, moisture-tolerant** native species can help outcompete any remaining phragmites and support long-term ecosystem recovery. Focus on planting a diverse mix of **native wetland and shoreline species** that are adapted to site-specific hydrology and capable of rapidly establishing cover. These native plants help outcompete invasive seedlings, improve biodiversity, and stabilize soils and sediments.

Once phragmites has been effectively removed, active restoration is essential to prevent reinvasion and restore the ecological integrity of wetland and shoreline habitats. Without revegetation, disturbed areas are **highly vulnerable** to recolonization.

Apply a 7–10 cm (3–4 inch) **mulch layer** in accessible areas to suppress remaining phragmites seed banks or rhizome fragments. Avoid compost or soil amendments that may promote invasive regrowth. In large or remote sites, **broadcasting native seed mixes** can support natural regeneration.

Restoration sites should be monitored at least **once annually** for several years to assess native plant establishment, hydrologic function, and any resurgence of Phragmites. Adaptive management, including follow-up planting or spot treatment, may be necessary to ensure long-term success.

Recommended Native Species

- **Visually Similar Plants**:
  - Prairie Cordgrass (*Spartina pectinata*),
  - Little bluestem (*Schizachyrium scoparium*),
  - Riverbank Wild Rye (*Elymus riparius*),
  - Side Oats Grama (*Bouteloua curtipendula*),
  - Hard–Stem Bulrush (*Scirpus acutus*), and
  - Indian Grass (*Sorghastrum nutans*)
- **Emergent & Wetland Plants:**
  - Soft-stem bulrush (*Scirpus cyperinum*),
  - Pickerelweed (*Pontederia cordata*),
  - Arrowhead (*Sagittaria latifolia*),
  - Blue flag iris (*Iris versicolor*)
- **Grasses & Sedges:**
  - Fox sedge (*Carex vulpinoidea*),
  - Tussock sedge (*Carex stricta*),
  - Rice cutgrass (*Leersia oryzoides*)
- **Pollinator Plants:**
  - Swamp milkweed (*Asclepias incarnata*),
  - Joe-Pye weed (*Eutrochium maculatum*),
  - Marsh marigold (*Caltha palustris*),
  - Boneset (*Eupatorium perfoliatum*)

By re-establishing native wetland plant communities, restoration efforts increase ecosystem resilience, improve wildlife habitat, and reduce the long-term risk of phragmites re-establishment.

For guidance on appropriate plant selections, refer to Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Spotted Lanternfly Control Plan

Lycorma delicatula

Overview

Spotted lanternfly is an invasive insect newly detected in Canada and is currently being monitored by the Canadian Food Inspection Agency (CFIA), listed as a **pest** under the Plant Protection Act. It feeds on a variety of trees and plants, weakening them and causing significant damage to agriculture, especially vineyards, fruit trees, and hardwoods.

Photo: Invasive Species Centre

Goal: To prevent spotted lanternfly (SLF) from establishing in NOTL and utilize rapid response methods to immediately notify the Canadian Food Inspection Agency (CFIA) if a sighting occurs.

Prevalence: Spotted lanternfly (SLF) sightings have been reported in Niagara Region (Fort Erie, Lincoln, Pelham, and Welland), though no established populations exist in Canada, per the Canadian Food Inspection Agency. Its presence in Buffalo increases the risk of cross-border spread. If established, SLF could appear in the thousands, threatening NOTL's wine industry, producing 40% of Canada's grapes, along with tourism, agriculture, trees, and trade due to potential transportation restrictions.

Characteristics:

- **Egg masses**: white when new and darken overtime to grey, arranged vertically
- **Nymphs (juvenile insect)**: black and white spots, the last nymph stage develops red colouration
- **Adults**: black spotted exterior wing and bright red colouration under wings
- Accumulation of sweet and sticky substance (honeydew) at base of trees
- Dark streaks of sap attracting more stinging insects
- Sooty mold at base of trees and surrounding ground

Lifecycle:

Feeding occurs from April to November, with adults favoring more selective hosts than nymphs. Survey efforts should align with the SLF's life stages. September offers an optimal window, as egg masses, nymphs, and adults may all be present. However, targeted scheduling can help identify and monitor specific life stages.

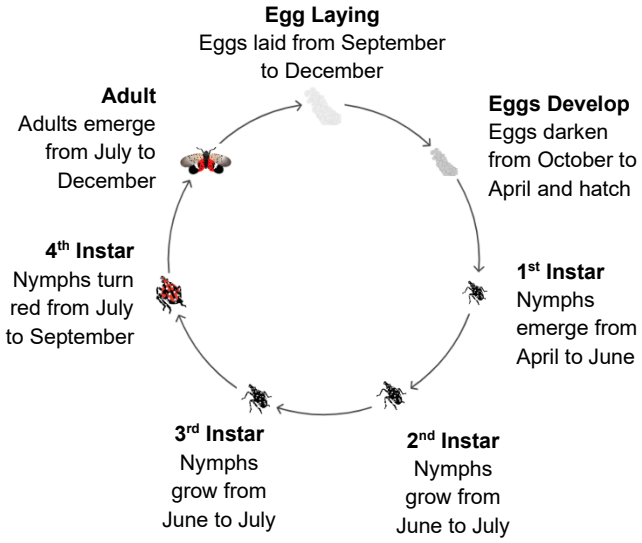


Image drawings: Invasive Species Centre

Spotted Lanternfly Control Plan

Lycorma delicatula

Detection of Spotted Lanternfly

If you see spotted lanternfly, take the following steps **immediately**:

1. **Take Clear Photos:** Capture close-up pictures to help confirm identification.
2. **Collect a Sample**: If safe, catch the insect and seal it in a plastic bag or container.
3. **Stop and Isolate**: If found on transported goods, seal off the material and pause all shipping activities.
4. **Report Immediately to CFIA**: Call the St. Catharines office at **905-937-7434** or complete the CFIA **online form**. Include:
    a. GPS coordinates or address
    b. Date spotted
    c. Life stage (egg mass, nymph, adult) & number seen
    d. Organization or contact information
    e. Number of nearby SLF host plants
5. **Keep Traceability Records:** Documentation must be kept for at least 3 years and contain the following:
    a. Location with maps or GPS coordinates
    b. Shipping/receiving information (if applicable)
    c. Scouting & trapping activities
    d. Pest control/eradication measures (if applicable)
6. **Consult with CFIA**: Follow their direction on further action required and disposal of the insect if captured.
7. **Record Everything**: Track all actions taken for future reference.

Priority Search Areas

Vineyards

Nursery Stock

Trucks and Shipments

Tree-of-heaven and host trees

Surveillance and Priority Monitoring Schedule

To prevent SLF from establishing in NOTL, regular monitoring efforts will be taken. Most activity will occur between **July to December** and represent different life cycle stages. **August** is Tree Check Month that can help support community engagement for monitoring, with nymphs and adults being active. **September** can also be a key time for monitoring, as egg masses, nymphs, and adults may be visible during this period.

- **Adults:** Most visible July to November
- **Egg Masses:** Most visible September to December (newly laid masses will be bright white, most prominent during this timeframe)

Safety: SLF attracts stinging insects by honey dew production. Operators should proceed with caution and have accessible PPE when monitoring or removing SLF.

Spotted Lanternfly Control Plan

Lycorma delicatula

Key Agency Roles

If spotted lanternfly is sighted at any life cycle stage, the Canadian Food Inspection Agency (CFIA) must be notified. However, there several groups working towards controlling spotted lanternfly outlined by the Invasive Species Centre.

- **Canadian Food Inspection Agency (CFIA)**: Operates under the authority of the *Plant Protection Act*, leading efforts in surveillance, report investigation, print material distribution, training of Canada Border Services Agency (CBSA) and rail personnel, delivering public presentations, and responding to media inquiries.
- **Ontario Ministry of Agriculture, Food and Agribusiness (OMAFA)**: Conducts monitoring using tree bands, engages in outreach through newsletters, blogs, and social media, delivers educational presentations, and supports insecticide research through the provincial minor use coordinator.
- **Natural Resources Canada (NRCan)**: Focuses on research initiatives, particularly in understanding the species' cold tolerance.
- **Agriculture and Agri-Food Canada (AAFC):** Supports surveillance programs, identifies opportunities for research funding, coordinates with provincial ministries and interested parties, and collaborates with international researchers.
- **Collaborative Working Groups**: These agencies and partners are actively involved in several coordinated efforts, including the Technical Advisory Committee, Research Coordination Group, Ontario SLF-Specific Task Force, and the Education and Outreach Committee.
- **Additional Partners**: Other key interested parties include the Ministry of Natural Resources (MNR), Canadian Lumber Standards Accreditation Board, Grape Growers of Ontario, Canadian Nursery and Landscape Association, Landscape Ontario, and the Eastern Ontario Regional Forest Health Network.

Removal of Spotted Lanternfly

The first step to management will involve monitoring sites that contain spotted lanternflies' preferred host species for feeding. Spotted lanternfly prefers certain host species to feed with some differing depending on its lifecycle stage. One of its most preferred hosts is Tree-of-Heaven (TOH), another invasive species that makes removal of the tree more beneficial.

Preferred Host Species

- **Nymph**: TOH, grape vine, black walnut, butternut, perennials, red/silver maple
- **Adult**: TOH, grape vine, black walnut, butternut, roses, river birch, willow, sumac

Spotted Lanternfly Control Plan

Lycorma delicatula

Removal of Spotted Lanternfly

The Town will conduct regular monitoring of Spotted Lanternfly (SLF) preferred host sites at least once a year to support early detection and rapid response. Survey's will follow the Spotted Lanternfly Survey Protocol developed by the Canadian Food Inspection Agency. Grape growers and ornamental nurseries will be strongly encouraged to include weekly inspections as part of their integrated pest management programs. Scouting in **September and October** is especially important, as adults migrate from wooded areas into crops during this time.

Egg masses are typically laid in sheltered spots, such as under loose bark or on the underside of branches. Females often deposit eggs near others, resulting in clumped distributions on host plants or nearby surfaces.

Based on guidance from relevant authorities, appropriate control measures may include scraping egg masses, setting traps, promoting natural habitats for predators like birds, removing tree-of-heaven, applying pesticides, or using alternative control methods, depending on infestation size.

Management Timing Summary: The table below outlines when to act based on the management activity but are all subject to use or change according to the appropriate agencies. Dark blue squares indicate the optimal timing for implementing control measures, while light blue squares represent suboptimal timeframes.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Monitoring Eggs												
Monitoring early nymphs												
Monitoring late nymphs								Tree Check Month				
Monitoring Adults								Tree Check Month				
Scrape Eggs												
Tree Band Traps												
TOH Removal												
Chemical Application												

Spotted Lanternfly Control Plan

Lycorma delicatula

Management Considerations

The Town of Niagara-on-the-Lake will follow the direction of the leading agencies and align with the guiding principles established by the inaugural Invasive Species Strategy Working Group, led by the Niagara Peninsula Conservation Authority. The Invasive Species Centre offers a free-online course to anyone seeking more information. As removal techniques evolve, this plan will be updated accordingly, and site-specific plans will be developed for each priority location to identify the most appropriate management practices. The following tables provide the most current information available.

Scrapping Egg Masses	
Location:	On plants or outdoor surfaces
Infestation Size:	Isolate to Small
Treatment Frequency:	Applied as needed with no max. limit to frequency
Timing:	Mid-October to Mid-April
Comments:	Egg masses can be removed by scraping them off with a hard plastic card and placing them in a container with ethanol, rubbing alcohol, hand sanitizer, or vinegar. These practices align with Best Management Practices from the Canadian Nursery Certification Institute, offering guidance on reducing the risk of spotted lanternfly introduction, which are applicable across production systems. This control method is also suitable for community engagement events and invasive species awareness. Although proactive, SLF tend to go higher into trees where it is out of reach without specialized equipment.

Traps/Adhesive Bands	
Location:	Preferred host species tree trunks
Infestation Size:	Isolated to large
Treatment Frequency:	One set up and dismount on multiple trees annually. Requires regular inspection visits
Timing:	Spring and summer
Comments:	Traps such as BugBarrier Tree Band can be placed on the trunks of host trees in alignment with SLF's life cycle to intercept nymphs and adults as they climb up trunks into the canopy. Bands should be at least 15 cm wide and at heights of approximately 1 to 1.5 m off the ground. Nymphs are particularly susceptible but use metal wiring cages to prevent birds and animals from entering traps.

Chemical Treatment

Pesticides should only be used under the guidance of the Canadian Food Inspection Agency (CFIA). Although the spotted lanternfly (SLF) is not currently established in Canada, five pesticide products are registered as proactive control measures in the event of an infestation. These products are approved under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA). Full details can be accessed through the PMRA's product label search.

If chemical treatment is to be used on sites it is likely to be completed by a contracted third-party organization within the Town. This control plan will guide the process, with recommended methods followed and monitored throughout. Before any pesticide is applied, the product label must be carefully reviewed and followed. Both contact and systemic insecticides are currently registered for SLF suppression; however, they must be used with caution, as research and efficacy testing are still ongoing. Contact sprays may have limited effectiveness due to SLF's tendency to climb high into trees and structures. The two most referenced products for potential spotted lanternfly control are KOPA Insecticidal Soap and ALTUS Insecticide.

Registration Number	Registrant Name	Product Name
31433	W. Neudorff GMBH KG	KOPA Insecticidal Soap
33176	Bayer Cropscience Inc.	ALTUS Insecticide
33817	Valent Canada, Inc.	Danitol Insecticide
34653	Mitsui Chemicals Crop & Life Solutions, Inc.	Starkle 20 SG
31452	Bayer Cropscience Inc.	Sivanto Prime Insecticide

Chemical Treatment

Example products commonly referenced to control spotted lanternfly, along with the necessary details for reviewing each product label, are listed below.

Chemical: Kopa Insecticidal Soap	
Product Name:	Kopa Insecticidal Soap
Registrant Name:	W. Neudorff GMBH KG
Active Ingredient:	Potassium salts of fatty acids
Registration Number:	31433
Application Placement:	Applied directly to nymphs
Application Rate:	4 – 8 L of product with 400 L of water
Treatment Frequency:	One application to nymphs (as needed)
Timing:	May to September
Comments:	Insecticidal soap to suppress **nymphs only** (not adults). Nymphs need to be contacted with spray solution to be effective as this product is not systemic. Can be used around tree fruit, grapes, ornamental and shade trees, and outdoor flowering, foliage and bedding plants.

Chemical: ALTUS Insecticide	
Product Name:	Altus Insecticide
Registrant Name:	Bayer Cropscience Inc.
Active Ingredient:	Flupyradifurone
Registration Number:	33176
Application Placement:	Applied to foliage of host species
Application Rate:	500 – 750 mL/ha Must not exceed 2000 mL/ha per year.
Treatment Frequency:	Apply once per year (and subsequent years as needed) Minium 7-day interval between applications
Timing:	May to September
Comments:	For suppression of SLF **nymphs and adults**. It can be used on outdoor nursery and landscape ornamental plants, including flowers, foliage plants, shrubs, trees and groundcovers. Systemic insecticide of the plant to be ingested by SLF and can provide control of pests that may be higher in the canopy of trees.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for spotted lanternfly (SLF) are provided below.

KPI	Description	Target/Benchmark
New infestation reports	Number of newly verified SLF sightings	Increase early detection; 100% of reports verified within 5 business days
Egg Mass Surveys Conducted	Total number of surveys targeting egg masses on host trees and objects	≥ 90% of high-risk locations surveyed annually
Survey Coverage	Number of priority sites surveyed (e.g., near nurseries, borders)	≥ 20 sites annually
Visual Inspection Accuracy	% of surveys accurately identifying SLF presence/absence	≥ 95% accuracy through field training programs
Time to Response	Time between confirmed SLF detection and initiation of control	≤ 5 business days
Quarantine Compliance Rate	% of businesses and transport operators adhering to quarantine protocols	≥ 95% compliance rate
Traps placed	Number of traps placed	≥ 50 traps placed annually
Number of Educational Campaigns on Phragmites	Social media posts, workshops, newsletters, etc. focused on SLF	At least 1 campaign annually (seasonal focus)
Volunteer/community participation rate	Number of community members involved in SLF work (events, monitoring, etc.)	≥ 20 participants annually

Disposal

Photo: Invasive Species Centre

Egg masses, nymphs, and adult spotted lanternflies should be placed in a sealable bag or container that has rubbing alcohol or vinegar inside. Once safely secured and the CFIA has been notified of the reported sighting, the vessel can be placed in a garbage bag to be sent to a landfill, unless otherwise specified by CFIA.

As spotted lanternfly has not yet been established in Canada, there are no regulated areas in the country. However, there are several regulated areas in the United States and the CFIA has **phytosanitary requirements** for import regulations of logs and nursery stock of deciduous species with bark entering Canada. A **phytosanitary certificate** or **permit** will be required if logs or nursery stock of deciduous species comes from a regulated area in the U.S. to anywhere in Canada.

To support traceability and compliance, all spotted lanternfly detections and disposal actions should be documented. This includes recording the location, date, volume of material removed, disposal method used, and Staff involved. This documentation should be maintained on file for at least **3 years**. Proper disposal, when conducted consistently and according to provincial and federal guidelines, plays a critical role in limiting the spread of spotted lanternfly and reducing its long-term ecological and economic impacts.

Restoration

Restoration is a key strategy in preventing and controlling spotted lanternfly (SLF), particularly in areas where tree-of-heaven or other preferred host species have been removed. Eliminating these hosts and replanting with other native species helps **disrupt the SLF lifecycle**, for long-term success. Habitat restoration that attracts **natural predators**, such as birds, further reduces the risk of infestation. Collectively, these measures support the recovery of healthy, resilient natural areas while maintaining ecological balance.

Restoration should prioritize **diverse native trees and shrubs** that do not serve as significant spotted lanternfly hosts. Restoration plantings should emphasize pollinator-friendly native species to support local insect and bird populations affected by SLF-related tree stress. This not only helps to suppress SLF populations but also supports pollinators, wildlife, and landscape resilience. In heavily disturbed or urban areas, the re-establishment of canopy and understory cover also helps prevent colonization by other

invasive species. Native groundcovers and cover crops can stabilize soil, while vegetated buffers protect waterways and help limit SLF migration.

Avoid planting species known to attract SLF and consider spacing and diversity in plantings to avoid creating large monocultures. Mulch may be applied around new plantings to reduce weed pressure and retain soil moisture, but compost should be avoided as it could promote invasive growth.

Restoration areas should be **monitored annually** for SLF egg masses, nymphs, and adults, as well as for the survival and growth of native species. Regular visual inspections and trap use are important for detecting reinfestations early. Trained volunteers and community scientists can play a valuable role in supporting long-term surveillance and control. Public education, signage, and community engagement around SLF awareness and native plant restoration further strengthen these efforts. Consistent monitoring and early detection are essential for the sustained success of SLF management in restored areas.

Recommended Native Species (Non-Host Focus):

- **Trees:**
  - Eastern red cedar (*Juniperus virginiana*),
  - American sycamore (*Platanus occidentalis*),
  - Yellow poplar (*Liriodendron tulipifera*),
  - White oak (*Quercus alba*),
  - Eastern Redbud (*Cercis canadensis*),
  - Serviceberry (*Amelanchier*), and
  - Blackgum (*Nyssa sylvatica*)

- **Shrubs & Understory:**
  - Buttonbush (*Cephalanthus occidentalis*),
  - Ninebark (*Physocarpus opulifolius*),
  - Winterberry (*Ilex verticillata*),
  - Spicebush (*Lindera benzoin*)

- **Groundcovers & Pollinator Plants:**
  - Wild bergamot (*Monarda fistulosa*),
  - New England aster (*Symphyotrichum novae-angliae*),
  - Little bluestem (*Schizachyrium scoparium*),
  - Black-eyed Susan (*Rudbeckia hirta*)

By restoring a diverse, non-host native plant community, sites become less attractive to SLF and more resilient to future pest pressures and ecological disturbances.

For guidance on appropriate plant selections, refer to Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Oak Wilt Control Plan

Bretziella fagacearum

Overview:

Oak wilt is an invasive fungal pathogen that spreads through the roots of all types of oak trees and can be transmitted through sap beetles. It is new to Canada and is currently monitored by the Canadian Food Inspection Agency (CFIA) and listed as a **fungus pest** under the Plant Protection Act.

Goal: To prevent oak wilt from establishing in NOTL and utilize rapid response methods to immediately notifying the Canadian Food Inspection Agency (CFIA) if a sighting occurs.

Prevalence: NOTL is one of only three confirmed locations in Canada with oak wilt, along with the City of Niagara Falls and the Township of Springwater. Oak trees are among the most common and valued landscape species, provide essential ecosystem services and include some of the Town's oldest trees. Like the impact of Emerald Ash Borer on ash trees, oak wilt poses a serious threat, capable of killing millions of oaks, especially red oaks, which can die within a single season. The disease endangers property values, the forestry sector, tree canopy cover, aesthetics, and biodiversity, while increasing maintenance costs and safety risks.

Characteristics:

- **Leaves:** turn dull green/yellow to brown, with edge-to-center discoloration; wilting and bronzing starting at the top of the tree and progress downward; premature leaf drop, including green leaves
- **Bark**: vertical crack from fungal mats (pressure pads); white, grey, or black fungal mats under bark
- **Odour**: fruity smell ("juicy fruit" or "fermented wine") from pressure pads

Lifecycle:

Above-ground: During feeding or breeding, nitidulid or sap beetles transport fungal spores from spore mats on infected trees to fresh wounds on healthy ones. Surveillance is most effective between July and August, when beetle activity peaks.

Below-ground: The fungus spreads through root systems, moving from infected trees to nearby healthy ones via interconnected roots growing in close proximity.

