



City of Richmond

Report to Committee

To: Public Works and Transportation Committee
From: John Irving, P.Eng. MPA
Director, Engineering
Re: **Richmond's Invasive Species Action Plan**

Date: December 7, 2015
File: 10-6160-07-01/2015-
Vol 01

Staff Recommendation

That the Invasive Species Action Plan, as described in the staff report titled "Richmond's Invasive Species Action Plan," dated December 7, 2015 from the Director, Engineering, be adopted.

John Irving, P.Eng. MPA
Director, Engineering
(604-276-4140)

Att. 1

REPORT CONCURRENCE		
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER
Parks Services Engineering - Planning Sewerage & Drainage	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: 	APPROVED BY CAO

Staff Report

Origin

This report summarizes invasive species management in the City of Richmond to date, and presents the Invasive Species Action Plan. Chapter 9 of the OCP, entitled “Island Natural Environment” provides direct support within its policies to “establish an Invasive Species Management Program which includes community and institutional partners, to reduce the spread of invasive species and consequent risk to City infrastructure and loss of biodiversity.” The development of the Invasive Species Action Plan is also supported by the recently adopted Ecological Network Management Strategy, which contains a priority action to develop a plan to guide management of invasive plants and other species.

To mitigate the significant infrastructure, ecological and economic implications of invasive species, the City has been proactively addressing emergent invasive species issues on City and privately-owned lands. The City is a demonstrated leader in invasive species response within the region, and the Invasive Species Action Plan formalizes a strategic and risk-based approach to guide and prioritize invasive species management into the future. The Plan provides guidance on setting priorities, establishing a consistent approach, and delivering public outreach and engagement.

This report supports Council’s 2014-2018 Term Goal #4 Leadership in Sustainability:

4.2. Innovative projects and initiatives to advance sustainability.

Background

Invasive Species in Richmond

Invasive species are plants, animals, and insects that occur outside of their natural range and have significant infrastructure, ecological, and economic impacts once established. A number of introduced species are considered ‘invasive’ because they flourish and spread rapidly in the absence of natural predators and other controls.

As an island municipality, Richmond faces unique challenges. The city’s floodplain, drainage network and transportation hubs create high susceptibility to invasive species. In particular, Richmond’s wetlands, watercourses, and foreshore facilitate the introduction and spread of aquatic and riparian invasive plants. The City’s drainage infrastructure is particularly affected by aquatic invasives (e.g. Parrot’s feather, Brazilian elodea) which trap sediment, limit drainage capacity and conveyance, and increase ditch maintenance costs. Dike infrastructure and pump stations can be undermined by the extensive root systems of invasive knotweed species. These invaders also significantly impact biodiversity, as they out-compete native vegetation, reduce suitable habitat for wildlife, and alter food webs.

Invasive Species Management to Date

Since the adoption of Invasive Species Management in 2009 through the Enhanced Pesticide Management Program (EPMP), the City has been able to address a burgeoning need. Invasives

Species Management first emerged in response to media campaigns and the discovery of Giant hogweed in 2010. Management continued to advance when the City identified the first known regional infestations of the Common Reed, Parrot's Feather, and Brazilian Elodea, all high-risk aquatic invasive plants. As a result, invasive species control and eradication measures have quickly expanded within the EPMP, and new initiatives and resources for management has become an increasingly larger component of the program over time. The City has undertaken a broad range of initiatives in recent years, positioning itself as a leader in the region for invasive species response, including:

- Establishment of a reporting phone line and email for residents;
- Internal education across City departments, including staff training;
- Inventory, monitoring and mapping of high-risk invasive species;
- Delivery of pilot trials for determining containment and control options;
- Partnership with the Province for early detection and rapid response (EDRR) programs, targeting new and aggressive invasive species;
- Annual provincial funding for invasive species management (\$7,000)
- Collaboration with regional and provincial organizations to develop best management practices and response protocols;
- Collaboration with YVR for inter-jurisdictional management of invasive species; and
- Community education and outreach, including invasive species removal events in City parks (e.g. Garden City Community Park).

Despite the many achievements to date with invasive species response, the lack of a comprehensive approach to invasive species in the City has resulted in an ad hoc approach to management. There is a clear need to formalize an overarching approach to guide the management of invasive species, and to ensure greater consistency and efficiencies for City-wide risk reduction.