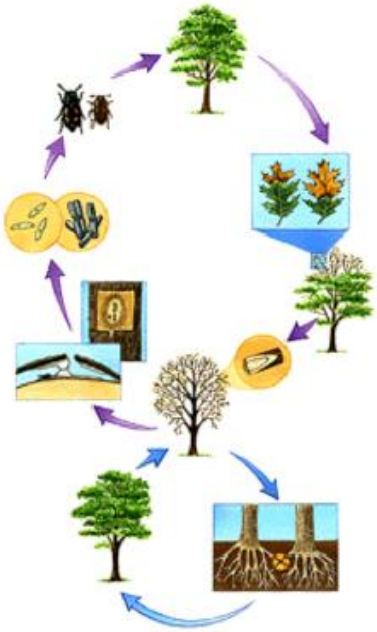


Image: USDA Forest Service

Oak Wilt Control Plan

Bretziella fagacearum

Oak Wilt Detection

If oak wilt is suspected the following should be implemented **immediately**:

1. **Stop and Isolate**: If found on transported wood, seal off the material and pause all shipping activities.
2. **Take Clear Photos:** Capture close-up pictures to help confirm identification.
3. **Report Immediately to CFIA**: Call the St. Catharines office at **905-937-7434**, email: OakWiltReportingOntario-Fletrissementduchene@inspection.gc.ca or complete the CFIA **online form**. Include:
    a. GPS coordinates or address
    b. Date spotted
    c. Symptoms
    d. Organization or contact information
    e. Number of nearby suspected cases
4. **Keep Traceability Records:** Documentation must be kept for at least 3 years and contain the following:
    a. Location with maps or GPS coordinates
    b. Shipping/receiving information (if applicable)
    c. Scouting & trapping activities
    d. Control/eradication measures (if applicable)
5. **Consult with CFIA**: Follow their direction on further action required and disposal of any tested tree parts.
6. **Record Everything**: Track all actions taken for future reference.

Priority Search Areas

Forests and sites of densely planted oaks

Border Crossings and Transportation Routes

Campgrounds and Firewood Shipment Areas

Priority Monitoring Schedule

To prevent oak wilt from establishing in NOTL, regular monitoring efforts will be taken. Priority monitoring will occur between **July to August** when symptoms are visible and still within early stages for rapid response and detection. **August** is also Tree Check Month that can help support community engagement for monitoring efforts. A confirmed case of oak wilt occurred in Queenston and several oak trees are present at Paradise Grove that will be priority spots for annual monitoring in the Town.

Oak Wilt Control Plan

Bretziella fagacearum

Biosecurity Precautions
All equipment (e.g. gloves, chainsaws, etc.) used to collect wood samples should be cleaned between samples with an alcohol-based sanitizer to prevent inadvertent spread of disease. Effort should be made to collect branch samples toward the end or after the high-risk period (April to November) when sap beetles are active. In the event that samples are collected during this period, a thin coat of latex spray paint should be applied to limit potential attraction of sap beetles.

Removal of Oak Wilt

Preventing oak wilt from occurring is the best course of action to avoid and reduce areas where disease can occur. Regular survey inspections at least once a year will be utilized to perform detection and rapid response measures. Survey's will follow the Oak Wilt Survey Protocol developed by the Canadian Food Inspection Agency and occur between **July and August**. Additional measures that should be taken include, not pruning oak trees from April to October and covering any wounds found during this time with latex spray paint can help not attract beetles. If pruning is required for safety reasons, any wounds or cut ends should also be sealed with paint.

If oak wilt is **suspected**, the Canadian Food Inspection Agency (CFIA) will come and take tree samples to examine eDNA for confirmation of oak wilt. If oak wilt is confirmed, the CFIA will likely direct action for tree removal and potentially of surrounding oak trees or root disruption (soil trenching or root rupture). Lindgren flight traps, a funnel shaped trap, can also be hung off oak tree branches to collect beetles.

Pesticides **should only** be used under the guidance of the Canadian Food Inspection Agency (CFIA). If chemical treatment is to be used on sites it is likely to be completed by a contracted third-party organization within the Town. This control plan outlines the guided process, but site-specific plans will be developed for each suspected location in coordination with the CFIA to identify the most appropriate management practices.

Although oak wilt is not currently established in Canada, there is one pesticide product, Meth-O-Gas, that is registered as a proactive control measure in the event of an infestation. This product is approved under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA). Full details can be accessed through the PMRA's product label search. Before any pesticide is applied, the product label must be carefully reviewed and followed.

Registration Number	Registrant Name	Product Name
9564	Lanxess Corporation	Meth-O-Gas Space Fumigant

Oak Wilt Control Plan

Bretziella fagacearum

Management Timing Summary: The table below outlines when to act based on the management activity. Dark blue squares indicate the optimal timing for implementing control measures. If oak wilt is suspected, the CFIA must be **immediately contacted** and follow their guidelines of management. Common practices and timing are listed below but are all subject to use or change according to the CFIA.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Priority Monitoring							■	■				
Acceptable Pruning	■	■	■								■	■
Paint Wounds				■	■	■	■	*Tree Check Month*	■	■		
Beetle Traps				■	■	■	■		■	■		
Tree Removal	■	■	■								■	■
Chemical Application								■	■	■		

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with the Canadian Food Inspection Agency (CFIA), contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for oak wilt are provided below.

KPI	Description	Target/Benchmark
Early Detection Reports	Number of new oak wilt cases identified through monitoring, public reporting, or Staff inspections.	≥ 90% of suspected cases verified and reported within 1 week.
Rapid Response Time	Time between confirmed detection and implementation of containment actions (e.g., tree removal, root trenching).	≤ 2 weeks from lab confirmation to control action.
Infected Tree Removal Rate	Percentage of infected trees removed or treated within the response window.	100% of confirmed cases addressed annually.
Root Graft Disruption Coverage	Proportion of confirmed outbreak sites where root graft severance is completed to prevent spread.	≥ 80% of eligible sites treated.
Public Outreach Engagement	Number of residents reached through education (workshops, signage, newsletters) on oak wilt prevention.	At least 1 campaign per season; ≥ 100 individuals engaged annually.
Volunteer Participation	Number of trained volunteers or community scientists involved in oak wilt monitoring or awareness.	≥ 20 participants annually.
Restoration Area	Total area (m² or hectares) replanted with non-host native species post-oak wilt removal.	≥ 500 m² restored per year (site dependent).
Native Species Survival Rate	Percentage of planted trees/shrubs that survive one year after planting.	≥ 70% survival rate.

Disposal

Disposal and removal efforts should be made around the high and low risk periods. Canadian Food Inspection Agency (CFIA) phytosanitary requirements are currently being revised for high and low risk periods. At presesnt, the highest risk period is from April 1 to July 31 and a low risk period from August 1 to March 31. The Invasive Species Centre specifies a **high risk period from April 1 to October 31** and will be used as the precautionary timeframe for both disposal activities and pruning or maintenance. Currently CFIA only has import regulations to prevent oak wilt spreading futher in Canada. Due to the nuaince of its arrival in Niagara-on-the-Lake and surrounding area, CFIA should be immediartely contacted if oak wilt is suspected and follow directions. Approved disposal methods include **incineration**, **deep burial** (at least 1.8 metres below ground), or **chipping** into pieces no larger than 2.5 cm in two dimensions for use as fuel. Whenever possible, disposal on-site is the preferred method as it is the lowest risk option for spread. Remaining **stumps** should be removed using a backhoe, bulldozer, or equivalent equipment and then flipped, burned, or buried. If oak wilt infected material needs to be transported off-site it must be sealed either in bags, tightly wrapped plastic, containers, or other method to ensure insect vectors cannot escape or access the wood, especially during peak season. Currently there are only regulated areas in the United States but transporting infested oak wilt material will require direction from CFIA, including possible documentation such as a movement certificate or permit. All equipment and tools used in handling infected trees must be disinfected, and logs should be debarked before disposal.

Property owners in affected areas may receive a CFIA-issued **Notice to Dispose** or **Notice of Prohibition of Movement** and are required to submit a disposal plan outlining their method of waste management. No bark, wood waste, or firewood may be reused, sold, or transported unless specifically approved by CFIA. These procedures help ensure that fungal spores are not unintentionally spread through improper handling or firewood movement. Follow-up monitoring and regulatory oversight may be required for several years following tree removal in confirmed infection zones.

To support traceability and compliance, all oak wilt removal and disposal actions should be documented. This includes recording the location, date, volume of material removed, disposal method used, and Staff involved. This documentation should be maintained on file for at least **3 years**. Proper disposal, when conducted consistently and according to provincial and federal guidelines, plays a critical role in limiting the spread of oak wilt and reducing its long-term ecological and economic impacts.

Restoration

Following the removal of infected trees or treatment to contain oak wilt, restoration is an important step in promoting forest and urban canopy recovery and building long-term resilience. Oak wilt can cause significant canopy loss, especially in red oak-dominated stands, leading to increased light or heat, changes in soil moisture, and opportunities for invasive species to establish.

Restoration should focus on **re-establishing a diverse mix of native tree and understory species** to maintain forest structure, reduce the risk of future outbreaks, and restore ecosystem function. Planting new oaks is generally not recommended immediately, as they may still be vulnerable to residual infection in the area.

However, in different planting locations or over time, unaffected oaks can support **natural regeneration**, and the inclusion of compatible companion species is encouraged. In areas with significant canopy loss, planting oak wilt-resistant or less-susceptible native species alongside healthy oaks is important to maintain biodiversity and reduce the overall vulnerability of the ecosystem.

Minimize soil disturbance during planting to avoid stimulating oak wilt spread or encouraging invasive plant growth. Mulching or groundcover planting can suppress unwanted regrowth from infected oaks and stabilize soils. Protective measures like tree shelters or deer fencing may be needed to ensure seedling survival.

Restoration areas should be **monitored twice annually** for tree survival, invasive species encroachment, and signs of new oak wilt infections. Adaptive management, such as supplemental planting or invasive species removal, may be needed to ensure long-term forest health. By restoring native diversity and structure, forests affected by Oak Wilt can recover more quickly and become more resilient to future stressors, pests, and diseases.

Recommended Native Species:

- **Visually Similar Trees to Oak**:
  - Sugar Maple (*Acer saccharum*)
  - Silver Maple (*Acer saccharinum*)
  - Freeman Maple (*Acer x freemanii*)
  - American basswood (*Tilia americana*)
  - Shagbark hickory (*Carya ovata*)
- **Natural Regeneration Trees:**
  - White oak (*Quercus alba*)

  - Bur oak (*Quercus macrocarpa*)
  - Eastern white pine (*Pinus strobus*)
  - Blackgum (*Nyssa sylvatica*)
- **Shrubs & Understory Species:**
  - Witch hazel (*Hamamelis virginiana*)
  - Serviceberry (*Amelanchier spp.*)
  - Wild geranium (*Geranium maculatum*)
  - Fox sedge (*Carex vulpinoidea*)

For guidance on appropriate plant selections, refer to the Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Tree-of-Heaven Control Plan

Ailanthus altissima

Overview

Tree-of-Heaven (TOH) is a perennial invasive tree species and considered the fastest-growing tree in North America. Listed as a **restricted species** under the Ontario Invasive Species Act, it is also the preferred host of the spotted lanternfly, another high-priority invasive in NOTL, and is recognizable by its showy foliage.

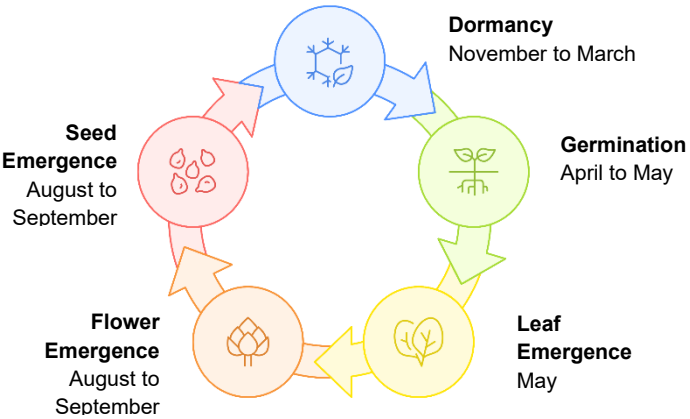
Goal: To control existing populations of invasive tree-of-heaven (TOH) and prevent the spread of new populations that will minimize the adverse impacts.

Prevalence: TOH is established in NOTL as with the Niagara Region. Known for its invincibility, it can crack through building foundations, pavement, roads, sewers, and other infrastructure. Its sap can cause skin issues and is a high pollen producer increasing allergies. More so it shifts soil chemistry that can also impact agriculture and biodiversity.

Characteristics:

- **Leaves**: large (30–120 cm), made up of several small leaflets spaced out along a central stem (compound) arranged alternately
- **Leaflets**: smooth edges, a protruding bump at base of each leaflet (glandular lobe)
- **Twigs**: hairless; greenish, pink, reddish, or brown; heart-shaped leaf scars; spongy brown center when broken
- **Bark**: young trees have thin, smooth, white-speckled bark with brownish-green base; mature bark becomes thick, rough, light brown to grey like cantaloupe skin
- **Flowers**: small, pale yellow to green, in large clusters
- **Fruits** (females): clusters of 1–2 inch single seed with papery wing (samaras)
- **Odour**: Emits foul or burnt peanut butter smell when crushed or scratched

Lifecycle:
Leaves emerge in early spring, flowers in late spring, and produces seeds from August to September. Surveillance is best done during spring and summer, while herbicide application should be timed for mid-summer to early fall to avoid when seeds are viable and easily spread.



Tree-of-Heaven Control Plan

Ailanthus altissima

Surveillance and Priority Monitoring Schedule

Tree-of-heaven is highly adaptable and commonly thrives in disturbed areas such as roadsides, park edges, and trails. To manage established populations, regular monitoring will be conducted, with priority inspections occurring annually between **August and September** when foliage is most visible. Monitoring will also include checking for spotted lanternfly, an invasive species that feeds on the tree. If removal measures are taken, the site should be revisited a few weeks later and again in spring to detect and address any regrowth early.

Removal of Tree-of-Heaven:

Removal of invasive tree-of-heaven (TOH) will likely involve contracting a third-party organization within the Town. However, this control plan will guide the process, and recommended methods will be followed and monitored. TOH can regenerate from stump and root fragments, making mechanical removal ineffective. Cutting one stump can result in multiple new shoots, so consistent herbicide use is essential for control.

The method chosen depends on the size and density of the infestation. For young trees with reachable foliage, foliar herbicide can be used. For mature or tall trees, basal bark, hack-and-squirt, or stem injection methods are preferred. Stem injections are costly, so basal bark treatments will be used in dense stands, while hack-and-squirt is reserved for isolated trees. Hack and squirt methods are more labour intensive that can be impractical with larger populations but ideal for a target species approach.

Another commonly used method is cut-stump treatment with herbicide; however, due to its limited effectiveness in controlling root systems, it will be reserved as a last resort. These methods are selected to maximize the efficiency of personnel time and resources while ensuring the most effective control of TOH. Methods to be used can be discussed with Staff and contractors ahead of removal.

Management Timing Summary: The table below outlines management techniques associated with Tree-of-Heaven and when to act based on activity.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Priority Monitoring								Tree Check Month				
Cut Stump												
Hack & Squirt												
Basal Bark												
Foliar												

Tree-of-Heaven Control Plan

Ailanthus altissima

Management Considerations

A variety of herbicide products are available to treat Tree-of-Heaven (TOH) and use different application techniques. Site-specific plans will be developed for each priority location to identify the most appropriate management practices. The following tables go into more detail about each herbicide product that will be considered to manage TOH in the Town.

Application Type	Description
Foliar Application	A mix of glyphosate and triclopyr provides broad-spectrum control of Tree-of-heaven and other woody species. Though non-selective, it has low soil activity, minimal risk to non-target species, and both herbicides are approved for use near water.
Basal Bark	The chemical is applied to the lower 12–18 inches of stems up to 6 inches in diameter. Ideal for small infestations or follow-up after foliar treatment. For larger stems, use hack-and-squirt. A 25% triclopyr solution can also be used on dormant bark but is best combined with other methods.
Hack-and-Squirt	Apply glyphosate or triclopyr in water to cuts spaced around the stem, leaving intact bark between hacks to allow herbicide movement to the roots. Use one hack per inch of diameter (minimum two). Best for stems over 1 inch in diameter and low stem densities. Must **not** completely sever trunk or stem with cuts, but rather leave them as wounds for the herbicide to easily enter. A spray bottle is used to squirt the herbicide into cuts.
Cut Stump	Use a 50% glyphosate or triclopyr solution on freshly cut stumps late in the growing season but before leaf drop. This method has limited root control and is used as a last resort.
Stem Injection	Aminocyclopyrachlor and triclopyr are effective. Apply mid-summer or late winter for best results. Follow label instructions for dosage and safety.

**Note: When manual tree removal is necessary for safety concerns, it is best to treat with one of the above-mentioned herbicide applications first, wait for symptoms to develop (generally for 30 days), and then cut.*

Chemical Treatment

Five pesticides are available for the control of Tree-of-Heaven, under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA).

Registration Number	Registrant Name	Product Name
28945	Corteva Agriscience Canada Company	Garlon XRT Herbicide
29334	Corteva Agriscience Canada Company	Garlon RTU Herbicide
30922	2022 Environmental Science CA Inc.	Navius Flex
31382	2022 Environmental Science CA Inc.	Navius VM Herbicide
33964	2022 Environmental Science CA Inc.	Trurange

As of 2025, the most commonly used product is Garlon and full details of the product can be accessed through the PMRA's product label search.

Chemical: Garlon XRT	
Product Name:	Garlon XRT
Registrant Name:	Corteva Agriscience Canada Company
Active Ingredient:	Triclopyr
Registration Number:	28945
Application Placement:	Basal bark or cut stump
Application Rate:	0.375% solution 375 mL per 100 L of water *Varies between application type – consult label*
Treatment Frequency:	Apply once per year and subsequent years as needed
Timing:	Anytime (except when snow or water prevents spraying at the ground line)
Comments:	Can only be used for **basal bark or cut stump** applications. Not intended as a foliar spray. For more information, please visit the product label.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for tree-of-heaven (TOH) are provided below.

KPI	Description	Target/Benchmark
Treated trees	Number of trees treated with herbicide	≥ 15 within 12 months
Infestation Reduction	% decrease in size or density of Tree-of-Heaven patches in managed areas.	≥ 75% reduction in cover within 12 months post-treatment
Site Monitoring Frequency	Number of follow-up site inspections after initial removal.	Minimum of 2 follow-ups per year for 3 years.
Regrowth Removal Rate	% of regrowth (suckers, seedlings) after treated sites	10% regrowth during follow-ups.
Native Species Replacement	Number or % of treated sites where native vegetation was re-established.	≥ 70% of sites restored within 1 year of removal.
Volunteer/Public Engagement	Number of community members participating in monitoring, removals, or educational events.	≥ 20 participants annually.
Public Reporting Participation	Number of public submissions through reporting tools (apps, email, hotline).	Annual increase in reporting (e.g., 10% growth).
Disposal Compliance	% of removed material disposed of according to provincial or CFIA regulations.	100% compliance with disposal protocols.

Disposal

All removed material, especially root fragments, suckers, and seeds, **must not** be composted, as this risks spreading viable reproductive tissue. Instead, it must be disposed of at a landfill or securely contained on-site. Composting is not recommended due to the tree's allelopathic compounds and persistent regenerative potential. Tools, equipment, and vehicles used during removal should be thoroughly cleaned before leaving the site to prevent inadvertent spread of seeds or fragments.

Restoration

After the removal or treatment of tree-of-heaven, restoration is an important step to prevent re-establishment and support the recovery of healthy native plant communities. Tree-of-heaven is a fast-growing, allelopathic species that suppresses native growth and thrives in disturbed, open environments, especially along roadsides, forest edges, and urban natural areas. Without active restoration, cleared areas are at **high risk** for reinvasion or colonization by other invasive species.

Apply a 7–10 cm (3–4 inch) **mulch layer** to suppress remaining seed banks and root sprouts. Avoid using compost as it can help with tree-of-heaven regrowth. Where herbicide was used, allow appropriate time for residual breakdown before planting to avoid damaging new seedlings. On disturbed slopes or in high-erosion areas, more immediate planting may be needed to stabilize the area.

Restoration should focus on planting a **diverse mix of native trees, shrubs, and herbaceous plants** that are competitive, site-appropriate (e.g. soil, moisture, sunlight conditions, etc.), and capable of quickly establishing canopy cover or ground cover to outcompete tree-of-heaven seedlings and root suckers. Fast-growing and deep-rooted native species are especially useful during early stages of recovery and improve soil structure. Sites should be **monitored at least once annually** for at least 3–5 years to detect and promptly remove any regrowth or new colonization.

Recommended Native Species:

- **Visually Similar Plants**:
  - Black walnut (*Juglans nigra*)
  - Staghorn sumac (*Rhus typhina*)

- **Trees:**
  - Eastern poplar/cottonwood (*Populus deltoides*)
  - Silver maple (*Acer saccharinum*)
  - Trembling Aspen (*Populus tremuloides*)
  - American elm (*Ulmus americana*)
  - Large tooth aspen (*Populus grandidentata*)
  - Tulip tree (*Liriodendron tulipifera*)

- **Shrubs:**
  - Serviceberry (*Amelanchier arborea*)
  - Nannyberry (*Viburnum lentago*)
  - Red-osier dogwood (*Cornus stolonifera/sericea*)
  - Silky dogwood (*Cornus amomum/oblique*)

- **Herbaceous Species:**
  - Little bluestem (*Schizachyrium scoparium*)
  - Canada goldenrod (*Solidago canadensis*)
  - Wild bergamot (*Monarda fistulosa*)
  - Black-eyed Susan (*Rudbeckia hirta*)

Restoring native vegetation not only reduces the risk of tree-of-heaven re-establishment but also promotes ecological resilience, wildlife habitat, and long-term landscape stability.

For guidance on appropriate plant selections, refer to the Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Emerald Ash Borer Control Plan

Agrilus planipennis

Overview

Emerald ash borer is an invasive, wood boring insect, known for the demolishment of ash trees. The beetle burrows through the trunk or branches, leaving distinct waved patterns on the wood. It is listed as a **pest** under the Plant Protection Act.

Photo: Invasive Species Centre

Goal: To control existing populations of emerald ash borer and prevent the spread of new populations that will minimize the adverse impacts.

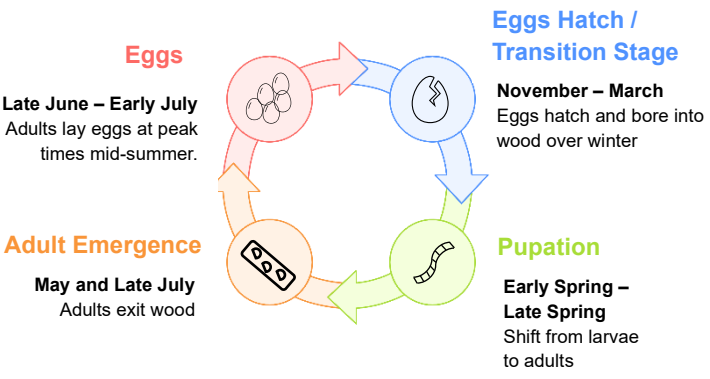
Prevalence: Emerald ash borer (EAB) is well established in Niagara-on-the-Lake and across Canada, killing up to **99% of ash trees** within 4 to 10 years of infestation. Black ash has been especially affected, leading to its designation as endangered and inclusion on the **Species at Risk in Ontario List** (2022). The severe loss of ash trees has cost Ontario municipalities over **$22 million annually** (Invasive Species Centre, 2019) and has significantly impacted local ecosystems. The Niagara Region Tree and Forest Canopy Summary Report (2024) identifies emerald ash borer as a major and ongoing threat to Niagara's urban forest and overall canopy health.

Characteristics:

- **Larve**: creamy white, thin, long body (25-32 mm length), brown head, 10 bell shaped segments
- **Transitional stage (pupae)**: thin, long body (10-15 mm), creamy white to start then transitions to adult colouration
- **Adults**: bright metallic green, long body (8-14 mm in length), flat head, bright red underneath wings

Additional Symptoms: Crown die back, yellowing leaves, bark deformities, waved or "S" shaped patterns in wood, exit holes in a half circle or "D" shape

Emerald Ash Borer Life Cycle: Adults lay eggs in tree bark or under bark that peaks in June and early July. When they hatch, they bore into the wood and stay in a transitional stage over winter. When populations are large enough the bark gridles and eventually leads to tree death. Pupation occurs early spring and adults emerge late spring from "D" shaped exit holes in the bark then feed on leaves.



Emerald Ash Borer Control Plan

Agrilus planipennis

Surveillance and Priority Monitoring Schedule

Regular mapping and surveillance of emerald ash borer are critical for identifying priority control areas, tracking spread, and informing timely management actions. Survey's will follow the Emerald Ash Borer Survey Guidelines developed by the Canadian Food Inspection Agency. As instructed, prior to any survey deployment, contact with the local Regional Program Officer to obtain their current survey plan for Niagara-on-the-Lake will be coordinated to combine efforts.

In areas with known infestations, routine **annual** site visits by the Climate Change Coordinator or Town Staff, as part of regular inspections and maintenance tasks, will ensure continued monitoring and early detection. Surveys may also be carried out by contractors, volunteers, or community members during organized events. To expand geographic coverage and improve efficiency, an **invasive species monitoring program** may be developed to engage trained volunteers in ongoing data collection.

Emerald ash borer is most recognizable at its adult stage from May to August, when it is outside of the tree wood and has a metallic green coat. Although it can fly immediately as an adult for approximately 10 kilometres, it does prefer neighbouring and local host trees. Baited traps should be deployed on black ash trees from **June 1st to August 31st** and visual ground surveys in **late August** when signs and symptoms of emerald ash borer are most obvious.

The larvae will create distinctive waved or **"S" shaped markings** under the wood when feeding in April and loss of leaves from adult feeding give the tree decline. Eggs are very difficult to detect in the field and will therefore not be prioritized for monitoring.

Focus on both known established sites and predicted emerging areas where emerald ash borer is likely, will be utilized for monitoring.

Priority surveillance areas can include:

- Areas with ash decline (particularly black ash)
- Trails and parks
- Campgrounds
- Forest and woodlot edges
- Roads and transportation corridors
- Urban centres
- Nurseries
- Previously treated or controlled sites

It is essential that after leaving any site suspected to have emerald ash borer, all vehicles, clothing, and equipment are checked prior to departure of the site to prevent spread.

Emerald Ash Borer Control Plan

Agrilus planipennis

Removal of Emerald Ash Borer

Emerald ash borers have caused such devastation in ash trees that they are commonly not recommended for planting. Often, removal of infested trees is the most common method to prevent further spread and maintain safety. However, there are chemical products that can be used for trees that are not yet infested or recently infested. Unfortunately, there are limitations to it as trees can take several years to recover from infestation and re-treatment is continually required.

Photo: Invasive Species Centre

Tree injections can be given to prevent emerald ash borer infestations but may require strategic approaches if infestations become so abundant and resources limited. In this case, factors such as tree health, proximity to other ash species and pathways of spread, safety, ecological impact, cultural significance, and economic impact should be investigated. If chemical treatment is to be used on sites it is likely to be completed by a contracted third-party organization within the Town. This control plan will guide the process, with recommended methods followed and monitored throughout.

Biological control agents also are approved in Canada with three species of wasps that have been released *Tetrastichus planipennisi*, *Spathius galinae*, and *Oobius agrili*. Although the Town of Niagara-on-the-Lake will not be utilizing the method, the wasps will be made aware to identify them and coordinate control methods.

Management Timing Summary: The table below outlines management techniques associated with emerald ash borer and when to act based on activity. The dark blue boxes indicate the most optimal times.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Baited Traps						■	■	■				
Visual Survey								■				
Tree Removal	■	■	■	■	■	■	■	■	■	■	■	■
Pesticides					■	■	■					

Tree Check Month

Emerald Ash Borer Control Plan

Agrilus planipennis

Management Considerations

Emerald ash borer management can include traps, tree removal, or pesticide use. Site-specific plans will be developed for each priority location to identify the most appropriate management practices. The following tables provide more detail on each management technique.

Baited Traps	
Location:	Ash trees
Infestation Size:	Isolated to large
Treatment Frequency:	As needed
Timing:	June 1st to August 31st
Comments:	Traps should be installed for June 1st and remain until August 31st. Only one trap should be placed at each site. Periodic visits between this time may be needed to dispose of any caught material. Traps must hang at least 5 metres above ground level and ideally sit as high as possible in the canopy. Placement on the south or southwest side of the tree. For more details on where to purchase supplies needed, please see section 9 in the Canadian Food Inspection Agency's Survey Guidelines.

Tree Removal	
Location:	Terrestrial
Infestation Size:	Large monoculture causing tree mortality or decline
Treatment Frequency:	As needed
Timing:	As soon as possible after confirmed infestation (anytime of year)
Comments:	The Town will likely hire a contractor to remove any infested ash trees. However, wood should be properly disposed of either by chipping, burying or burning material.

Chemical Treatment

As of 2025, 6 pesticides are registered in Canada for emerald ash borer control. The Town of Niagara-on-the-Lake (NOTL) will continue to update its control plan as needed to ensure treatments remain effective, cost-efficient, and environmentally appropriate.

Currently, the most used products are Treeazin and Ima-Jet due to their ability to affect other invasive species such as hemlock woolly adelgid, but best management practices recommend **rotating products annually** (e.g., Year 1: Treeazin; Year 2: IMA-Jet) to maintain effectiveness and reduce the risk of resistance.

Emerald Ash Borer Control Plan

Agrilus planipennis

For a full list of current pesticides registered for use on emerald ash borer, please refer to the Health Canada's Pest Management Regulatory (PMRA)'s online product label search tool (appendix 1) before selecting or applying any product.

Registration Number	Registrant Name	Product Name
21568	UPL Agrosolutions Canada Inc.	Acecap 97 Systemic Insecticide Implants
29703	2022 Environmental Science CA Inc.	Confidor 200 SI Systemic Insecticide
30559	Lallemand, Inc.	Treeazin Systemic Insecticide
31375	Arborjet Inc	IMA-Jet
31479	Arborjet Inc	IMA-Jet 10
34403	G.D.G. Environnement LTEE	Fraxiprotec

Example products commonly used to control emerald ash borer, along with the necessary details for reviewing each product label, are listed below.

Chemical: TreeAzin® (Azadirachtin)	
Product Name:	TreeAzin®
Registrant Name:	Lallemand Inc.
Active Ingredient:	Azadirachtin
Registration Number:	30559, Pest Control Products Act
Application Placement:	Applied as injection at a pre-drilled hole ~ 15 cm to 30 cm above ground level at a 20 to 45 degree downward angle
Application Rate:	2 mL per cm DBH as preventative 5 mL per cm DBH for attacked trees or greater than 30 cm DBH
Treatment Frequency:	One application per tree (bi-annually if needed)
Timing:	Apply in early summer (June to July)
Comments:	To be used when detection occurs in the area or within 24 km and trees appear healthy. When the injection is completed, wait for 1-2 minutes before removing the canister and nozzle to avoid pesticide spillage. Moves rapidly throughout the treated tree (approx. 48 hours) and provides protection for ~2 years where populations are present. Product also suited for hemlock woolly adelgid, spongy moth, tent caterpillars, European elm scale, sawflies, and more at different application rates. For more information visit the product label.

Chemical: IMA-jet (Imidacloprid 5%)	
Product Name:	IMA-jet
Registrant Name:	Arborjet Inc.
Active Ingredient:	Imidacloprid
Registration Number:	31375, Pest Control Products Act
Application Placement:	Injections around the base of the tree (the trunk flare or tissue immediately above the trunk flare)
Application Rate:	15 to 30 cm DBH = 1.6 – 3.2 mL/cm DBH Greater than 30 cm DBH = 3.2 mL/cm DBH
Treatment Frequency:	Once annually per tree (with other injections as needed in subsequent years)
Timing:	To be used when detection occurs in the area or within 24 km and trees appear healthy. Optimal times are during active larvae feeding (May)
Comments:	Apply at least 30 days before historical egg hatch or adult flight and to trees whose vascular tissue is not damaged.

Chemical: IMA-jet 10 (Imidacloprid 10%)	
Product Name:	IMA-jet 10
Registrant Name:	Arborjet Inc.
Active Ingredient:	Imidacloprid
Registration Number:	31479, Pest Control Products Act
Application Placement:	Injections around the base of the tree (the trunk flare or tissue immediately above the trunk flare)
Application Rate:	15 to 30 cm DBH = 1.6 – 3.2 mL/cm DBH Greater than 30 cm DBH = 3.2 mL/cm DBH
Treatment Frequency:	Once annually per tree (with other injections as needed in subsequent years)
Timing:	To be used when detection occurs in the area or within 24 km and trees appear healthy. Optimal times are during active larvae feeding (May)
Comments:	Apply at least 30 days before historical egg hatch or adult flight and to trees whose vascular tissue is not damaged.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for emerald ash borer are provided below.

KPI	Description	Target/Benchmark
Rapid Response Time	Time from detection to management action for new emerald ash borer invasions	≤ 2 weeks from verified detection to action plan initiation
Infestation Area (ha or m²)	Total area affected by emerald ash borer	Annual reduction in total infestation zone
Number of Priority Sites Treated	Total number of identified priority sites where emerald ash borer management occurred	Annual increase; e.g., 1+ sites treated per year
% Reduction in Invasive Cover	Percentage decrease in area cover of emerald ash borer at treated sites	≥ 60% reduction in invasive cover within 1 year
Infested Tree Removal Count	Total number of confirmed infested ash trees removed or safely disposed	≥ 90% of confirmed infested trees removed within 1 year
Restored Area (in hectares or m²)	Total area restored with native planting, soil rehab, and other actions post-treatment	≥ 500 m² restored per year, depending on infestation
Native Species Survival Rate	Percentage of planted native trees and shrubs that survive after 1 growing season	≥ 70% survival rate post-planting
Number of Educational Campaigns	Social media posts, workshops, newsletters, etc. focused on emerald ash borer prevention and ID	At least 1 campaign annually (seasonal focus)
Volunteer/Community Participation Rate	Number of community members involved in emerald ash borer work (events, monitoring, etc.)	≥ 20 participants annually

Disposal

All life stages of **emerald ash borer (EAB)**, including eggs, larvae, pupae, and adult beetles, must be handled and destroyed using approved methods. For small specimens, such as adult beetles or larvae collected during monitoring or removal, submerging them in a container of soapy water is an effective option. The biomass should remain submerged for at least 48 hours to ensure mortality. Once fully soaked, the material can be sealed in a plastic bag or container and disposed of in regular waste, ensuring no living organisms remain viable.

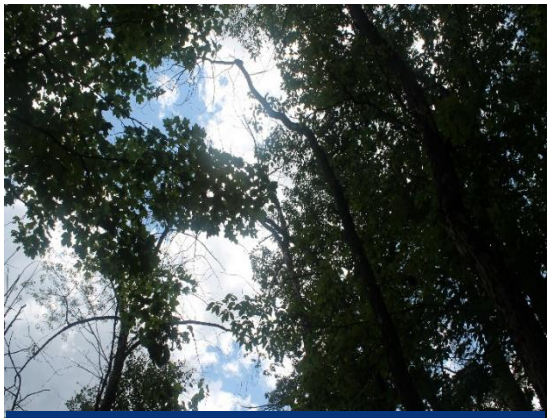


Photo: Invasive Species Centre

All equipment, tools, clothing, and surfaces that have come into contact with ash wood or EAB material should be thoroughly inspected and cleaned to prevent accidental spread. Washing with water followed by soap is recommended, ideally done on-site to reduce transport risks. For non-porous surfaces such as boots, saws, or tree-removal equipment, wiping with a 70% ethanol solution is strongly encouraged, as it helps break down biological residues and potential egg fragments that may not be visible.

Niagara-on-the-Lake, along with the broader Niagara Region, is designated by the **Canadian Food Inspection Agency (CFIA)** as a regulated area for emerald ash borer. The disposal and movement of infested ash material, including logs, branches, and wood chips, will therefore comply with all applicable **CFIA phytosanitary requirements** and Ministerial Orders. Where required, a CFIA Movement Certificate will be obtained prior to transporting any regulated material. Wherever feasible, disposal of infested ash wood should occur on site or as close to the removal location as possible to minimize risk of spread.

CFIA recognized methods for eliminating ash infested tree material include burning, deep burial, and chipping. **Burning** infested ash wood is effective where permitted under Town bylaws and provincial open burn regulations. **Deep burial** to a minimum depth of 2 metres is also an accepted disposal method, as it prevents adult beetles from emerging following pupation. **Chipping** is an effective control measure provided the wood is processed into pieces no larger than 2.5 cm (1 inch) in at least two dimensions, which is necessary to destroy or render non-viable remaining eggs or larvae embedded in the wood. All movement and disposal of infested ash material will follow CFIA guidance to prevent the further spread of emerald ash borer.

At present, repurposing infested ash wood as mulch, compost, or other organic products is **not recommended** unless the material has been treated to meet CFIA phytosanitary standards. While research into safe reuse is ongoing, the risk of inadvertently spreading emerald ash borer remains high without sterilization or regulatory approval.

To support traceability and compliance, all emerald ash borer related disposal actions should be documented. This includes recording the location, date, volume of material removed, disposal method used, and Staff involved. The documentation should be maintained on file for at least **2 years**. Proper disposal, when conducted consistently and according to provincial and federal guidelines, plays a critical role in limiting the spread of emerald ash borer and reducing its long-term ecological and economic impacts.

Restoration

Restoration is a critical component of long-term emerald ash borer (EAB) management, especially in areas where large numbers of ash trees have been lost or removed. The death of ash canopy trees can significantly disrupt native ecosystems, altering light regimes, soil moisture, and understory composition. **Active restoration** efforts not only reduce the likelihood of secondary invasions by opportunistic species like buckthorn or honeysuckle but also help accelerate ecological recovery and stabilize affected sites.

Restoration should be prioritized once infested ash trees have been removed or have declined to a point where their ongoing management is minimal. This helps prevent disturbance to newly planted species and ensures a more stable environment for establishing native vegetation. Restoring a diverse and resilient native plant community is key to preventing reinvasion and promoting long-term ecological function.

Efforts should focus on replanting a variety of native trees, shrubs, and groundcovers adapted to the site's post-EAB conditions, such as increased sunlight and altered soil moisture. In wetland or riparian areas previously dominated by green ash or black ash, restoration should emphasize moisture-tolerant trees and native herbaceous species. In upland forests, oak-hickory or mixed hardwood species can help re-establish canopy structure and wildlife habitat.

Avoiding monocultures and selecting a diversity of native, non-host species will help promote resilience and reduce future pest vulnerability. Mulching around young trees and shrubs can assist with moisture retention and weed suppression but should be used with care to avoid promoting invasive seed germination. In remote or larger sites, broadcasting native seed mixes or encouraging natural regeneration may be more feasible.

Annual **monitoring** for several years post-restoration is essential to evaluate native species establishment, identify invasive resurgence, and assess overall site recovery.

Adaptive management, including supplemental planting, spot treatments, or invasive control, may be needed to ensure long-term success. Engaging local communities, volunteers, and landowners in restoration efforts can enhance early detection, build local support, and strengthen stewardship of recovering landscapes.

By restoring native plant communities adapted to local conditions and resilient to future disturbances, ecosystems affected by emerald ash borer can regain biodiversity, ecological function, and resistance to future invasions. Well-planned restoration not only helps fill ecological gaps left by ash mortality but supports pollinators, wildlife, and long-term forest health.

Recommended Native Species

Canopy Tree Replacements (Non-host, Resilient Species):

- Red Maple (*Acer rubrum*)
- Swamp White Oak (*Quercus bicolor*)
- American Sycamore (*Platanus occidentalis*)
- Blackgum (*Nyssa sylvatica*)
- Bur Oak (*Quercus macrocarpa*)
- Hackberry (*Celtis occidentalis*)
- Tulip Tree (*Liriodendron tulipifera*)

Moist Site & Riparian Species:

- River Birch (*Betula nigra*)
- Silver Maple (*Acer saccharinum*)
- Bald Cypress (*Taxodium distichum*, regionally appropriate)
- Shellbark Hickory (*Carya laciniosa*)
- Buttonbush (*Cephalanthus occidentalis*)

Shrubs & Understory Plants:

- Spicebush (*Lindera benzoin*)
- Winterberry (*Ilex verticillata*)
- Ninebark (*Physocarpus opulifolius*)
- Elderberry (*Sambucus canadensis*)
- Red-osier Dogwood (*Cornus sericea*)

Groundcovers & Pollinator Plants:

- Virginia Wildrye (*Elymus virginicus*)
- Tussock Sedge (*Carex stricta*)

- Wild Bergamot (*Monarda fistulosa*)
- New England Aster (*Symphyotrichum novae-angliae*)
- Black-eyed Susan (*Rudbeckia hirta*)
- Joe-Pye Weed (*Eutrochium maculatum*)

For guidance on appropriate plant selections, refer to Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Spongy Moth Control Plan

Lymantria dispar

Overview

Spongy moth (previously known as gypsy moth) is an invasive insect listed as a **pest** under the Plant Protection Act. It is federally regulated by the Canadian Food Inspection Agency and has caused significant declines in Canada's forestry industry.

Photo: ottoleu, iNaturalist

Goal: To control existing populations of spongy moths and prevent the spread of new populations that will minimize the adverse impacts.

Prevalence: Spongy moth is well established in NOTL and spans across eastern regions in Canada. There are over 300+ plant species that spongy moth is known to impact, but most concern comes with favoured host tree species such as Oak (*Quercus spp*.), Maple (*Acer spp*.), Birch (*Betula*), Alder (*Alanus spp*.), Hawthorne (*Crataegus spp*.). Managing spongy moth infestations has cost Ontario municipalities nearly **$4.5 million per year** (Invasive Species Centre).

Characteristics:

- **Egg mass**: tanned yellow, fuzzy egg masses
- **Caterpillar**: up to 6 cm in length, light grey/brown, with distinctive five pairs of blue dots followed by six pairs of red dots along the back
- **Cocoon/pupal stage**: hard dark brown shell
- **Adult moth males**: brown and feathery antennae
- **Adult moth females**: beige and cannot fly despite wings

Photo: darkraptormacro, iNaturalist

Spongy Moth Life Cycle:

Spongy moth lays 500–1,000 eggs in tree bark crevices. Eggs hatch in April, and the caterpillars feed on leaves for about 40 days, causing the most damage. Afterward, they enter a two-week pupal stage before emerging as adult moths, which live only about two weeks. While adult moths do not feed on leaves, bark remains vulnerable due to the egg masses they deposit.