Analysis

Invasive Species Action Plan – Management Strategies

The management strategies presented within the Invasive Species Action Plan focus primarily on eight priority invasive species that pose serious impacts to infrastructure, ecology, and human health, and are summarized below:

Priority Invasive Species in Richmond

<i>Common Name</i>	<i>Area of Impact</i>		
	<i>Infrastructure</i>	<i>Ecological</i>	<i>Human health & safety</i>
Brazilian Elodea	✓	✓	
Eurasian Milfoil	✓	✓	
Parrot's Feather	✓	✓	
Giant Hogweed		✓	✓
Common Reed	✓	✓	
Knotweed species	✓	✓	
Wild Chervil		✓	✓
European fire ants		✓	✓

The management strategies outline the implementation approach of the Invasive Species Action Plan, targeting different areas of application for Invasive Species Management within the City. The management strategies are:

- Monitoring and mapping to determine species distribution and abundance;
- Early detection and rapid response (EDRR) for new introduced species;
- Control methods for knotweed, aquatic species, giant hogweed, and fire ants;
- Integration of best management practices into City operations;
- Development and delivery of control trials;
- Community education, outreach, and stewardship; and
- Collaboration and partnerships.

Each management strategy is supported by a number of recommended short, medium, and long-term actions that build off the unique issues and opportunities facing priority invasive species. Some short-term priorities include:

- Develop inventory and mapping protocol for priority aquatic (Parrot's Feather) and terrestrial (Knotweed, Giant Hogweed) species;
- Develop best management practices for controlling Knotweed near shoreline and water bodies;
- Deliver internal education and training for City staff;
- Deliver City's EDRR program for public and private lands; and
- Develop online, social media tools, and public workshops to educate residents about invasive species management.

As Invasive Species Management is an evolving field, priorities may change over time as new information and research becomes available, or new high risk invasive species emerge.

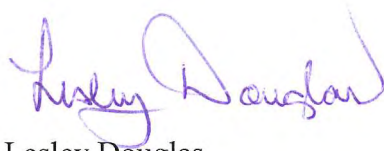
Financial Impact

None at this time. Staff resources for Invasive Species Management are currently funded through the EPMP, while existing departmental operating budgets support ongoing management activities. Additional funds received through annual capital budget requests further augment the capacity for staff to manage and deliver invasive species initiatives. As implementation proceeds, any additional funding needs (capital and/or operating) will be brought forward for Council consideration.

Conclusion

Since the inception of Richmond's Enhanced Pesticide Management Program (EPMP), the City has actively demonstrated leadership in Invasive Species Management through a variety of control, containment, EDRR, and outreach initiatives. There is an increasing need for a comprehensive framework to guide management and prioritization of invasive species response. The Invasive Species Action Plan builds on the City's accomplishments to date and provides clear direction for the management and control of invasive plants and other species within Richmond over time. While the establishment and spread of invasive species will continue to be

an ongoing challenge, articulating priorities and pursuing early detection and rapid response initiatives can ultimately decrease the ecological impact and economic cost of control measures in the long term.



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LD:hst

Att. 1: Invasive Species Action Plan



City of Richmond Invasive Species Action Plan

December 2015



Acknowledgements

This document was prepared by the City of Richmond Engineering and Public Works Division – Sustainability and District Energy Section. We would like to acknowledge the contribution of Diamond Head Consulting and Raincoast Applied Ecology in the development of this report.



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Executive Summary



Wild chervil found along Richmond's popular West Dike trail

Invasive species are plants, animals which occur outside their natural range and can have significant ecological, social and/or economic impacts once established. As an island municipality with extensive shoreline, inland watercourses, and significant people and goods movement hubs, Richmond is particularly vulnerable to the introduction and spread of invasive species.

Over two dozen invasive plants, animals and insects have been detected in Richmond. This includes several high risk species such as knotweed (which can grow through asphalt), parrot's feather (which impacts the storm drain system), fire ants (whose painful sting renders infested turf impassable) and giant hogweed (which can cause severe skin burns).

The City of Richmond (the City) has taken a pragmatic approach to managing invasive species and continues to be at the forefront of efforts to detect and rapidly respond to newly arrived invasive species. Under the City's Enhanced Pesticide Management Program invasive species management in Richmond has produced many noteworthy accomplishments including:

- **Identification** and control of all known giant hogweed and common reed occurrences;
- **Inventory** of high risk species, including Brazilian elodea and parrot's feather in watercourses, and knotweed on dike infrastructure;
- **Treatment trials and research** for parrot's feather, knotweed and wild chervil control;
- **Partnerships** with regional and provincial organizations and agencies;
- **Control and monitoring** of invasive species in City parks and trails;
- **Awareness and education** initiatives for the community; and
- Providing invasive species **training to City staff**; and
- Active collaboration on the management of invasive species with Metro Vancouver, Invasive Species Council of Metro Vancouver (ISCMV), Invasive Species Council of BC (ISCBC), Ministry of Forests, Lands and Natural Resources (FLNRO), and Inter-Ministry Invasive Species Working Group (IMISWG).