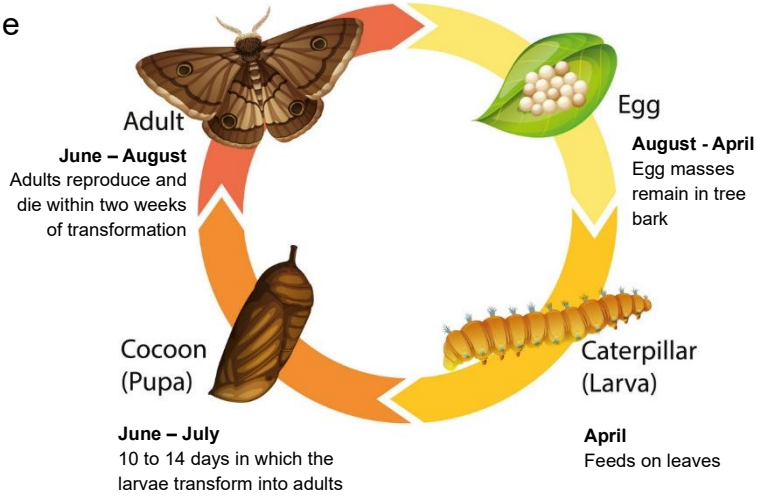


Photo: VectorStock.com/28466074

Spongy Moth Control Plan

Lymantria dispar

Surveillance and Priority Monitoring Schedule

Regular mapping and surveillance of spongy moths are critical for identifying priority control areas, tracking spread, and informing timely management actions. Routine field surveys will be conducted by the Climate Change Coordinator or Town Staff annually, as part of early detection and monitoring. These efforts can be supported with volunteer engagement, and possible **invasive species monitoring program** developed for data collection. Information to be collected is mapped sightings, tree canopy health, and actions taken.

Spongy moth has rather distinctive features throughout its lifecycle, but is known most at its caterpillar stage, with bright blue and red dots, making April to July an ideal time for easier detection. At this stage caterpillars will be actively moving to feed on tree leaves and other host plants. Detecting spongy moth egg masses are also paramount to prevent them from hatching and spreading in abundance. Priority monitoring and field surveys can be conducted in **March to July** to surveillance egg masses, cocoons, and caterpillars, prior to adult moths with flight. **August** can be utilized for monitoring adults in alignment with Tree Check month. Spongy moths can be found on any surface, including backyard furniture or vehicles, and communication pieces in August can help the community become alert of its presence. Pheromone traps can also be used to define the area of occurrence easier on Town property.

Priority surveillance areas for the Town can include:

- Trails and parks
- Woodlots
- Street trees
- Previously controlled sites

Some Preferred Host Trees:

- Oak (*Quercus spp.*)
- Maple (*Acer spp.*)
- Birch (*Betula*)
- Alder (*Alanus spp.*)
- Hawthorne (*Crataegus spp.*)

Removal of Spongy Moth

Removal efforts for spongy moths will be primarily immediate responses and occur at the same time of detection during surveys. The Invasive Species Centre advises to kill these insects on site to prevent spread. If spongy moth is in any stage other than an egg mass, squishing them or placing them in a container of ethanol or soapy water are recommended for control. If egg masses are detected, they should be scrapped and either crushed or submerged into a bucket of ethanol, vinegar, or soapy water for at least 2 days. Afterwards they can be placed in a sealed bag or container and disposed of at landfill.

Spongy Moth Control Plan

Lymantria dispar

Pesticide application is also an alternative treatment for spongy moth. This treatment is to be used only if populations of spongy moths are so great at the site, manual removal is not practical.

Management Timing Summary: The table below outlines management techniques associated with spongy moth and when to act based on activity. The dark blue boxes indicate the most optimal times.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Field Survey			■	■	■	■	■	*Tree Check Month*				
Traps				■	■	■	■					
Egg Removal	■	■	■	■	■				■	■	■	■
Caterpillar Removal				■	■	■						
Adult Removal						■	■	■				
Pesticide									■	■		

Safety: Spongy moth caterpillars have long hairs that can cause people to have allergic reactions or skin irritation. When handling spongy moth always wear gloves.

Spongy Moth Control Plan

Lymantria dispar

Management Considerations

Although spongy moths are established in the Town of Niagara-on-the-Lake, sightings typically do not occur in clusters, making manual removal an appropriate control response. Adults are short lived (approximately 2 weeks) and are not seen as a priority compared to other life stages for management. However, larger populations can warrant chemical application. Site-specific plans will be developed for each priority location to identify the most appropriate management practices, where the following tables provide more detail on technique.

Scrapping Egg Masses	
Location:	Terrestrial
Infestation Size:	Isolated to Medium
Treatment Frequency:	As needed
Timing:	August to April (when egg masses are present)
Comments:	The operator will use a paint scrapper, hard plastic card, butter knife, or similar object to scrap egg masses from the tree bark. Insert the tool to get behind the egg mass and remove its entire composition. The scrapped material should be submerged immediately into a bucket of soapy water and left for two days prior to disposal at landfill. Wearing gloves and eye protection at minimum is required to ensure safe biomaterial handling.

Squishing or Submerging Non-Egg Mass	
Location:	Terrestrial
Infestation Size:	Isolated to Medium
Treatment Frequency:	As needed
Timing:	April to August
Comments:	After eggs hatch either caterpillars, cocoons, or adult moths can be squished or directly submerged into a bucket of ethanol, vinegar, or soapy water for at least two days. Female moths are unable to fly and can be picked up, whereas male moths may be able to escape more readily requiring traps. Wearing gloves at minimum is required to ensure safe handling of biomaterial.

Chemical Treatment

Although manual removal of spongy moths will be the primary mechanism of removal, heavily infested areas can be treated chemically. If chemical treatment is to be used on sites it is likely to be completed by a contracted third-party organization within the Town. This control plan will guide the process, with recommended methods followed and monitored throughout.

Currently, there are currently 45 pesticides registered for use on spongy moth, with the most common product being Treeazin due to its versatility with other species use. For the most updated and complete list of pesticides currently registered for use on spongy moth under the Pest Control Products Act and regulated by Health Canada's Pest Management Regulatory Agency (PMRA), please refer to the PMRA's online product label search before selecting or applying any product.

Registration Number	Registrant Name	Product Name
24175	2022 Environmental Science CA Inc.	Dragnet Ft Emulsifiable Concentrate Insecticide
24778	Natural Resources Canada	Disparvirus Technical
30559	Lallemand, Inc.	Treeazin Systemic Insecticide
31943	Neogen Corporation	Prozap Annihilator-Xp
34427	Andermatt Canada Incorporated	Bovir

The following table provides key product label information for TreeAzin, serving as an example of some details that must be reviewed prior to use.

Product: Treeazin Systemic Insecticide	
Location:	Terrestrial sites
Product Name:	Treeazin Systemic Insecticide
Registrant Name:	Lallemand Inc./Bioforest
Active Ingredient:	Azadirachtin
Registration Number:	30559
Application Placement:	Applied at a pre-drilled hole ~ 15 cm to 30 cm above ground level at a 20 to 45 degree downward angle
Application Rate:	3 mL per cm DBH
Treatment Frequency:	One application per tree (bi-annually if needed)
Timing:	Fall (after nesting season)
Comments:	To be used when detection occurs in the area or within 24 km and trees appear healthy. When the injection is completed, wait for 1-2 minutes before removing the canister and nozzle to avoid pesticide spillage. Moves rapidly throughout the treated tree (approx. 48 hours) and provides protection for ~2 years. Products are also suited for emerald ash borer, hemlock woolly adelgid, tent caterpillars, European elm scale, sawflies, and more at different application rates. For more information visit the product label.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for spongy moth are provided below.

KPI	Description	Target/Benchmark
Species Early Detection Reports	Number of early detections of new spongy moth sites submitted through internal or public reporting	≥ 5 verified early detection annually
Rapid Response Time	Time from detection to management action for new spongy moth invasions	≤ 1 week from verified detection to action plan initiation
Infestation Area (ha or m²)	Total area affected by spongy moth	Annual reduction in total infestation zone
Number of Priority Sites Treated	Total number of identified priority sites where spongy moth management occurred	Annual increase; e.g., 1+ sites treated per year
% Reduction in Invasive Cover	Percentage decrease in area cover of spongy moth at treated sites	≥ 60% reduction in invasive cover within 1 year
Native Species Establishment Rate	Percentage of planted native species that survive after 1 growing season	≥ 70% survival rate of planted native species
Restored Area (in hectares or m²)	Total area restored with native planting, soil rehab, and other actions post-treatment	≥ 500 m² restored per year, depending on scale
Number of Educational Campaigns	Social media posts, workshops, newsletters, etc. focused on spongy moth prevention and ID	At least 1 campaign annually (seasonal focus)
Volunteer/Community Participation Rate	Number of community members involved in spongy moth work (events, monitoring, etc.)	≥ 20 participants annually

Disposal

Spongy moth can be safely and effectively disposed of at any life stage. Egg masses, caterpillars, and adult moths should be placed directly into a bucket or container filled with soapy water (approximately 2 tablespoons of dish soap per litre). The biomass must remain fully submerged for **at least 48 hours** to ensure complete mortality. After soaking, the material should be sealed in a plastic bag or container and placed in the regular garbage. Spongy moth material must not be composted or included with yard waste, unless specified by the facility to treat, as this increases the risk of accidental spread.

All tools, equipment, and clothing that have come into contact with spongy moths should be carefully inspected for any residual biomass, such as egg masses or body fragments. Whenever possible, cleaning should take place **on-site**, starting with a water rinse followed by soap. For non-porous items such as boots or hand tools, wiping with ethanol is preferred to ensure disinfection.

Tree removal associated with spongy moth infestation can result in a significant volume of wood waste. Niagara Region is a regulated area for spongy moth under the Canadian Food Inspection Agency (CFIA), and all movement or disposal activities must follow their movement requirements policy. A Movement Certificate will be required if transporting wood material with bark attached. Additional phytosanitary requirements for marine vessels entering Canada are also provided by CFIA. High risk season for flighted spongy moth in Eastern Canada begins March 15 and ends September 15 for all Canadian ports.

The recommended methods for disposing of wood infested with spongy moth include burning, burying, and chipping, each of which is effective in eliminating all life stages of the insect when performed correctly. **Burning** the material on site, where permitted, is a reliable way to completely destroy eggs, larvae, pupae, and adults. **Burying** infested wood to a depth of at least 1.8 metres prevents the emergence of any surviving insects and minimizes the risk of reinfestation. **Chipping** wood into pieces smaller than 2.5 cm (1 inch) physically destroys any hidden life stages within the material, making it another effective disposal method.

These activities should be carried out on site or as close as possible to the area of infestation to reduce the risk of transporting spongy moths to new locations. Documentation for all removal and disposal activities are required to be on file for a **minimum of 2 years**.

Restoration

Restoration plays a critical role in mitigating the long-term ecological impacts of spongy moth (*Lymantria dispar*), especially in areas where repeated defoliation has caused significant canopy loss and understory degradation. Although outbreaks are cyclical, repeated infestations can alter forest composition, create openings for invasive species, and reduce native biodiversity. Active restoration helps re-establish resilient plant communities, improve forest structure, and support long-term ecosystem stability.

Efforts should begin once spongy moth populations have declined and defoliation has subsided, allowing new plantings to establish without additional stress. Restoration should prioritize increasing **species diversity and site resilience**, rather than directly replacing lost host trees. While oaks, particularly white and chestnut oak, are preferred by spongy moth, many individuals can survive moderate defoliation. Retaining healthy survivors supports natural regeneration, wildlife habitat, and acorn dispersal.

In stands with high tree mortality, planting a diverse mix of native tree and shrub species, especially those less preferred by spongy moth, such as maples, hickories, and conifers, can reduce vulnerability to future infestations. **Avoid replanting large monocultures** of highly susceptible species (e.g., oaks, aspens, birches) without incorporating more resilient companions.

Restoration strategies should be tailored to site conditions, which may shift significantly due to defoliation-related changes in light, soil, and moisture. On slopes or disturbed areas, native groundcovers and erosion-control species can help stabilize soil and reduce runoff. Applying a 5–7 cm (2–3 inch) mulch layer around new plantings helps retain soil moisture and suppress weeds, but compost or amendments that may favor invasive growth should be avoided. In remote or larger areas, natural regeneration or broadcast seeding with native species may offer practical alternatives to full-scale planting.

Monitoring is essential to track the success of restoration efforts, including native plant survival, potential resurgence of spongy moth populations, and encroachment by other invasive species. Annual site assessments should guide adaptive management actions such as replanting, selective thinning, or targeted pest control. Community engagement, volunteer monitoring, and collaboration with local forest agencies can further strengthen long-term outcomes.

By re-establishing diverse, resilient native plant communities, restored areas become better equipped to resist future pest pressures, support native wildlife and pollinators, and recover ecological function. Early, strategic, and sustained restoration improves the long-term health of forested landscapes impacted by spongy moth.

Recommended Native Species

Canopy Tree Species:

- Red Maple (*Acer rubrum*)
- Sugar Maple (*Acer saccharum*)
- American Beech (*Fagus grandifolia*)
- Eastern Hemlock (*Tsuga canadensis*) – susceptible to hemlock woolly adelgid
- Eastern White Pine (*Pinus strobus*)
- Black Cherry (*Prunus serotina*)
- Shagbark Hickory (*Carya ovata*)
- Tulip Tree (*Liriodendron tulipifera*)

Species to Retain Where Possible:

- White Oak (*Quercus alba*)
- Chestnut Oak (*Quercus montana*)
- Northern Red Oak (*Quercus rubra*) – replant only with diverse buffer species

Shrubs & Understory Plants:

- Witch Hazel (*Hamamelis virginiana*)
- Spicebush (*Lindera benzoin*)
- Silverberry *(Elaeagnus commutata*)
- Red-osier Dogwood (*Cornus sericea*)
- Native Viburnums (*Viburnum lentago,V. lantanoides, and others*)

Groundcovers & Pollinator Plants:

- Big Bluestem (*Andropogon gerardii*)
- Ivory Sedge (*Carex eburnea*)
- Golden Alexander (*Zizia aurea*)
- Wild Geranium (*Geranium maculatum*)
- Foamflower (*Tiarella cordifolia*)
- Large leaved aster (*Eurybia macrophylla*)

For guidance on appropriate plant selections, refer to Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Knotweed Control Plan

Fallopia

Overview

Knotweed is a terrestrial, perennial plant with four invasive varieties: Japanese knotweed, giant knotweed, bohemian knotweed, and Himalayan knotweed (not yet established). Each one is listed as a restricted species under the Ontario Invasive Species Act. These plants resemble bamboo vegetation and prefer areas with water but rapidly grow in a variety of places including concrete cracks.

Goal: To control existing populations of invasive knotweeds (Japanese, giant, bohemian, and Himalayan), while preventing the spread of new populations that will minimize the adverse impacts.

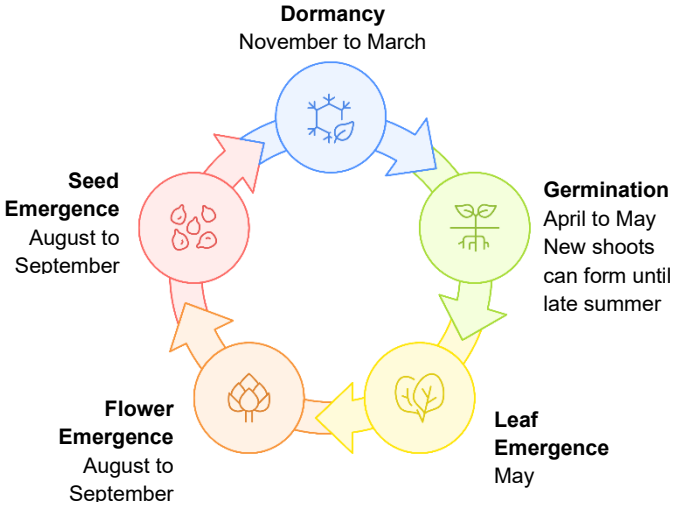
Prevalence: Knotweed is well established in NOTL and spreads rapidly, outcompeting native species and destroying biodiversity. Its aggressive roots can penetrate concrete and asphalt up to 8 cm thick, causing costly infrastructure damage. In places like the United Kingdom, soil with fragments of knotweed must be treated as hazardous waste. Favoring stream banks, knotweed weakens soil stability, increasing erosion and flood risk. It also obstructs access to waterways, disrupting recreation like canoeing, boating, angling, and swimming.

Characteristics:

- **Leaves**: large, spade to triangular-shaped; giant knotweed has heart-shaped leaves twice the size of other species.
- **Stems**: thick, smooth, hollow, with jointed red-brown nodes. Mature stems are green; juvenile stems are slightly purple and resemble asparagus.
- **Flowers**: small white to green flowers bloom in clusters from July to August.
- **Seeds**: small, shiny, winged, and triangular, easily dispersed by wind or water.

Lifecycle:

Knotweed begins growing in April and spreads rapidly, primarily through rhizomes and root fragments, though it can also reproduce by seed. While seeds may stay viable for up to 15 years, seedlings are rare, with most reproduction occurring vegetatively. After the first hard frost, the plant goes dormant in winter, though dead canes often remain until spring. Rhizomes are the main source of spread, dispersed by floods, erosion, or human activities like roadside clearing and contaminated fill dirt.



Surveillance and Priority Monitoring Schedule

Knotweed thrives along stream banks and sloped areas with a lot of water. To control established populations regular monitoring efforts will be taken. Priority monitoring will occur at least once a year by the Climate Change Coordinator or other Staff during asset inspections between **April and May** when stalks and leaves are visible and still before nesting occurs for other desired wildlife. If any control management occurs the site should be revisited 2 weeks after to monitor efficacy.

Removal of Knotweed

Removal of knotweed will likely be completed by a contracted third-party organization within the Town. This control plan will guide the process, with recommended methods followed and monitored throughout. **Removal efforts will focus on areas where safety concerns exist or infrastructure may be at risk**, such as road ditches, irrigation channels, or stormwater management ponds identified during regular inspections.

When knotweed is found to obstruct infrastructure or pose safety issues, the Divisional Supervisor and Climate Change Coordinator will be notified. The Coordinator will visit the site to collect pre-removal data, including photographs and measurements of the area affected. The Divisional Supervisor will arrange for removal by a contractor or Staff using appropriate herbicide or manual methods.

Following treatment, the Climate Change Coordinator will revisit the site to document post-treatment conditions and record data for invasive species management. Treated locations and areas of concern will be mapped, with management actions and key performance indicators tracked in the Town's GIS database.

Knotweed can regenerate from cut stems, making mechanical removal ineffective. Cutting one stem may produce several new shoots, so consistent herbicide use is essential. For tall stands, stems should be cut and then treated with herbicide to reduce spray drift, leaving one to two leaves to ensure effective transfer to the roots. Cutting to ground level should be avoided when using chemical treatment. Shorter stands can be treated directly with herbicide from **August to October**, when control is most effective. Habitat Aqua is the only pesticide currently registered in Canada for knotweed control in aquatic sites and must be used in those areas.

Where feasible, grazing can provide an effective alternative control method, particularly where other invasive species are present. However, grazing is not permitted at sites treated with herbicides within the past three years. A new manual method being tested in the United Kingdom uses a metal mesh to suppress growth. As knotweed grows through the mesh, repeated abrasion weakens the plant and can eventually kill it.

Knotweed Control Plan

Fallopia

Management Timing Summary: The table below outlines management techniques associated with knotweed and when to act based on activity.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Priority Monitoring			■	■				■	■			
Cutting							■	■				
Metal Mesh Pilot					■	■	■	■	■			
Herbicide Foliar								■	■	■	■	
Grazing							■	■	■			

Management Considerations

Due to the height of knotweed, it can sometimes limit spraying herbicides and require cutting plant material prior to chemical application. Site-specific plans will be developed for each priority location to identify the most appropriate management practices. The following tables go into more detail about each management technique.

Cutting	
Location:	Aquatic sites and terrestrial sites occasionally if stands are too high to spray or creates access barriers to spray
Infestation Size:	Small to large
Treatment Frequency:	Multiple times annually or as needed
Timing:	May through August (dependent on nesting sites)
Comments:	Cutting will occur if the knotweed stems are too high to apply herbicides safely or for removing dead stalks. If cutting is used as the only control of untreated living plants all cuts should be made at ground or substrate level and is optimal to have several removal timings throughout the growing season to reduce the stem density.

Pilot: Metal Mesh	
Location:	Aquatic sites
Infestation Size:	Small to medium
Treatment Frequency:	Only for aquatic sites
Timing:	May (after cut stems) to October
Comments:	This control measure is novel to the United Kingdom and has not been heavily researched in North America. Therefore, this method should be utilized as a pilot project to determine effectiveness and best practices.

Chemical Treatment

Currently, there are 226 pesticides registered for the control of knotweed, under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA). The first five products listed are exemplified below.

Registration Number	Registrant Name	Product Name
5931	Loveland Products Canada Inc.	2,4-D Amine 600 Herbicide
9516	Loveland Products Canada Inc.	MCPA Amine 500 Herbicide
14545	Gowan Company, L.L.C.	Treflan QR5 Granular Herbicide
14726	Nufarm Agriculture Inc.	Nufarm 2,4-D Amine 600 Liquid Herbicide
16279	Tessenderlo Kerley, Inc.	Lorox L Herbicide

Chemical Treatment

Currently, the most commonly used products are Roundup and Vision Max, with preference given to glyphosate-based pesticides. However, full details of each product can be accessed through the PMRA's product label search.

Chemical: Roundup WeatherMAX (Glyphosate)	
Location:	Terrestrial sites
Product Name:	Roundup WeatherMAX® With Transorb 2 Technology Liquid Herbicide
Registrant Name:	Bayer Cropscience Inc.
Active Ingredient:	Glyphosate
Registration Number:	27487, Pest Control Products Act
Application Placement:	Applied directly to foliage (absorbed systemically to target roots) or as injection between the second and third internode.
Application Rate:	Foliar: 1.2-1.5 L/ha with 80-100 L/ha water Injection: 5mL per stem
Treatment Frequency:	Apply maximum of 2 treatments per year as needed annually
Timing:	Mid-August to early November
Comments:	Visual effects will occur within 7-10 days of application slowly wilting and darkening the plant. For more information visit the chemical label

Product: Vision Max (Glyphosate)	
Location:	Terrestrial sites
Product Name:	VisionMAX Silviculture Herbicide
Registrant Name:	Bayer Cropscience Inc.
Active Ingredient:	Glyphosate
Registration Number:	27736
Application Placement:	Applied directly to foliage; absorbed systemically to target roots.
Application Rate:	0.67 – 1.34 percent solution
Treatment Frequency:	Apply maximum of 2 treatments per year as needed annually
Timing:	Late-August to End of September (late summer to early fall)
Comments:	Do not treat directly over water. Targets plant enzymes that are not found in animals and has low toxicity to humans. It is rapidly broken down by soil microorganisms and binds tightly to clay or organic matter in soil. There is low potential for groundwater leaching and affect to human and wildlife.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for knotweed are provided below.