The development of the 2015 **Invasive Species Action Plan** is intended to build upon these accomplishments and to provide a clear direction regarding the City's management of invasive species over the short, medium and long-term. The three overarching goals that guide the development of the Invasive Species Action Plan are:

1. To reduce the economic and environmental risks of invasive species in Richmond by establishing a comprehensive approach to invasive species management;
2. To establish and implement monitoring and control procedures to reduce the risk and impacts of invasive species in the city; and
3. To increase awareness of invasive species within the community and the importance of prompt management.



The spread of knotweed creates local and regional challenges, and requires both partnerships and local action

To achieve these goals, the Invasive Species Action Plan recommends 11 overarching management strategies to guide the City. The management strategies are summarized below:

1. **Monitor and Map Invasive Species** to understand distribution and abundance;
2. **Establish an Early Detection and Rapid Response** as an overarching approach to identify, track and control emerging invasive species in their early stages;
3. **Manage and Control Knotweed** on dikes, shorelines, vulnerable sites, and areas of high ecological value;
4. **Manage and Control Aquatic Weeds**, within the city's watercourses;
5. **Manage and Control Giant Hogweed** through building on ongoing initiatives;
6. **Monitor and Control Fire Ants**, in collaboration with external agencies, specialists, and organizations;
7. **Integrate Invasive Species Management into City Processes** to internalize effective approaches to prevent spread and control infestations;
8. **Research Control Methods** and implement trials, in order to identify viable control solutions;
9. **Provide Invasive Species Education and Awareness** for staff, residents, and stakeholders;
10. **Support Community Stewardship** to control invasive species on public and private lands, and restoration with native plantings; and
11. **Collaboration and Partnerships** to address invasive species management across boundaries.

Each management strategy is supported by a number of recommended action items, assigned as either short-term (1 to 2 years), medium-term (3 to 5 years), or long-term (5 years onwards) priorities. Some of the recommended short-term actions include:

- Develop inventory surveys and mapping protocol focused on priority aquatic (parrot's feather) and terrestrial (knotweed, giant hogweed) species;
- Develop best management practices for controlling knotweed near shoreline and watercourses;
- Promote internal education and training for City staff on invasive species management;
- Delivery of City's early detection and rapid response program for public and private lands; and
- Active utilization of tools such as the City's webpage, social media, and workshops to inform and update residents about invasive species management.

1.0 Introduction

1.1 What are Invasive Species?

Invasive species are plants, animals and insects that occur outside of their natural range and have significant ecological, social and/or economic impacts once established. Introduced (i.e. exotic) species are common in our landscapes. Most non-native species are either unable to adapt to local conditions or, if they do establish, do not cause significant impacts. However, a small number of introduced species are considered “invasive” because they are able to flourish and spread rapidly in the absence of natural predators and other controls. Invasive species that flourish tend to out-compete native vegetation and reduce local ecosystem biodiversity. Climate change and resulting ecological shifts also increase the city and region’s vulnerability to the arrival and spread of new invasive species.

Social Impacts	Ecological Impacts	Economic Impacts
<ul style="list-style-type: none">• Health and safety risks for humans and domestic animals• Alter and degrade valued landscapes and view corridors• Impede recreation access	<ul style="list-style-type: none">• Reduce biodiversity and alter ecosystem function• Reduce wildlife habitat and forage• Increase vulnerability of species at risk• Outcompete native plants• De-stabilize riparian areas	<ul style="list-style-type: none">• Degradation and loss of productive agricultural land• Damage to critical infrastructure (drainage systems, dikes, roads, building foundations, etc.)• Reduce property values• Increase maintenance costs

Invasive species spread by a variety of means including farming, gardening, improper disposal of garden waste, dumping of unwanted pets and aquariums, soil transfer, water and wind movement, and by ‘hitching a ride’ on vehicles, cargo ships, people, animals and birds. Once established, invasive species are difficult and costly to control because they are very effective at establishing, reproducing, and spreading.

Successful invasive species management requires a long-term approach. Some invasive plants have long-lived seeds or deep roots that require monitoring and treatment over many years to ensure they are eradicated. In addition, new species are introduced and new infestations develop or expand. This strategy addresses both short- and long-term actions for managing invasive species in Richmond.