KPI	Description	Target/Benchmark
Reduction in Aboveground Biomass	% reduction in stem count per m² or % cover over time	Baseline stem density or canopy cover is compared annually post-treatment (e.g., 50%+ in year 1)
Herbicide Treatment Effectiveness	% of treated stems showing no regrowth after 1–2 growing seasons	Visual inspection post-application; target is >90% mortality where appropriate
Containment of Spread	No new satellite patches within a defined buffer zone	0% increase in patch size; no new satellite patches within 10 m buffer zone annually
Native Vegetation Recovery	Increase in native species richness and cover (%) in treated areas	At least 30–50% native vegetation cover within treated areas by year 2
Soil Disturbance Minimization	No increase in erosion or bare soil following treatment	<10% increase in bare soil area or erosion indicators post-treatment
Community / Partner Engagement	# of local landowners, volunteers, or municipal partners involved	Involve 5 interested parties per year (e.g., landowners, NGOs, municipal representatives)
Post-Treatment Monitoring Frequency	# of follow-up surveys or treatments per season/year	Minimum 2 follow-up monitoring visits per growing season (spring & late summer)
Reduction in Management Cost Over Time	Decrease in cost per m² treated after year 2–3	≥25% reduction in cost per m² by year 3

Disposal

Any residual plant parts of knotweed that have not been treated with herbicides must not be left on moist soil or in water (intentionally or indirectly with animals) as they will resprout. All plant parts, including the stem, must therefore be left either in bags or on elevated platforms to be solarized prior to being sent to landfill, composted at municipal facility, or burned. Pesticide killed material can be left on site to decompose, if appropriate, or disposed elsewhere. Tools, equipment, and vehicles used during removal should be thoroughly cleaned before leaving the site to prevent inadvertent spread of seeds or fragments.

Restoration

Following the removal of knotweed (e.g., Japanese, Giant, or Bohemian), active restoration is essential to prevent regrowth and reestablish healthy, competitive native vegetation. Knotweed aggressively colonizes disturbed soils, riverbanks, roadsides, and other open areas, forming dense monocultures that exclude native species and alter ecosystem processes.

Once removal is complete restoration should focus on **replanting with fast-growing, deep-rooted, native species** that can stabilize soils, shade out knotweed regrowth, and support biodiversity. In riparian zones, restoring vegetation is especially important to reduce erosion and maintain bank integrity.

Apply a 7–10 cm (3–4 inch) **mulch layer** in treated areas to suppress any remaining root fragments or seedlings and to give native plantings a competitive advantage. Avoid using compost or topsoil that may be contaminated with knotweed fragments.

Sites should be monitored at least **twice annually** for 3 – 5 years to detect any resprouting or new growth. Repeat treatments and follow-up planting may be needed to ensure long-term control and successful restoration.

Recommended Native Species:

- **Visually Similar Plants:**
  - Nannyberry (*Viburnum lentago*)
  - Common elderberry (*Sambucus canadensis*)

- **Riparian Trees & Shrubs:**
  - Eastern cottonwood (*Populus deltoides*)
  - Red-osier dogwood (*Cornus sericea*)

- **Herbaceous & Groundcover Plants:**
  - Canada goldenrod (*Solidago canadensis*)
  - Blue vervain (*Verbena hastata*)
  - Virginia wild rye (*Elymus virginicus*)
  - Switchgrass (*Panicum virgatum*)
  - Boneset (*Eupatorium perfoliatum*)

- **Pollinator Species:**
  - Wild bergamot (*Monarda fistulosa*)
  - Black-eyed Susan (*Rudbeckia hirta*)
  - New England aster (*Symphyotrichum novae-angliae*)

By restoring native plant communities, the risk of knotweed re-invasion is significantly reduced, while improving habitat quality and ecosystem function.

For guidance on appropriate plant selections, refer to the Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Purple Loosestrife Control Plan

Lythrum salicaria

Overview

Purple loosestrife is a hardy perennial of freshwater habitats such as wetlands, marshes, water-filled ditches, natural waterways, and irrigation canals. It is found in every province in Canada and across North America.

Photo: Lauren Bell

Goal: To control existing populations of invasive purple loosestrife and prevent the spread of new populations that will minimize the adverse impacts.

Prevalence

Purple loosestrife is abundant in NOTL, capable of producing up to two million seeds per growing season. It forms dense stands that clog irrigation canals, degrade farmland, and reduce water flow in ditches, while its thick growth can also impede boat travel. The plant decreases recreational use of wetlands, crowds out native vegetation, and degrades habitats for birds, insects, and other wildlife. The release of *Galerucella* beetles as biological control agents has helped control efforts.

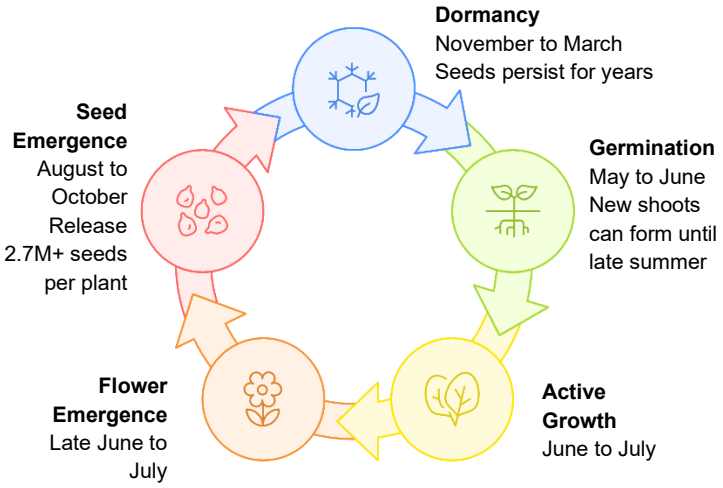
Photo: Lauren Bell

Characteristics:

- **Stems**: Square, woody, 60–120 cm tall; new growth is green, older stems red-brown or purple.
- **Leaves**: Narrow, long, triangular, smooth-edged with fine hairs; green in summer, turning bright red in fall.
- **Flowers**: Showy, deep pink to purple (occasional light pink or white), in dense cone-shaped clusters; 5–7 wrinkled petals with a small yellow center.

Lifecycle:

Purple loosestrife seeds remain dormant through winter and can stay viable for years. In its first season, the plant develops a deep taproot and root system, allowing it to resprout annually. Active growth occurs from June to mid-September, with flowering starting in mid to late June and seed production beginning by early August. After the first hard frost (September–October), the above-ground parts die back, and seeds are released throughout winter.



Purple Loosestrife Control Plan

Lythrum salicaria

Surveillance and Priority Monitoring Schedule

To manage established purple loosestrife populations, regular monitoring will be conducted. Priority monitoring will occur at least once annually between **mid-July and early August**, when the plants are in bloom. Look for spikes of **pink-purple flowers** and **square woody stems**, up to 2 m tall. To avoid encountering seed production and risk of spread, monitoring will stop prior to mid-August. If control measures are implemented, the site should be revisited two weeks later to assess effectiveness and monitored twice annually, in spring or fall, in addition to summer.

Removal of Purple Loosestrife

Purple loosestrife removal will likely be completed by a contracted third-party organization authorized to apply herbicides within the Town. This control plan will guide the process, with recommended methods followed and monitored throughout. **Removal efforts will focus on areas where safety concerns exist or infrastructure may be at risk**, such as road ditches, irrigation channels, or stormwater management ponds identified during regular inspections.

When purple loosestrife is found to obstruct infrastructure or pose safety issues, the Divisional Supervisor and Climate Change Coordinator will be notified. The Coordinator will visit the site to collect pre-removal data, including photographs and measurements of the area affected. The Divisional Supervisor will arrange for removal by a contractor or Staff using appropriate herbicide or manual methods.

Following treatment, the Climate Change Coordinator will revisit the site to document post-treatment conditions and record data for invasive species management. Treated locations and areas of concern will be mapped, with management actions and key performance indicators tracked in the Town's GIS database.

Purple loosestrife spreads through root and stem fragments, making control difficult and requiring different approaches based on population size. For isolated or small infestations, **hand-pulling or digging** is the most effective manual method, ensuring complete root removal and careful disposal to prevent spread. Mowing or brush cutting are discouraged, as they leave the root system intact and risk spreading plant fragments.

Purple Loosestrife Control Plan

Lythrum salicaria

For medium to large populations, **herbicide** may be used at terrestrial locations and should be applied to the leaves for foliar application. **Currently there is no herbicide registered for use in Canada that can be applied in aquatic sites for purple loosestrife.** Where herbicide use is limited, cutting within three weeks of flowering can prevent seed production and reduce spread, with all cutting occurring before seed set.

Mating black-margined loosestrife beetle
Photo: Donna MacKenzie, Ontario Beetles

The deployment of ***Neogalerucella* beetles as a biological control agent** in Ontario has proven highly effective in reducing purple loosestrife populations. Although the Town will not be applying this control method directly, it is recommended to recognize and not harm *Neogalerucella* beetle populations encountered in natural areas. Avoid disturbing or removing these beetles, as they serve as valuable natural allies in the long-term control of purple loosestrife.

Golden loosestrife beetle
Photo: Central Lake Ontario Conservation

Grazing may be considered to help suppress loosestrife and promote native species, especially in large or mixed invasive species infestations. ***Flooding and prescribed burns should be avoided**, as loosestrife thrives in wet conditions and its deep roots are protected from fire in moist soil.*

Management Timing Summary: The table below outlines management techniques associated with purple loosestrife and when to act based on activity.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Priority Monitoring												
Hand pulling/ digging												
Herbicide Foliar												
Grazing												

Management Considerations

Due to easy spread of purple loosestrife by stem fragments, roots, and seeds hand pulling is considered the best control measure whenever feasible at smaller densities or sites. Herbicide will be used for larger populations at terrestrial sites and evaluated in the future for aquatic use, if products become available. Site-specific plans will be developed for each priority location to identify the most appropriate management practices.

Hand Pulling/Digging	
Location:	Terrestrial or shallow aquatic sites
Infestation Size:	Isolated to small
Treatment Frequency:	As often as needed
Timing:	Mid-June to July
Comments:	Must be completed prior to flowers go into seed (mid-August). If pulling, it must be done gently to not break the taproot that can re-sprout and prevent seeds from coming to the surface where they can germinate. When digging the perimeter needs to be large enough to not break the roots for the same reason.

Chemical Treatment

As of 2025, there are 114 pesticides registered for the control of purple loosestrife, under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA). The first five products listed are exemplified below.

Registration Number	Registrant Name	Product Name
27487	Bayer Cropscience Inc.	Roundup Weathermax with Transorb 2 Technology Liquid Herbicide
27615	Albaugh LLC	Vantage Plus Max Herbicide Solution
27736	Bayer Cropscience Inc.	Visionmax Silviculture Herbicide
27946	Bayer Cropscience Inc.	Renegade HC Liquid Herbicide
27988	Interprovincial Cooperative Limited	IPCO Factor 540 Liquid Herbicide

Currently, the most commonly used products are Roundup and Vision Max, with preference given to glyphosate-based pesticides. However, full details of each product can be accessed through the PMRA's product label search. More details of these two commonly used products are outlined below.

Chemical: Roundup Weathermax (Glyphosate)	
Product Name:	Roundup WeatherMAX® With Transorb 2 Technology Liquid Herbicide
Registrant Name:	Bayer Cropscience Inc.
Active Ingredient:	Glyphosate
Registration Number:	27487
Application Placement:	Applied directly to leaves (foliage); absorbed systemically to target roots.
Application Rate:	0.67-1.34 solution (higher rate for heavier infestations)
Treatment Frequency:	Apply maximum of 2 treatments per year as needed annually
Timing:	June to early August (active growth)
Comments:	**Terrestrial sites only – do not** directly apply over waterbodies. When feasible, remove the flower heads to before application to prevent spread of seeds. Extreme care needs to be taken for spray drift when adjacent to agricultural lands and avoid crop damage or untargeted species.

Chemical: Vision Max (Glyphosate)	
Product Name:	VisionMAX™ Silviculture Herbicide
Registrant Name:	Bayer Cropscience Inc.
Active Ingredient:	Glyphosate
Registration Number:	27736
Application Placement:	Bayer Cropscience Inc
Application Rate:	0.67 – 1.34% solution (higher rate for heavier infestations)
Treatment Frequency:	Apply maximum of 2 treatments per year as needed annually
Timing:	August to September (late summer)
Comments:	Do **NOT** use over open water, the product is not registered for direct application to bodies of water. Treat when plants are actively growing at or beyond the bloom stage.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for purple loosestrife are provided below.

KPI	Description	Target/Benchmark
Percentage Cover or Density	% cover or number of stems per square meter in standardized plots over time	Reduce density to ≤ 5 stems/m² within 2–3 years of intervention
Infested Area Treated	Total square metres of loosestrife-infested habitat surveyed versus treated	Treat ≥ 90 percent of identified infested area
Change In Stem Count or Density	Track reduction in flowering stems per plot; % decrease in flower length or count can reflect reproductive decline	80% reduction in flowering stems
Biocontrol Damage Indicators	Proportion of leaves or buds showing *Galerucella* beetle feeding damage (e.g. round feeding holes); Number of beetles or larvae in monitored areas	60% of leaves or buds show feeding damage
Monitoring Frequency	Number of surveys conducted per year (e.g. early summer for flowering, mid-summer for feeding)	≥ 1 survey annually
Response Time	Days between detection of new outbreak and initiation of treatment or prevention actions	Initiate control within 30 days of new report
Native Species Cover	Number of native species planted in area; % established	Increase in native cover by 30%

Disposal

Any residual plant parts of purple loosestrife that have not been treated with herbicides must not be left on moist soil or in water (intentionally or indirectly with animals) as they will resprout. **All plant parts**, including the **stem**, must therefore be left either in bags or securely tarped on elevated platforms to be solarized prior to being sent to landfill, composted at municipal facility, or burned. Pesticide killed material can be left on site to decompose, if appropriate, or disposed elsewhere. Tools, equipment, and vehicles used during removal should be thoroughly cleaned before leaving the site to prevent inadvertent spread of seeds or fragments.

Restoration

Once purple loosestrife has been effectively removed, it is recommended to support native wetland vegetation to prevent reinvasion and restore ecological function. Restoration efforts should include planting a diverse mix of native species well-adapted to **moist to wet soils**. These species support pollinators, stabilize soil, and help reestablish diverse native communities, while helping suppress loosestrife regrowth.

Restoration should focus on planting a **diverse mix of native, wetland species** that are well-adapted to the site's moisture levels and soil type. These plants help suppress loosestrife regrowth, stabilize soils, and support healthy wetland food webs, including pollinators, amphibians, and waterfowl.

Apply a 7–10 cm (3–4 inch) **layer of mulch** in bare areas to suppress any remaining loosestrife seeds and reduce early competition as native species become established. Avoid the use of compost, as it can promote invasive growth. In larger areas or where replanting is not feasible, encouraging **natural regeneration** of native wetland plants may be effective if the loosestrife seed bank has been depleted.

Restored areas should be **monitored annually** to assess native plant establishment, coverage, and any signs of Purple Loosestrife resurgence. Follow-up planting or spot removal may be required to ensure long-term restoration success.

Recommended Native Species:

- **Visually Similar Plants:**
  - Hoary vervain (*Verbena stricta*)
  - Blue vervain (*Verbena hastata*)
  - Tall ironweed (*Vernonia altissima*)
  -
- **Emergent & Moist Soil Plants:**
  - Swamp milkweed (*Asclepias incarnata*)
  - Arrowhead (*Sagittaria latifolia*)
  - Marsh marigold (*Caltha palustris*)
  - Pickerel weed (*Pontederia cordata*)

- **Shrubs:**
  - Meadowsweet (*Spiraea alba*)
  - Buttonbush (*Cephalanthus occidentalis*)
  - Red-osier dogwood (*Cornus sericea*)

- **Pollinator-Supporting Species:**
  - Dense blazing star (*Liatris spicata*) *Listed as Threatened in Ontario and Canada*
  - Cardinal flower (*Lobelia cardinalis*)
  - Joe-Pye weed (*Eutrochium maculatum*)
  - Great blue lobelia (*Lobelia siphilitica*)
  - Star-flowered Solomon's seal (*Smilacina stellata*)

A well-planned restoration approach not only discourages purple loosestrife from returning but also strengthens the ecological integrity of the wetland for years to come.

For guidance on appropriate plant selections, refer to the Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Giant Hogweed Control Plan

Heracleum

Overview:

Giant hogweed is a terrestrial perennial plant listed as a **noxious weed** under the Ontario Weed Control Act. It is the common name of four species of large hogweeds that are invasive outside of their native range (*Heracleum mantegazzianum* – the most common, *H. persicum*, *H. sosnowski*, *and H. sphondylium*). All species are very similar in appearance with only minor differences but can cause **serious human health risks**.

Photo: Invasive Species Centre

Goal: To prevent populations of invasive giant hogweed from occurring in NOTL and utilize rapid response actions to newly established populations to eradicate the species.

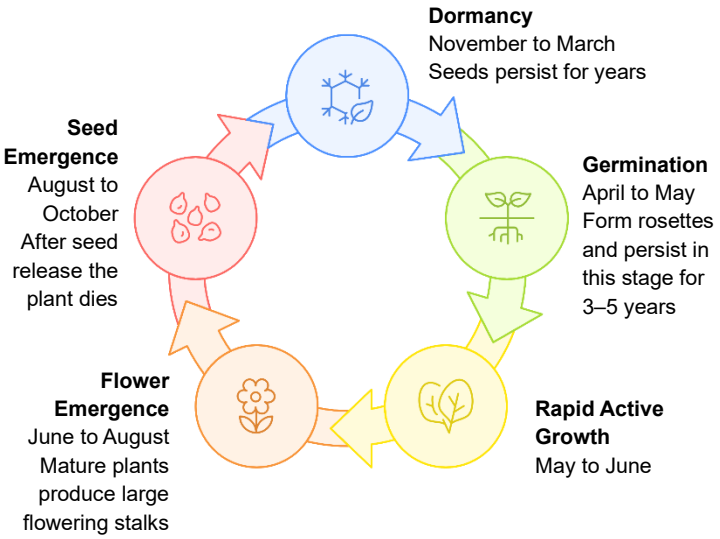
Prevalence: Invasive giant hogweed has not yet been confirmed in NOTL but is present in other parts of Ontario and can spread rapidly. Contact with its **sap can cause second-degree burns, painful blisters, and temporary or permanent blindness**. It typically invades roadsides, ditches, riverbanks, fields, and open woodlands, and less commonly, agricultural land. Ontario municipalities spend an average of over **$200,000 annually** on management and control efforts (Invasive Species Centre, 2019).

Characteristics:

- **Leaves**: Shiny, large with coarse, jagged edges, cut into 3 large segments, and height 8-14 ft.
- **Stems**: Thick bright green stem with purple blotches and bristly hairs
- **Flowers**: White flowers in large umbrella shape cluster (12-36 in) containing smaller clusters

Lifecycle:

Giant hogweed seeds germinate in April to May. The plant stays in this vegetative stage for 3–5 years. In its final year, a flowering stalk emerges in early to mid-June, with full bloom from mid-June to August. Flowers turning from white to green signal seed production. By late summer (August–September), the plant produces thousands of seeds and then dies, completing its monocarpic life cycle.



Giant Hogweed Control Plan

Heracleum

Surveillance and Priority Monitoring Schedule

Giant hogweed is among the first plants to emerge in spring and bloom in summer, making it ideal for monitoring efforts from **late April to August**. Treated sites should be monitored every six weeks for up to three years, or until no regrowth or new seedlings appear, as the seed bank can remain viable for several years.

Safety Warning:

Giant hogweed poses a **serious health risk**. Its sap contains toxins that, when exposed to sunlight, can cause **severe skin burns**, blistering, long-term scarring, and temporary or permanent **blindness** if it contacts the eyes.

Always wear full protective gear when handling or working near the plant: waterproof gloves, long sleeves, pants, eye protection, and ideally a disposable spray suit over clothing. Tape sleeves and pant legs to reduce exposure.

After removal: Carefully take off protective gear to avoid sap contact. Wash gloved hands, then remove and clean eye protection, followed by gloves.

Exposure or Contact: If sap contact has been made with skin, immediately wash the area with soap and water. Keep it out of the sun and see a doctor if inflammation occurs. If contact has been made with eyes, immediately flush them with water and seek medical attention.

DO NOT attempt removal without proper protection.

Due to the health risks that are present with giant hogweed, it is advised not to conduct on-site community events where giant hogweed is known to be growing or for monitoring efforts. Instead, digital communications (i.e. social media, newsletter, etc.) can be used to spread awareness and methods available for the community to be involved with early response and rapid detection.

Removal of Invasive Giant Hogweed

If giant hogweed is detected in Niagara-on-the-Lake removal should occur immediately to limit populations from growing and ensure the safety of others. When found, the Divisional Supervisor and Climate Change Coordinator will be notified. The Coordinator will visit the site to collect pre-removal data, including photographs and measurements of the area affected. The Divisional Supervisor will arrange for removal by a contractor or Staff using appropriate herbicide or manual methods.

Following treatment, the Climate Change Coordinator will revisit the site to document post-treatment conditions and record data for invasive species management. Treated locations and areas of concern will be mapped, with management actions and key performance indicators tracked in the Town's GIS database.

Due to the toxins released by giant hogweed, chemical control is recommended to minimize direct contact. The most effective time for treatment is in **early spring, (April to May)** when plants are under 30 cm tall and more susceptible to herbicide. During this stage, foliar applications of glyphosate are most effective, and cooler temperatures make protective gear easier to wear. As the season progresses, plants become larger and more hazardous, making control increasingly difficult. To further suppress regrowth, treated areas should be mulched 10–14 days after application.

If herbicide application occurs, it will likely be completed by a contracted third-party organization, following the methods and monitoring procedures outlined in this control plan. Environmental assessments should also be completed before treatment, as nesting activity occurs in May.

Manual methods such as digging are suitable for isolated or small populations but must be done with caution due to the toxic sap. Digging widely around the plant helps remove the entire taproot, while keeping safer distances. Hand pulling is not recommended to limit safety hazards. Tarping the area after removal can smother regrowth, with repeated efforts as needed. **Flowering umbels should not be removed**, especially if flower heads have turned green, as this indicates seed production. Attempting removal at this stage poses high health risks and increases the chance of spreading seeds. Mechanical cutting (e.g., with brush cutters) is not recommended unless required to access plants for herbicide application in large populations and should only be done with extreme caution. ***Giant hogweed must not be burned and its effects on grazers digestion are unknown, limiting control measures.***

Giant Hogweed Control Plan

Heracleum

Management Timing Summary: The table below outlines management techniques associated with phragmites and when to act based on activity.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Priority Monitoring												
Digging												
Foliar Herbicide												

Management Considerations

Due to giant hogweed sap toxicity, herbicide applications are recommended as the first control measure to prevent handholding of the plant and contact. However, with small, isolated populations digging can be an effective approach to removal. Site-specific plans will be developed for each priority location to identify the most appropriate management practices.

Digging	
Location:	Terrestrial
Infestation Size:	Isolated to small
Treatment Frequency:	As needed
Timing:	April to May
Comments:	When digging, create enough space around the plant to remove it fully without leaving fragments or roots behind. Be careful not to brush skin against the plant. Always wear gloves, safety glasses, long sleeves, and pants during removal.

Chemical Treatment

Currently, there are nine pesticides registered for the control of giant hogweed, under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA). The first five are listed below.

Registration Number	Registrant Name	Product Name
29190	G.D.G. Environnement LTEE	Ragweed Off
30917	2022 Environmental Science CA Inc.	Method 50SG
30920	2022 Environmental Science CA Inc.	Truvist Herbicide
30922	2022 Environmental Science CA Inc.	Navius Flex
31382	2022 Environmental Science CA Inc.	Navius VM Herbicide

Chemical Treatment

Registered pesticide products to control giant hogweed involve a non-target application that makes other plant species susceptible to damage. Ensuring there is a buffer area is important when applying pesticide. Currently, the most commonly used product is Ragweed and additional details from the product label are outlined below as an example. More information on each product can be accessed through the PMRA's product label search.

Chemical: RagWeed Off	
Location:	Terrestrial sites
Product Name:	RagWeed Off
Registrant Name:	GDG Environnement Ltée
Active Ingredient:	Sodium Chloride
Registration Number:	29190
Application Placement:	Contact spray (apply an even coat without causing it to drip. Untreated areas will remain unaffected.)
Application Rate:	150 g/L and 350 g/L
Treatment Frequency:	2 to 4 applications per year
Timing:	July to August
Comments:	Ideal for areas of high density such as roadsides, highways, pathways, in vacant lots and industrial areas. This product will cause the loss of water from cells within the plant leaves. It also affects phragmites, poison ivy, and ragweed.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for giant hogweed are provided below.

KPI	Description	Target/Benchmark
Survey Monitoring	Number of surveys conducted	≥ 1 survey conducted annually for new sightings
Public Education & Outreach	Number of educational events or materials distributed (e.g., posters, flyers, talks)	≥ 3 public outreach initiatives per year, targeting high-risk zones
Response Time	Number of days it takes to respond to a reported sighting	Initiation of removal or treatment within 30 days of confirmed new infestation
Reporting Accessibility	Number of platforms viewers can access reporting information	≥ 3 platforms for reporting sightings of giant hogweed
Sightings	Number of reported confirmed cases of giant hogweed	0 confirmed cases of giant hogweed
Infestation Reduction	% of stems or area reduced in size	≥ 75% reduction in density of flowering hogweed (stems/m² or patch size) within 1 year
Health Hazard Incidents Reported	Number of reported sap exposure incidents or injuries to humans/pets	0 incidents in managed sites; any incident investigated and documented
Area Treated	% area treated 1 year after detection	≥ 90% of mapped giant hogweed patches treated within 1 year of detection
Regrowth Removal Rate	% of giant hogweed that has regrown after being treated	≤ 10% regrowth (new seedlings or root sprouts) detected and removed during follow-up visits

Disposal

Dead, uncut giant hogweed stalks from herbicide treatment may be left to decompose naturally. However, if the material is cut or needs to be moved, it must be solarized for safe disposal. Carefully place all plant material in sealed plastic bags to prevent accidental contact and leave them in full sun near the original site, out of public access, for 1 to 3 weeks (weather dependent) until fully dried. Label the bags to identify the material such as *Invasive Plant: Giant Hogweed*, so people know its contents. Once dried, material can be taken to a landfill. Giant hogweed **must not** be burned or composted, and its effects on grazers digestion are unknown.

It is crucial that all equipment used be fully cleaned of all plant parts before moving on to prevent inadvertent spread.

Restoration

Ideally, native plants from the soil seed bank will recolonize the area once giant hogweed is removed. As of 2025, there are no known occurrences of giant hogweed in Niagara-on-the-Lake that should allow the seed bank to **naturally recover**. However, active restoration through seeding or planting may be necessary to promote biodiversity and can support the succession.

Restoration efforts can focus on planting **fast-growing, native species** that tolerate full sun to partial shade and thrive in moist, nutrient-rich soils. These species will help outcompete invasive seedlings, stabilize soil, and support pollinators and native wildlife. In high-risk areas (e.g., riparian slopes or flood-prone zones), consider using erosion control fabric or native seed mixes to quickly re-establish cover and protect bare soil.

Apply a 5–10 cm (2–4 inch) **layer of mulch** in bare areas to suppress any remaining seed bank and reduce competition from non-native regrowth. Avoid using compost or untreated topsoil, as these can introduce or support invasive species. Restoration sites should be **monitored annually** for native plant establishment and any resurgence of Giant Hogweed.

Recommended Native Species:

- **Visually Similar Plant:**
  - Tall meadow rue (*Thalictrum pubescens*)

- **Tall Forbs & Grasses:**
  - Canada goldenrod (*Solidago canadensis*)
  - Switchgrass (*Panicum virgatum*)
  - Big bluestem (*Andropogon gerardii*)

- **Riparian Species:**
  - Meadowsweet (*Spiraea alba*)
  - Red-osier dogwood (*Cornus sericea*)
  - Blue vervain (*Verbena hastata*)
  - Wild rye (*Elymus canadensis*)
  - Common elderberry (*Sambucus canadensis*)
  - Silky dogwood Cornus amomum/oblique
  - Highbush Cranberry (*Viburnum trilobum*)

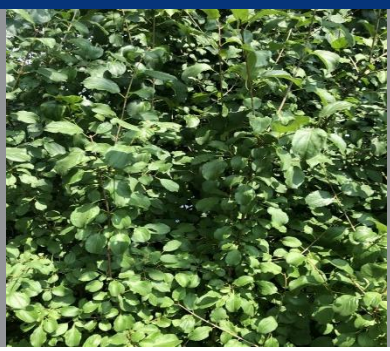
- **Pollinator-Supporting Plants:**
  - New England aster (*Symphyotrichum novae-angliae*)
  - Black-eyed Susan (*Rudbeckia hirta*)
  - Common milkweed (*Asclepias syriaca*)
  - Boneset (*Eupatorium perfoliatum*)

Restoring a diverse native plant community not only discourages Giant Hogweed re-establishment but also improves habitat quality and increases ecosystem resilience.

For guidance on appropriate plant selections, refer to the Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Buckthorn Control Plan

Rhamnus



Overview:

Common buckthorn is a terrestrial perennial woody shrub or tree that spreads aggressively, outcompeting native vegetation and degrading natural habitats. Common buckthorn is classified as a **noxious weed** under the Ontario Weed Control Act and is listed as a **pest** under the Plant Protection Act. Glossy buckthorn (*Rhamnus frangula* or *Frangula alnus*) is commonly integrated into management as it is also invasive.

Goal: To control existing populations of invasive buckthorn (common and glossy), while preventing the spread of new populations that will minimize the adverse impacts.

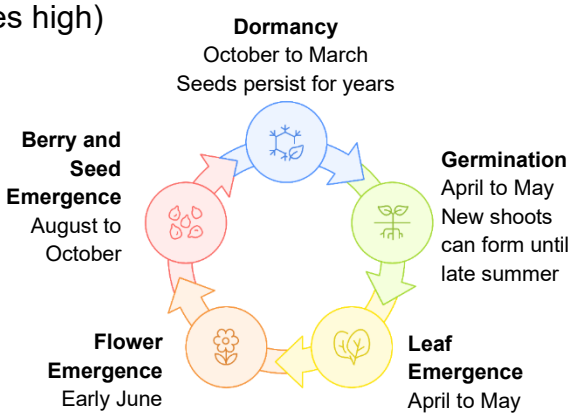
Prevalence: Buckthorn is moderately present in NOTL but grows rapidly when left on treated quickly taking over the area. It is of concern to the agricultural community because it can host oat crown rust and soybean aphid, both of which reduce crop yields. It obstructs trails, park access points, and natural areas with thick shrubbery stands reducing visibility. On average, Ontario municipalities spend over **$830,000 annually** on management and control initiatives (Invasive Species Centre, 2019).

Characteristics:

- **Leaves**: Green, egg shaped, with parrel veins (common buckthorn has rounder leaves with glossy buckthorn having more oval shaped leaves both that come to a point)
- **Thorns:** Small thorns on common buckthorn with absent thorns on glossy buckthorn
- **Flowers**: White, yellow, or green in June
- **Fruit**: Small black berries when mature and green when immature
- **Bark**: brown with white horizontal specs/pores (lenticels), smooth, shiny when young, rough when mature, and contains orange heartwood (when cut the centre is orange)
- Can form small trees when mature (6-7 metres high)

Lifecycle:

Leaves emerge early in spring and stay until late fall. It flowers in early June, produces berries by late summer, and allow bird-dispersed seeds that remain viable for years. The best time for monitoring is early spring when it's most visible, while removal efforts are most effective in late fall (mid-October) or during the dormancy in winter.



Surveillance and Priority Monitoring Schedule

Buckthorn's leaves emerge early in the spring as one of the first plants to show greenery, making April an ideal time to begin monitoring efforts. Sites where removal has occurred should be monitored at least twice annually for three years, or until no regrowth or new seedlings are observed. Since seeds can be dispersed so easily and remain viable in the soil for several years, ongoing monitoring is essential to detect and remove regrowth early, preventing further spread.

Safety: Buckthorn contains sharp thorns, wear gloves, safety glasses, long sleeved shirts and pants. When using power equipment, woody debris may move unpredictably; stay alert, especially with larger shrubs, to anticipate their fall direction.

Removal of Buckthorn

Removal of buckthorn will likely be completed by a contracted third-party organization within the Town. This control plan will guide the process, with recommended methods followed and monitored throughout. **Removal efforts will focus on areas where safety concerns exist or infrastructure may be at risk**, such as trails, parks, or roadsides identified during regular inspections.

When buckthorn is found to obstruct infrastructure or pose safety issues, the Divisional Supervisor and Climate Change Coordinator will be notified. The Coordinator will visit the site to collect pre-removal data, including photographs and measurements of the area affected. The Divisional Supervisor will arrange for removal by a contractor or Staff using appropriate herbicide or manual methods.

Following treatment, the Climate Change Coordinator will revisit the site to document post-treatment conditions and record data for invasive species management. Treated locations and areas of concern will be mapped, with management actions and key performance indicators tracked in the Town's GIS database.

Buckthorn produces abundant seeds that can remain viable in the soil for several years and they readily resprout from cut stumps. Brush-cutting can provide temporary canopy reduction but to achieve long-term control, these treatments must be followed by herbicide application or many repeated follow-up cuts.

For large or **mature buckthorn**, cut-stump treatment with herbicide will be the primary approach. Stems should be cut as close to the ground as possible and immediately treated with herbicide to prevent resprouting. When population sizes are **small or young**, foliar spray applications can be used while basal bark application can be left for larger size stems covering a larger area.

When using herbicides the product label must always be followed but in general buckthorn should be treated in **late summer through fall**, when energy is moving to the roots, maximizing herbicide effectiveness. Where feasible, shading through reforestation or native shrub planting can suppress buckthorn regrowth over time by reducing available light. Innovative non-chemical methods, such as grazing and repeated cutting combined with heavy mulching, may be piloted in sensitive sites. Long-term monitoring and follow-up removals will be required for at least 5 years, given the seed bank persistence and buckthorn's aggressive growth.

Management Timing Summary: The table below outlines management techniques associated with buckthorn and when to act based on activity.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Priority Monitoring												
Cutting												
Foliar Spray								*Tree Check Month*				
Cut Stump												
Basal Bark Spray												
Grazing												

Management Considerations

Due to buckthorn being able to quickly regrow sprouts from cut stumps, herbicide applications are recommended as a first control measure to intensive labour. However, with isolated or small populations cutting can be an effective approach of removal if repeatedly done. Site-specific plans will be developed for each priority location to identify the most appropriate management practices. The following tables go into more detail about each management technique.

Cutting	
Location:	Terrestrial sites, commonly along trails and shoreline
Infestation Size:	Small to Large
Treatment Frequency:	Multiple cuts annually for several years
Timing:	Start around early July, when plants are beginning to reach maturity, and continue throughout the summer.
Comments:	Apply to cut as low to the ground as possible unless using herbicide afterwards and the product label specifies other instructions

Grazing	
Location:	Terrestrial sites
Infestation Size:	Medium to Large
Treatment Frequency:	2-3 treatments annually for at least three years
Timing:	Start around early July, when plants are beginning to reach maturity, and continue throughout the summer.
Comments:	Apply to cut as low to the ground as possible unless using herbicide afterwards and the product label specifies other instructions

Chemical Treatment

Application Type	Description
Foliar Application	Spray the solution onto leaves or foliage of smaller buckthorn plants to prevent potential spray drift of larger ones. This method is not species specific and requires planning to not impact surrounding species.
Basal Bark	The chemical is applied to the lower 12–18 inches of stems up to 6 inches in diameter. Ideal for small infestations or follow-up after foliar treatment. For larger stems, use hack-and-squirt.
Hack-and-Squirt	Create cuts are spaced around the stem, leaving intact bark between hacks to allow herbicide movement to the roots. Use one hack per inch diameter (minimum two). Best for stems over 1 inch in diameter and low stem densities. Must not completely sever trunk or stem with cuts but rather leave them as wounds for the herbicide to easily enter. A spray bottle is used to squirt the herbicide into cuts.
Cut Stump	Use a solution on freshly cut stumps late in the growing season but before leaf drop. This method has limited root control and is used as a last resort.

Currently, there are 23 pesticides registered for the control of buckthorn, under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA). The first five products listed are exemplified below.

Registration Number	Registrant Name	Product Name
21053	Corteva Agriscience	Garlon 4 Herbicide
26420	Corteva Agriscience	Remedy EC Herbicide
28430	Corteva Agriscience	Remedy MSO Herbicide
28433	Corteva Agriscience	Fencerow EC Herbicide
28942	Corteva Agriscience	Remedy XRT Herbicide

The most commonly used product to control buckthorn is Garlon and more details on this product are exemplified below. Full details of each product can be accessed through the PMRA's product label search.

Chemical: Garlon 4 Herbicide (Triclopyr)	
Product Name:	Garlon 4 Herbicide
Registrant Name:	Corteva Agriscience Canada Company
Active Ingredient:	Triclopyr
Registration Number:	21053
Application Placement:	Cut stump: Can be applied to stumps days to weeks after cutting all year Foliar: apply to leaves (foliage) Cut stump: apply to stump of main trunk Basal bark: apply around the stem in a 30 cm high strip. On stems <8 cm, it can be applied to one side
Application Rate:	Low volume foliar: 1 to 5 L in 100 L solution Cut stump: 20 to 30 L in oil to make 100 L solution Basal bark: add diluent (e.g. mineral/vegetable oil)
Treatment Frequency:	Apply once per year and subsequent years as needed
Timing:	July to early August
Comments:	Do not use as broadcast foliar spray in residential areas.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for buckthorn are provided below.

KPI	Description	Target/Benchmark
Treated Areas	Number of distinct sites or plots where buckthorn removal was conducted.	≥ 10 treatment sites annually
Stem Density Reduction	% reduction in buckthorn stem density in treated areas.	≥ 75% reduction within 1 year post-treatment
Individual size	Proportion of shrubs/trees that are mature	Mature individuals make up ≤ 25% of the population within 5 years
Site Monitoring Frequency	Number of follow-up inspections after initial removal.	Minimum of 2 inspections per site per year for 3 years
Regrowth Removal Rate	% of buckthorn regrowth (seedlings or resprouts) addressed in follow-up visits.	≤ 15% regrowth per site annually
Native Species Re-establishment	% of treated areas replanted or naturally recolonized by native vegetation.	≥ 70% of treated sites within 1 year
Public Engagement	Number of volunteers or community members involved in monitoring events.	≥ 25 participants per year
Education & Outreach	Number of outreach materials distributed (e.g., flyers, signage, workshops).	≥ 100 materials distributed annually

Disposal

Buckthorn plant material must be managed carefully to prevent further spread. Shrubs cut during removal, especially larger individuals, may require chipping using heavy machinery. All brush, including smaller stems and root fragments, should be piled and **solarized prior to seed development** to ensure seeds or viable parts do not spread. Place the material under clear plastic sheeting in direct sunlight, securing the edges to trap heat and moisture. Solarization should occur for **1 to 3 weeks**, depending on weather conditions, until the material is fully dried and non-viable.

For large volumes of material or chipped debris, label the piles clearly (e.g., *Invasive Plant – Buckthorn*) and keep them **away from public access and water sources where regrowth can occur**. Once solarized and dried, the material may be taken to a landfill or composted at an approved municipal facility.

The Plant Protection Regulation prohibits the importation and domestic movement of buckthorn (all *Rhamnus* spp.) due to being an alternate host to crown rust of oats, *Puccinia coronata*. This is noted in the Barberry phytosanitary requirements and can be used for reference with buckthorn. If specific buckthorn requirements come into effect, that would take precedence. When moving buckthorn, it should be labeled with its botanical name but currently no other requirements are requested.

All equipment used during removal, such as saws, vehicles, and chippers, must be **cleaned** of seeds, twigs, and root fragments before leaving the site to prevent accidental spread to unaffected areas. **Documentation** to support any disposal or removal efforts should be maintained on file for at least two years.

Restoration

A 5–10 cm (2–4 inch) **layer of mulch** should be applied immediately after treated areas to suppress buckthorn seed banks and reduce competition while native plants establish. Avoid using compost, as it may unintentionally promote buckthorn or other invasive regrowth. In areas with extensive removal, consider temporary shading or ground cover plantings to minimize soil exposure or erosion on slopes.

Once buckthorn has been effectively removed (20% or less regrowth), it is crucial to restore native plant communities to prevent reinvasion and promote long-term ecological health. Restoration should focus on planting a **diverse mix** of regionally appropriate native trees, shrubs, and herbaceous species that are well-suited to the site's light, soil, and moisture conditions. Native species will help reestablish natural structure, outcompete invasive seedlings, and support local wildlife, including birds and pollinators.

Restoration sites should be **monitored annually** to assess native plant survival, coverage, and signs of buckthorn regrowth. Adaptive management, such as additional planting or spot treatment, may be required for successful long-term restoration. Restoring native biodiversity not only discourages future buckthorn growth but also contributes to a more resilient and functional ecosystem.

Recommended Native Species:

- **Visually Similar Plants:**
  - Nannyberry (*Viburnum lentago*)
  - Chokeberry (*Aronia melanocarpa*)
  - Bayberry (*Morella (syn. Myrica) pensylvanica*)

- **Trees and shrubs:**
  - Shagbark hickory (*Carya ovata*)
  - Red-osier dogwood (*Cornus sericea*),
  - Serviceberry (*Amelanchier spp.*),
  - Eastern white cedar (*Thuja occidentalis*),

- **Herbaceous Plants:**
  - Wild bergamot (*Monarda fistulosa*),
  - Black-eyed Susan (*Rudbeckia hirta*),
  - Big bluestem (*Andropogon gerardii*),
  - New England aster (*Symphyotrichum novae-angliae*)

For guidance on appropriate plant selections, refer to the Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Hemlock Woolly Adelgid

Adelges tsugae

Overview

Hemlock Woolly Adelgid is an invasive insect that attacks and kills hemlock trees by feeding on their sap. It causes needle loss, branch dieback, and eventual tree death. This pest poses a serious threat to forest ecosystems and is currently listed as a **pest** under the Plant Protection Act.

Goal: To prevent populations of hemlock woolly adelgid from occurring in NOTL and utilize rapid response actions to newly established populations to eradicate the species.

Prevalence: Niagara-on-the-Lake, along with the broader Niagara Region, is designated by the Canadian Food Inspection Agency (CFIA) as a regulated area for hemlock woolly adelgid. The insect reproduces asexually, allowing a single individual to trigger a rapid infestation that can devastate hemlock stands. Hemlock woolly adelgid places significant strain on the forestry and lumber industries, transportation corridors, property values, and causes extensive ecological damage, including habitat destruction, biodiversity loss, and increased erosion and sedimentation.

Characteristics:

- Adult: white wool-like sacs at the base of needles on twigs or branches
- Nymphs: flat, black, oval shape with halo of white woolly wax
- Infested hemlock trees:
    - Premature bud and shoot dieback
    - Premature needle loss
    - Thinner, greyish-green crown
    - Dieback of twigs and branches
    - Discolouration of foliage
    - Tree death within 4-15 years

Lifecycle:

Hemlock woolly adelgid (HWA) has two generations each year: the overwintering **sistens** (June–March) and the spring **progrediens** (March–June). Both progress through six stages: eggs, four nymphal stages (including crawlers), and adults. The **crawler** stage is most concerning, as crawlers can attach to humans or wildlife and spread over long distances.

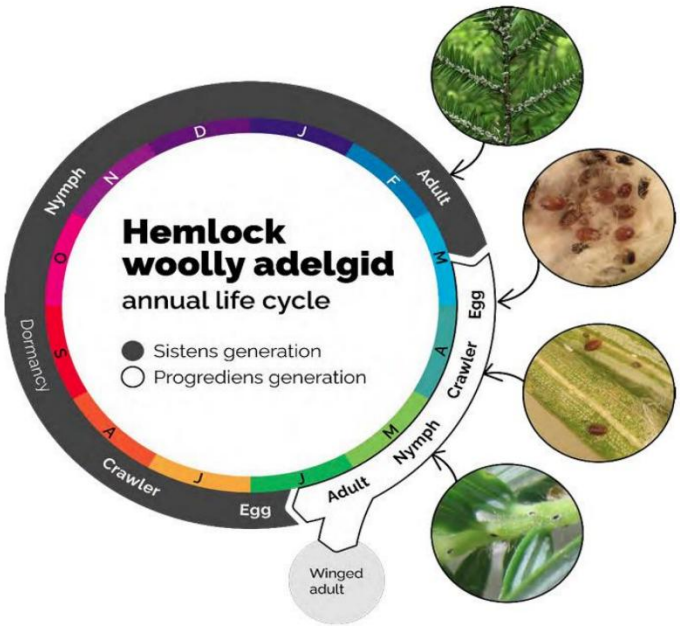


Photo: Parker et al. 2023

Hemlock Woolly Adelgid

Adelges tsugae

Detection of Hemlock Woolly Adelgid

If you see hemlock woolly adelgid, take the following steps **immediately**:

1. **Take Clear Photos:** Capture close-up pictures to help confirm identification.
2. **Collect a Sample**: If safe, catch the insect and seal it in a plastic bag or container.
3. **Stop and Isolate**: If found on transported goods, seal off the material and pause all shipping activities.
4. **Report Immediately to CFIA**: Call the St. Catharines office at **905-937-7434** or complete the CFIA online form. Include:
    a. GPS coordinates or address
    b. Date spotted
    c. Organization or contact information
    d. Number of nearby hemlock trees
5. **Keep Traceability Records:** Documentation must be kept for at least 3 years and contain the following:
    a. Location with maps or GPS coordinates
    b. Shipping/receiving information (if applicable)
    c. Scouting & trapping activities
    d. Pest control/eradication measures (if applicable)
6. **Consult with CFIA**: Follow their direction on further action required and disposal of the insect if captured.
7. **Record Everything**: Track all actions taken for future reference.

Priority Search Areas

Forests and sites of densely planted hemlock

Lakes and Streams

Bird Feeders

Nursery Stock

Border Crossings and Transportation Routes

Biosecurity: Extra care is needed from **April to July**, when **crawlers are active**. Use a lint roller on clothing until it can be washed, clean equipment with ethanol, and rinse boots and gloves with water on site until they can be properly washed with soap later.

Hemlock Woolly Adelgid

Adelges tsugae

Surveillance and Priority Monitoring Schedule

To prevent hemlock woolly adelgid from establishing in NOTL, regular monitoring efforts will be taken. To detect hemlock woolly adelgid (HWA), examine the underside of branches near the base of needles for white woolly sacs, which are visible from November to May and become more prominent from March to May as ovisacs develop. Inspectors will follow the Canadian Food Inspection Agency's Hemlock Woolly Adelgid Detection Survey Protocol, that states surveys should be complete in **April or May**.

The woolly sacs are waxy and firmly attached to the twig at the base of the needle, not on the needle itself. **Fallen branches** are critical to examine as they can reveal infestations higher in the canopy, and after spring rainstorms, the bark should be checked for wool. Monitoring is especially important for trees near lakes, streams, bird feeders, or planted nursery stock. When branches are within reach, direct inspection is ideal, but tools such as a pole pruner or ladder can be used. Binoculars can also help to inspect branches that are higher from the ground.

For taller trees, where drones cannot easily access the top of a canopy, creative methods have been employed like **ball sampling**. This approach utilizes a slingshot with a Velcro-wrapped ball that can leave traces of HWA. When this survey method is used the Invasive Species Centre tutorial video How TO: Ball Sampling for HWA will be followed. Another option is the use of ground-installed **sticky traps** placed beside hemlock trees to detect HWA. This method will also follow the Invasive Species Centre tutorial video HOW TO: Sticky Trap Sampling for HWA. Both techniques provide practical monitoring alternatives that, with proper training and program support, could be well-suited for volunteer involvement.

Photo: Natural Resources Canada, Canadian Forest Service researcher Chris MacQuarrie

Photo: Invasive Species Centre, HOW TO: Sticky Trap Sampling for HWA

Hemlock Woolly Adelgid

Adelges tsugae

Removal of Invasive Hemlock Woolly Adelgid

Hemlock woolly adelgid (HWA) can cause severe damage to hemlock trees, making **removal of infested trees** the most common method to prevent further spread and maintain safety. If hemlock woolly adelgid is detected, the Divisional Supervisor, Climate Change Coordinator, and Canadian Food Inspection Agency will be notified. The Coordinator will visit the site to collect pre-removal data, including photographs and measurements, while the Divisional Supervisor will arrange for a contractor to remove any infested trees as directed from the Canadian Food Inspection Agency.

For healthy or recently infested trees, chemical treatments can be applied as a preventative measure. **Stem injections**, delivered by drilling at a downward angle (20–45°), 15–30 cm above ground, 1.5–2 cm into the sapwood, are currently the primary treatment option in Ontario. Registered products include TreeAzin® (Azadirachtin 5%), IMA-jet (Imidacloprid 5%), and IMA-jet 10 (Imidacloprid 10%). Treatments must be repeated every two years, which can make this approach costly and limit the number of trees that can be maintained.

Where chemical treatment is applied, a contracted third-party organization will likely perform the work under the guidance of this control plan, ensuring recommended methods are followed and monitored. Post-treatment, the Climate Change Coordinator will revisit sites to document conditions and record data for invasive species management. Treated areas and other points of concern will be mapped, with management actions and key performance indicators tracked in the Town's GIS database.

In situations where infestations are extensive or resources are limited, site-specific control plans will prioritize interventions based on factors such as tree health, ecological function, proximity to other hemlocks, safety, recreational and cultural significance, and potential pathways of spread. A cost-effective alternative in these cases is to remove infested or high-risk trees and replant with site-appropriate species. While this strategy helps contain hemlock woolly adelgid, it results in the **loss of mature hemlocks** and their ecological contributions.

Effective hemlock woolly adelgid management requires **coordination** among municipal Staff, contracted specialists, and regulatory agencies, combining direct treatment with strict measures to prevent further spread. Following best practices from the Ontario Invasive Plant Council, stem injections remain the recommended preventative approach for healthy trees, while removal and replanting may be necessary where infestation is severe.

Hemlock Woolly Adelgid

Adelges tsugae

Management Timing Summary: The table below outlines management techniques associated with hemlock woolly adelgid and when to act based on activity. Darker shades represent optimal windows of management while lighter shades are suboptimal timing.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Priority Monitoring								*Tree Check Month*				
Surveys												
Traps												
Injections												

Management Considerations

The Town of Niagara-on-the-Lake will follow the direction of the Canadian Food Inspection Agency (CFIA) and align with the guiding principles established by the inaugural Invasive Species Strategy Advisory Committee, led by the Niagara Peninsula Conservation Authority. As control techniques evolve, this plan will be updated accordingly and site-specific plans will be developed for each priority location to identify the most appropriate management practices.

Currently, there are seven pesticides registered for the control of hemlock woolly adelgid, under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA).

Registration Number	Registrant Name	Product Name
30559	Lallemand, Inc.	Treeazin Systemic Insecticide
31375	Arborjet Inc.	IMA-Jet
31479	Arborjet Inc.	ImMA-Jet 10
34596	Rainbow Ecoscience	XYTECT 2F
34653	Mitsui Chemicals Crop & Life Solutions, Inc.	Starkle 20 SG
28124	Plant Products Inc.	Landscape Oil Spray
29703	2022 Environmental Science CA Inc.	Confidor 200 SL Systemic Insecticide

Chemical Treatment

The most commonly used products for hemlock woolly adelgid are TreeAzin and IMA-jet. However, full details of each product can be accessed through the PMRA's product label search. More details of these two commonly used products are outlined below.

Hemlock Woolly Adelgid

Adelges tsugae

Chemical: TreeAzin® (Azadirachtin)	
Product Name:	TreeAzin®
Registrant Name:	Lallemand Inc.
Active Ingredient:	Azadirachtin
Registration Number:	30559, Pest Control Products Act
Application Placement:	Applied at a pre-drilled hole ~ 15 cm to 30 cm above ground level at a 20 to 45 degree downward angle
Application Rate:	3 mL per cm DBH
Treatment Frequency:	One application per tree (bi-annually if needed)
Timing:	Apply in early spring (April), prior to bud break; alternatively, apply in late summer (August) when adelgids resume feeding activity (crawler stages).
Comments:	To be used when detection occurs in the area or within 24 km and trees appear healthy. When the injection is completed, wait for 1-2 minutes before removing the canister and nozzle to avoid pesticide spillage. Moves rapidly throughout the treated tree (approx. 48 hours) and provides protection for ~2 years. Product also is suited for emerald ash borer, spongy moth, tent caterpillars, European elm scale, sawflies, and more at different application rates. For more information visit the product label.

Chemical: IMA-jet (Imidacloprid 5%)	
Product Name:	IMA-jet
Registrant Name:	Arborjet Inc.
Active Ingredient:	Imidacloprid
Registration Number:	31375, Pest Control Products Act
Application Placement:	Around the base of the tree (the trunk flare or tissue immediately above the trunk flare)
Application Rate:	0.8 to 1.6 mL per cm DBH for trees with DBH = 15 to 30 **OR** 1.6 to 2.4 mL per cm for trees with DBH greater than 30 cm
Treatment Frequency:	Max. once annually per tree (with other injections as needed in subsequent years)
Timing:	Apply in early spring (April), prior to bud break; alternatively, apply in late summer (August) when adelgids resume feeding activity. To be used when detection occurs in the area or within 24 km and trees appear healthy.
Comments:	Takes approximately 6-9 months to show reductions in HWA abundance on treated trees but provide approximately 4-7 years of protection against HWA

Chemical: IMA-jet 10 (Imidacloprid 10%)	
Product Name:	IMA-jet 10
Registrant Name:	Arborjet Inc.
Active Ingredient:	Imidacloprid
Registration Number:	31479, Pest Control Products Act
Application Placement:	Around the base of the tree (the trunk flare or tissue immediately above the trunk flare)
Treatment Frequency:	Max. once annually per tree (with other injections as needed in subsequent years)
Timing:	Apply in early spring (April), prior to bud break; alternatively, apply in late summer (August) when adelgids resume feeding activity. To be used when detection occurs in the area or within 24 km and trees appear healthy.
Comments:	Takes approximately 6-9 months to show reductions in HWA abundance on treated trees but provide approximately 4-7 years of protection against HWA

Hemlock Woolly Adelgid

Adelges tsugae

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for hemlock woolly adelgid (HWA) are provided below.

KPI	Description	Target/Benchmark
Survey Coverage	Number of high-risk hemlock stands surveyed for HWA annually.	≥ 90% of known hemlock stands surveyed per year
Detection Accuracy	Number of confirmed detections verified from public or Staff reports.	≥ 95% verification rate of suspected reports
Public Reporting Participation	Number of HWA reports submitted via apps, email, or hotline.	10% annual increase in engagement
Response Time	Average time between confirmed detection and initiation of response action.	≤ 30 days from detection to response
Treatment Implementation	Number of infested trees treated with insecticide or other control measures.	75% of treatable trees within 1 month of detection
Outreach Events	Number of public education or training sessions held on HWA identification and reporting.	≥ 1 events annually
Outreach Material Distribution	Number of materials (flyers, signs, digital content) shared with the public or interested parties.	≥ 100 materials distributed annually
Staff/Volunteer Training	Number of individuals trained in HWA detection and sampling protocols.	≥ 2 trained personnel per year
Follow-up Monitoring	Frequency of monitoring previously infested or treated sites.	Minimum of 2 follow-ups per site per year
Interagency Coordination	Number of coordinated response actions with regional/provincial/ federal partners.	≥ 2 coordinated actions or meetings annually

Disposal

Proper disposal of infested hemlock material is essential to prevent the spread of Hemlock Woolly Adelgid (HWA), which can be easily transferred on branches, needles, or bark. If infested branches or trees must be removed, do so between **August 1 to the last day of February (low risk period)** and avoid the **high risk period from March 1 to July 31,** to reduce the risk of dispersal. Disposal strategies must be in compliance with any directives given by the Canadian Food Inspection Agency (CFIA).

Niagara-on-the-Lake, along with the broader Niagara Region, is designated by the **Canadian Food Inspection Agency (CFIA)** as a regulated area for hemlock woolly adelgid. The disposal and movement of infested hemlock material with bark, including logs, branches, and wood chips, will therefore comply with all applicable CFIA **phytosanitary requirements** and Ministerial Orders. Where required, a CFIA **Movement Certificate** will be obtained prior to transporting any regulated material. Wherever feasible, disposal of infested hemlock wood should occur on site or as close to the removal location as possible to minimize risk of spread.

CFIA recognized methods for eliminating hemlock woolly adelgid **with tree bark** include burning, deep burial, and chipping. **Burning** infested hemlock wood is effective where permitted under Town bylaws and provincial open burn regulations. **Deep burial** to a minimum depth of 1.8 metres is also an accepted disposal method, provided the site has been approved by a CFIA inspector and re-excavation of the material will not occur for 2 years. Alternatively, **chipping** is an effective control measure when either approved CFIA sanitation processes have been completed or the chips will be used for a secondary process such as paper finish mulch or recycled fiber board. All movement and disposal of infested hemlock material will follow CFIA guidance to prevent the further spread of hemlock woolly adelgid.

All removed material for transport is recommended to be securely tarped and solarized in full sun for a minimum of 2 to 4 weeks. **Solarization** involves piling the material into sealed bags or covering the material tightly with a clear or black plastic tarp to heat and dehydrate any remaining adelgids. Keep solarization areas away from public access and label it clearly (e.g., *Invasive Pest – HWA Infested Hemlock*). Once dried, material can be chipped on-site, burned, transported to landfill or an approved municipal compost faciltiy in secured bags or containers. **Do not** transport undried infested material off-site. All tools, clothing, and machinery used in infested areas must be thoroughly cleaned before leaving the site to avoid spreading adelgids to uninfested trees or locations.

At present, repurposing infested hemlock wood as mulch, compost, or other organic products is not recommended unless the material has been treated to meet CFIA phytosanitary standards. While research into safe reuse is ongoing, the risk of inadvertently spreading hemlock woolly adelgid remains high without sterilization or regulatory approval.

To support traceability and compliance, all hemlock woolly adelgid related disposal actions should be documented and maintained on file for at least **3 years**. This includes recording the location, date, volume of material removed, disposal method used, and Staff involved. Proper disposal, when conducted consistently and according to provincial and federal guidelines, plays a critical role in limiting the spread of hemlock woolly adelgid and reducing its long-term ecological and economic impacts.

Restoration

Following the treatment or removal of infested hemlock trees due to Hemlock Woolly Adelgid (HWA), it is essential to restore forest structure and ecological function to prevent erosion, protect biodiversity, and support long-term forest resilience. Since eastern hemlock often creates cool, shaded understories critical for moisture-sensitive species, restoration should prioritize **native conifer and shade-tolerant hardwood species** that can fill similar ecological roles.

Where possible, encourage **natural regeneration** of unaffected hemlocks or nearby native species. In heavily impacted areas, **replant with a diverse mix of native trees and understory plants** that support soil stabilization, wildlife habitat, and canopy recovery. Restoration should also consider microclimate conditions, especially in riparian zones where hemlock loss can cause temperature increases and streambank instability.

To support replanting success, minimize soil disturbance, protect seedlings from browsing (e.g., with tree guards or fencing), and avoid introducing non-native species during restoration activities. **Mulching** around new plantings can help retain moisture and reduce competition from invasive plants.

Restoration sites should be **monitored annually** to track plant survival, canopy recovery, and signs of reinfestation. Adaptive measures may be necessary to respond to changes in site conditions or forest dynamics. Restoring native forest composition helps mitigate the ecological impacts of HWA and supports long-term forest health in the face of future stressors.

Hemlock Woolly Adelgid

Adelges tsugae

Recommended Native Species:

- **Visually Similar Plants:**
  - Eastern white cedar (Thuja occidentali)
  - Eastern white pine (*Pinus strobus*)
  - White spruce (*Picea glauca*)
  - Balsam fir (*Abies balsamea*)

- **Shade-Tolerant Hardwoods:**
  - Sugar maple (*Acer saccharum*)
  - American beech (*Fagus grandifolia*)
  - Yellow birch (*Betula alleghaniensis*)

- **Understory Species:**
  - Striped maple (*Acer pensylvanicum*)
  - Wild ginger (*Asarum canadense*)
  - Pawpaw (*Asimina triloba*)
  - Bladdernut (*Staphylea trifolia*)

For guidance on appropriate plant selections, refer to the Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Flowering Rush Control Plan

Butomus umbellatus

Overview:

Flowering rush is an invasive aquatic, submergent, plant that spreads rapidly in lakes, rivers, and wetlands. It crowds out native vegetation, disrupts habitats, and can interfere with recreational activities like boating and swimming. It is listed as a restricted species under the Ontario Invasive Species Act.

Photo: Invasive Species Centre

Goal: To control existing populations of invasive flowering rush, while preventing the spread of new populations that will minimize the adverse impacts.

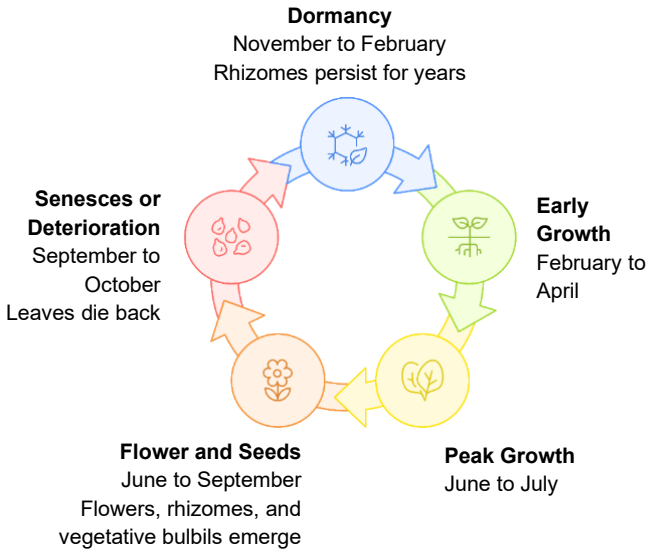
Prevalence: Flowering rush is commonly found in shallow waters throughout NOTL, spreads rapidly and can overtake aquatic areas. It damages irrigation and drainage systems, reduces water quality, and negative impacts recreation and tourism. The plant outcompetes native vegetation, disrupts nutrient cycling, contributes to algal blooms, and degrades fish and wildlife habitat.

Characteristics:

- **Leaves and Stems**: triangular, parallel veined, twist at the tip, and are 1 to 3 metres long
- **Flowers**: not always present, but they are white, pink, or purple, umbrella shaped clusters, 3 petals, 3 sepals, 9 stamens, 6 pistils per flower
- **Fruit**: not always present but are dry crown shaped capsule

Lifecycle:

Germination and early growth occur in spring, while peak growth occurs mid-summer. At this stage flowering rush reaches its full size. Not all plants will flower, but the ones that do occur in late summer, making **June to September** the best time for visual surveys. Another prominent visual is leaf dieback in fall that is unlike similar looking cattails that remain standing. The rhizomes contribute to reproduction the most, making fragments the largest concern for spread.



Flowering Rush Control Plan

Butomus umbellatus

Surveillance and Priority Monitoring Schedule

To manage established flowering rush populations, regular monitoring will be conducted. Priority monitoring will occur at least once annually between **June and early August**, when the plants are in bloom. If control measures are implemented, the site should be revisited two weeks later to assess effectiveness.

Removal of Flowering Rush

Removal of flowering rush will likely be completed by a contracted third-party organization within the Town. This control plan will guide the process, with recommended methods followed and monitored throughout. **Removal efforts will focus on areas where safety concerns exist or infrastructure may be at risk**, such as stormwater management ponds and wetlands identified during regular inspections.

When flowering rush is found to obstruct infrastructure or pose safety issues, the Divisional Supervisor and Climate Change Coordinator will be notified. The Coordinator will visit the site to collect pre-removal data, including photographs and measurements of the area affected. The Divisional Supervisor will arrange for removal by a contractor or Staff using appropriate herbicide or manual methods.

Following treatment, the Climate Change Coordinator will revisit the site to document post-treatment conditions and record data for invasive species management. Treated locations and areas of concern will be mapped, with management actions and key performance indicators tracked in the Town's GIS database.

Removal of flowering rush will follow Ontario Invasive Plant Council best practices which currently consist of manual removal and herbicide application when appropriate **aquatic** licenses and permits have been obtained. Eradication is possible with chemical treatment, whereas manual removal will prevent the spread and prevent new populations from forming but has had less success with eradication of established areas. There are two common aquatic herbicide products that are registered to use in Canada Reward Aquatic Herbicide and Habitat Aqua.

Management Timing Summary: The table below outlines management techniques associated with flowering rush and when to act based on activity.

Practice	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Priority Monitoring						■	■	■				
Hand pulling							■					
Herbicide							■	■	■			

Flowering Rush Control Plan

Butomus umbellatus

Management Considerations

Herbicide control is considered the most effective approach; however, because flowering rush is an aquatic species, permitting requirements can present challenges. Due to the species' ability to spreadily readily though stem fragments and root material, hand pulling is considered the preferred manual method, as it allows for the complete removal of plant biomass. Pulling should be conducted slowly and carefully to ensure intact root removal. Herbicide application may be considered for the management of larger or more established populations. Site-specific plans will be developed for each priority location to identify the most appropriate management practices.

Hand Pulling/Digging	
Location:	Terrestrial or shallow aquatic sites
Infestation Size:	Isolated to small
Treatment Frequency:	As often as needed
Timing:	Mid-June to July
Comments:	Must be completed prior to reproductive parts emerge (August). If pulling, it must be done gently to not break the roots that can re-sprout. Once removed, observe the surrounding area for any fragments and collect them if present.

Cutting	
Growth Form:	Apply to submerged or emergent growth
Infestation Size:	Small to Medium
Treatment Frequency:	Multiple cuts annually for several years
Timing:	Start around early July, when plants are beginning to reach maturity, and continue throughout the summer.
Comments:	Cut plants below the water line with a raspberry cane cutter or other appropriate tool. Best for emergent plants in shallower areas (at water depth less than 1.3 m). Effective for controlling the spread in dryer, shallower areas, very challenging in greater water depths (greater than 1.3 m). Cutting multiple times in a season over several years is required.

Currently, there are two pesticides registered for the control of flowering rush, under the Pest Control Products Act and listed by Health Canada's Pest Management Regulatory Agency (PMRA). For use in and around water bodies, appropriate permits and licenses are required.

Registration Number	Registrant Name	Product Name
32374	BASF Agricultural Solutions Canada Inc.	Habitat Aqua
26271	Syngenta Canada Inc.	Reward Aquatic Herbicide

Chemical Treatment

The two registered products to use in Canada are Habitat Aqua and Reward Aquatic Herbicide. More products may become registered for aquatic use and full details of each product can be accessed through Health Canada's Pest Management Regulatory Agency (PMRA) product label search. More details of these two commonly used products are outlined below.

Chemical: Habitat Aqua (Imazapyr)	
Product Name:	Habitat Aqua
Registrant Name:	BASF Agricultural Solutions Canada Inc.
Active Ingredient:	Imazapyr
Registration Number:	32374
Application Placement:	Applied directly to emergent foliage; absorbed systemically to target roots
Application Rate:	3.0 L/ha
Treatment Frequency:	Once per year as needed annually
Timing:	After July 1 (post fish spawning season)
Comments:	Extreme care needs to be taken for spray drift when adjacent to agricultural lands and avoid crop damage or untargeted species.

Flowering Rush Control Plan

Butomus umbellatus

Chemical: Reward Aquatic Herbicide (Glyphosate)	
Product Name:	Reward
Registrant Name:	Syngenta Canada Inc.
Active Ingredient:	Diquat
Registration Number:	26271
Application Placement:	Applied direct
Application Rate:	18.3 L/ha
Treatment Frequency:	Apply maximum of 2 treatments per year as needed Must wait at least 2 weeks after application to reapply
Timing:	Late May through June (active growth)
Comments:	Priority application should be given prior to flowering rush becoming thickly populated, as dense growth of mature weeds will make application difficult and less effective.

Key Performance Indicators

All mapping, surveys, and control measure data should be recorded in a centralized system and integrated with site-specific data collection, including:

- Updated records from previous mapping efforts
- Documentation of any control measures taken
- Before-and-after photographs
- Key Performance Indicators (KPIs) tailored to each site

Development of key performance indicators should be coordinated with contractors and relevant Town Staff to ensure consistency and alignment with broader management goals. These should be specific to the site location, but some example KPIs for flowering rush are provided below.

KPI	Description	Target/Benchmark
Survey Coverage	Number of high-risk waterbodies or shoreline areas surveyed annually	≥ 90% of known or potential infestation sites surveyed per year
Infestation Mapping	% of flowering rush infestations mapped with GPS coordinates	100% of infestations mapped and recorded in database
Rapid Response Initiation	Average time between new detection and initial management action	≤ 60 days from confirmed detection
Biomass Reduction	% reduction in flowering rush biomass or cover at treated sites	≥ 75% reduction within 1 year of treatment
Public Reporting Participation	Number of public reports of flowering rush through apps or hotline	≥ 10 reports annually; 10% increase per year
Outreach Events	Number of educational events, community meetings, or training sessions	≥ 1 event per year
Outreach Material Distribution	Number of materials (brochures, signage, digital content) shared with interested parties and public	≥ 100 materials distributed annually
Aquatic monitoring and removal	Number of in-water surveys and removal efforts conducted annually	≥ 1 scheduled survey and/or removal per year
Post-Treatment Monitoring	Number of follow-up site visits to assess regrowth and native species return	Minimum of 2 follow-ups per treated site per year

Disposal

Proper disposal of flowering rush is critical to prevent fragmentation and spread. Fragments of flowering rush are very hardy and can survive out of water for several weeks that allows it to spread easily with minor disturbance such as moving water, ice movement, or boats. However, due to its aquatic nature, floating vessels such as canoes are often used to transport biomass onto land for solarization. All plant material including rhizomes, roots, and above-ground parts must be carefully contained immediately upon removal.

Once on land, it can be shoveled or wheel barreled out of the aquatic vessel and onto the designated solarization zone, away from waterbodies and public access. To solarize, pile the material on a dry surface off any soil and cover it tightly with a clear plastic tarp, securing the edges to trap heat and moisture. If able, biomass can be placed in bags and set aside to solarize. Allow it to solarize in full sun for 2 to 4 weeks, or until fully dried and non-viable. Label piles clearly (e.g., *Invasive Aquatic Plant – Flowering Rush*).

Do not leave plant material near any waterbody, as even small fragments can lead to new infestations. After solarization biomass can be sent to landfill or disposed at an approved municipal compost facility.

All equipment, boats, paddles, boots, gloves, and nets must be cleaned, drained, and dried thoroughly after use to prevent the spread of plant fragments to unimpacted areas.

Restoration

After removal of flowering rush, it is recommended to restore native aquatic and shoreline vegetation to prevent reinfestation and support the recovery of healthy wetland and riparian ecosystems. This invasive species often outcompetes native plants in shallow water and wetland edges, so re-establishing native cover is critical to stabilizing sediments, improving water quality, and enhancing habitat for fish, birds, and pollinators.

Restoration should include planting a **diverse mix of native emergent and shoreline species** suited to the site's water depth, substrate, and hydrology. Avoid using compost or nutrient-rich soil amendments, as they may favor invasive regrowth. In sensitive areas, allowing native vegetation to **naturally regenerate** may be effective, provided flowering rush is fully removed.

Sites should be **monitored annually** to assess native species establishment, plant cover, erosion control, and any resurgence of Flowering Rush. Follow-up plantings or spot removals may be necessary to ensure long-term success.

Recommended Native Species:

- **Visually Similar Plants:**
  - White turtlehead (*Chelone glabra*)
  - Blue vervain (*Verbena hastata*)
  - Joe-pye weed (*Eupatorium maculatum*)

- **Emergent & Aquatic Plants:**
  - Pickerelweed (*Pontederia cordata*),
  - Arrowhead (*Sagittaria latifolia*),
  - Hard-stem bulrush (*Scirpus acutus*),
  - Soft-stem bulrush (*Schoenoplectus validus*),
  - Cattail (*Typha latifolia*)

- **Shoreline Species:**
  - Blue flag iris (*Iris versicolor*),
  - Swamp milkweed (*Asclepias incarnata*),
  - Joe-Pye weed (*Eutrochium maculatum*),
  - Boneset (*Eupatorium perfoliatum*),
  - Marsh marigold (*Caltha palustris*)

By restoring native plant communities, the site becomes more resilient to future invasions and continues to support the ecological functions of healthy aquatic ecosystems.

For guidance on appropriate plant selections, refer to the Grow Me Instead: Southern Ontario Guide by the Ontario Invasive Plant Council, A Guide to Celebrate Niagara Peninsula's Native Plants by the Niagara Peninsula Conservation Authority, Tree Atlas by the Government of Ontario, or the Tree Species Selector Tool developed by Vineland Research and Innovation Centre.

Connect to the Town

For more information on invasive species, please visit the Town's website at: https://www.notl.com/town-services/environmental-stewardship/biodiversity-and-nature/invasive-species

Spot an invasive species? Report it at:

- EDDMaps,
- Canadian Food Inspection Agency,
- iNaturalist, or
- Call the Invading Species Hotline at **1-800-563-7711**

Contact the Town:

905-468-3266

info@notl.com

1593 Four Mile Creek Road, Virgil, L0S 1T0

www.notl.com

Follow the Town on Social Media:

@Town of Niagara-on-the-Lake

@niagara.on.the.lake

@Town_of_NOTL

@Town of Niagara-on-the-Lake

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Appendix

Permits and Licensing

Permits must be obtained for pesticide use on land and water, with applications available online.

Licensing Requirements

To apply certain pesticides, a valid exterminator license is required. Specific license classifications, such as Forestry or Landscape, must be identified and obtained to use in appropriate settings. The application process includes:

1. Submitting an application form and $195 fee to the University of Guelph Ridgetown Campus.
2. Studying provided materials: a Core Manual and a License Category Specific Module.
3. Writing and passing a two-part exam (Core: 1-hour, closed book; Category: 1.5-hour, open book) with a minimum 75% on both parts.
4. Sending your certification letter to the MECP to receive your license.

If failed, you may rewrite the exam (max. two more times in 12 months, $75 per attempt). The license ($90) is valid for five years.

Contact MECP's Client Services and Permissions Branch at 416-314-8001 | 1-800-461-6290 or | enviropermissions@ontario.ca

Aquatic Herbicide Application

Herbicides used in water may require a permit from the Ministry of Environment, Conservation and Parks (MECP). Licensed exterminators must follow strict guidelines, including timing, dosage, setback distances, and environmental protections. Treatments for aquatic invasive plants can be applied July 15 to March 14, after fish spawning has ended. If endangered species are present, approval under the Endangered Species Act, 2007 may also be required.

Search for approved products using PMRA's pesticide label database and always consult the current product label before use.

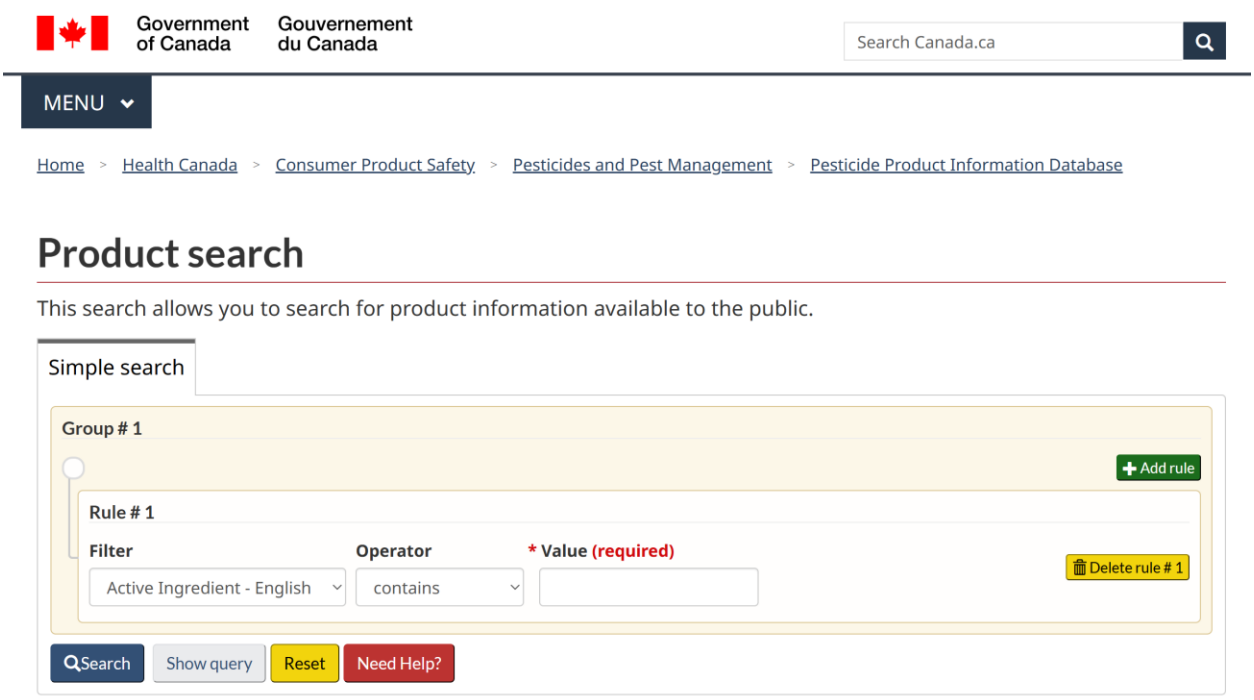
Appendix

Health Canada Search Product Label Tool

A full list of registered pesticides can be found on the Pest Management Regulatory Agency's (PMRA) website linked here.

Their product search tool (linked here) can allow viewers to search for products that are registered for use on specific invasive species and other applications.

On this page the viewer will see a series of three columns to fill in, as shown here:



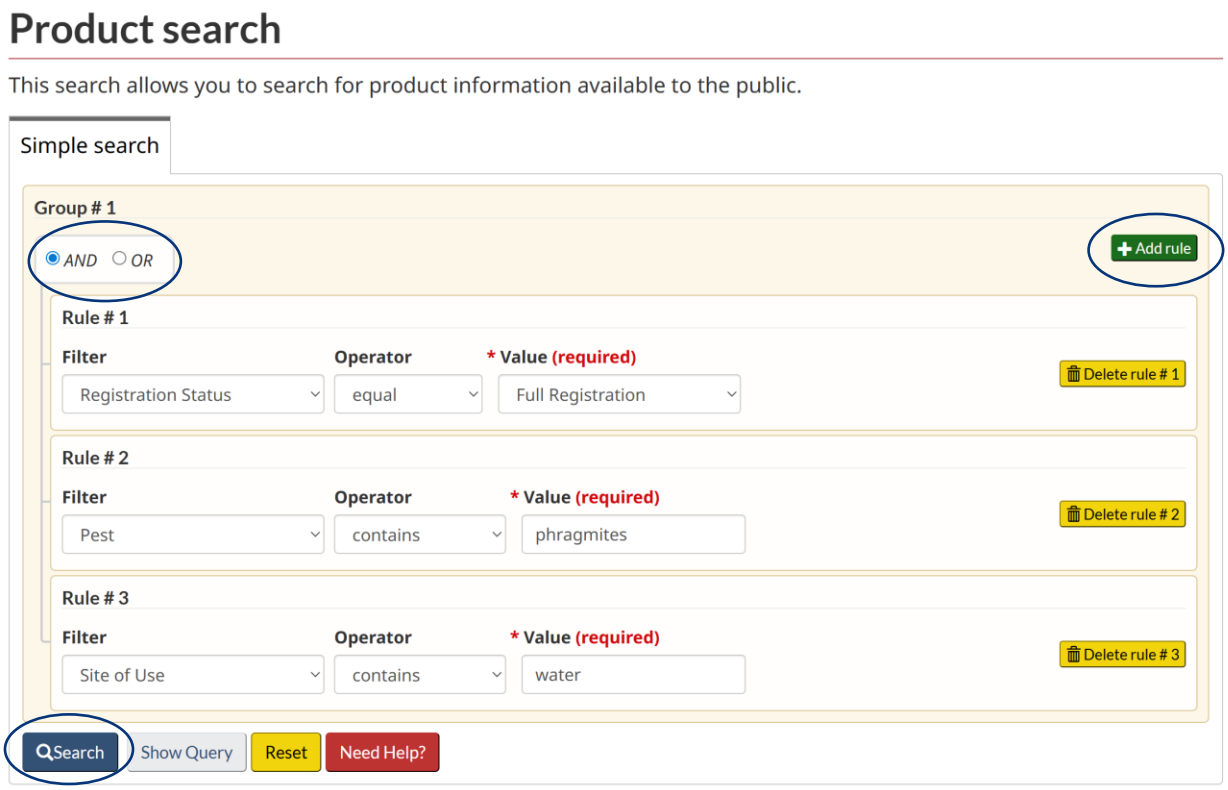
It will automatically show one row of available search criteria that the user can choose to filter from and enter selected text. The first column under "Filter" provides a list of options to sort from including active ingredient, current/historical, date first registered, exclusive period start date, expiry date, marketing type, pest, product name, product type, registrant, registration number, registration status, site of use, or use-site category. The most useful options for searches on invasive species products are pest, site use, and registration status. However, anyone could be used at any time.

Under the "Operator" column the user can select either equal, contains, does not equal, does not contain, or empty to match the desire search. This will allow the individual to search for items that include or exclude specific text entered from the last column "Value". This column allows the user to input the specific item they are seeking to find. For example, if it is an invasive species the user might enter phragmites, if needed for

an aquatic site they may enter “water”, etc. Typically, entering one or two words works best in the search query.

The user can also click the “Add rule” button to add a combination of filters for the search such as registration status, pest, and site of use that would be helpful for determining products to use for invasive species. When listing more than one rule, an additional option at the top left corner will appear to select either “and” vs. “or”. Selecting “and” will make sure all criteria listed are included in the product label search whereas “or” will search for one or more of these criteria in the label. When all fields have been entered, the user can click “Search” at the bottom left corner and view the list of products available.

An example search entry is illustrated below:



Appendix

Key Legislation

Both federal and provincial legislation exists that regulates invasive species to prevent and control populations.

Legislation	Purpose
Plant Protection Act (Federal)	"To protect plant life and the agricultural and forestry sectors of the Canadian economy by preventing the importation, exportation and spread of pests and by controlling or eradicating pests in Canada".
Invasive Species Act (Provincial)	"Sets out a legislative framework that provides for the identification of invasive species that threaten Ontario's natural environment, including mechanisms for detecting the appearance of invasive species and bringing them within the legislative framework as quickly as possible after they first appear".
Weed Control Act (Provincial)	Regulates the designation and management of noxious (harmful, destructive) weeds in Ontario.

Key Agency Roles

Agency / Partner	Role / Mandate	Legislation / Framework	Contact
Canadian Food Inspection Agency (CFIA)	Federal lead for detection, surveillance, and response to invasive pests or diseases (e.g., oak wilt, spotted lanternfly, hemlock woolly adelgid).	Plant Protection Act	Phone: 905-937-7434 Address: 10-350 Ontario Street, St. Catharines, ON L2R5L8 Online Contact Form
Pest Management Regulatory Agency's (PMRA)	Registers and re-evaluates pesticide products on the market in Canada, while promoting sustainable pest management.	Pest Control Products Act	Phone: 613-996-9231 Address: 2 Constellation Drive Ottawa, ON K1A0K9 Email: pmra.info-arla@hc-sc.gc.ca
Ministry of Environment, Conservation and Parks (MECP)	Get, renew, replace or update information on an exterminator or operator licence and permits to apply pesticides in Ontario.	Pesticides Act; O. Reg. 63/09	Phone: 416-314-8001 Address: 135 St. Clair Avenue West, Toronto, ON M4V 1P5

Appendix

Agency / Partner	Role / Mandate	Legislation / Framework	Contact
Ministry of Agriculture, Food, and Agribusiness (OMAFA)	Monitors agricultural invasive species; outreach via tree bands, newsletters, blogs, and presentations; supports insecticide research.	Provincial ministry mandate	Phone: 519-826-3100 Email: ag.info.omafra@ontario.ca
Ministry of Natural Resources	Lists prohibited and restricted invasive species, provides educational material and resources	Invasive Species Act; Invasive Species Strategic Plan	Phone: 1-800-563-7711
Natural Resources Canada (NRCan)	Researches invasive species biology and cold tolerance to inform management strategies.	Federal department mandate	Phone: 1-343-292-6098
Agriculture and Agri-Food Canada (AAFC)	Supports surveillance, funds research, coordinates with provinces and international partners.	Federal department mandate	Phone: 1-855-773-0241
Invasive Species Centre (ISC)	Provides resources, training, and support for invasive species prevention and management across Ontario/Canada.	Non-profit, collaborative with governments	Phone: 705-541-5790 Email: info@invasivespeciescentre.ca Website: invasivespeciescentre.ca
Ontario Invasive Plant Council (OIPC)	Promotes awareness and best practices for managing invasive plants through training, guides, and collaboration.	Non-profit, provincial network	Email: info@oninvasivespecies.ca Website: ontarioinvasiveplants.ca
Niagara Phragmites Management Area Collaborative (PMAC)	Regional initiative (launched Feb 2025) coordinating phragmites control efforts among municipalities and local groups.	Regional collaborative	Contact via NPCA and Town of Niagara-on-the-Lake
Niagara Invasive Species Strategy Working Group	Developing a coordinated invasive species strategy for Niagara Region (first meeting Fall/Winter 2025).	Regional initiative (in development)	Contact via NPCA and Town of Niagara-on-the-Lake