Himalayan Knotweed



Parrot's feather spreads prolifically, impeding drainage and water flow, making consistent management necessary

1.2 Why Develop an Action Plan?

The establishment and spread of invasive species will continue to be an ongoing challenge within the City of Richmond, however early action and prevention measures can decrease the impact and cost of control measures in the long term.

The ***Invasive Species Action Plan*** provides a strategic, risk-based approach to guide and prioritize invasive species management in Richmond. The Plan provides guidance on setting management priorities, establishing a consistent approach to invasive species management for City staff and departments, and coordinating public outreach and engagement.

1.3 Goals

There are three overarching goals that guide the development of the ***Invasive Species Action Plan***:

- To reduce the economic and environmental risks of invasive species in Richmond by establishing a comprehensive approach to invasive species management;
- To establish and implement monitoring and control procedures to reduce the risk and impacts of invasive species in the city;
- To increase awareness of invasive species within the community and the importance of prompt management.

1.4 Regulatory Context

Invasive species are regulated at the federal, provincial and municipal level, each with regulatory tools that influence how invasive plants and pests are managed. Most federal and provincial regulations are focused on invasive species with potential economic harm (agricultural or forest pests) and have limited effect on urban areas. The following section summarizes the key regulations supporting invasive species management.

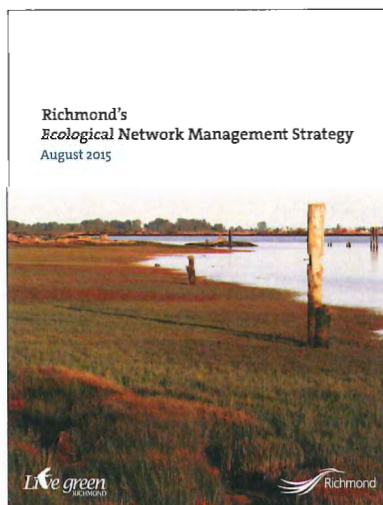
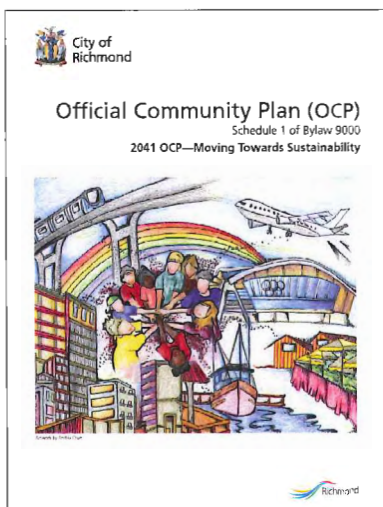
- The **federal** *Plant Protection Act* and *Seeds Act* restrict the entry of regulated pests into Canada.
- The **provincial** *Weed Control Act* and *Community Charter Act* enable the City to manage the invasive plant problem through legislation and bylaws. The *Weed Control Act* is considered to be the key invasive plant legislation that offers municipalities the greatest ability to encourage and seek action of private property owners. The Act only applies to listed Noxious Weeds.
- In the **municipal** setting, historically the City of Richmond has relied on the authority provided by its *Unightly Premises Bylaw* and the BC *Weed Control Act* to compel private landowners to control noxious weeds as well as comply with its own duties as a land owner. In the case of giant hogweed, this has proven an effective means of obliging private property owners to treat their own infestations. The use of chemical treatments to control invasive species is regulated under the City's *Pesticide Use Control Bylaw*.

Summary of existing federal, provincial and municipal regulations related to invasive plant management.

Jurisdiction	Regulation/Bylaw	Relevance
Federal	<i>Plant Protection Act</i> S.C. 1990, c.22	Identifies a list of species ¹ that are considered <i>pests</i> in Canada. Regulates the distribution of these species. Species include diseases, insects, plants, nematodes, etc.
	<i>Seeds Act</i> , R.S.C. 1985, c. S-8	Regulates the distribution of the seeds of species that are designated as <i>Prohibited Noxious Weeds</i> .
	<i>Fisheries Act</i> – Proposed Aquatic Invasive Species Regulations ²	Purpose of proposed regulations is to manage the threat of aquatic invasive species. Species will be classified into three categories which will dictate risk level and prohibitions.
Provincial	<i>Weed Control Act</i> [RSBC 1996] CHAPTER 487	Identifies plants that are classified as noxious weed species in BC. Places a duty on all land owners to control these species. This does not apply to federal lands.
	<i>Community Charter Act</i>	Authorizes municipalities to regulate invasive plants on private property through the use of bylaws. Regulatory powers depend on the threat posed (environmental, nuisance or public health concern).
	<i>Integrated Pesticide Management Act</i>	The Integrated Pest Management (IPM) Act and regulation are the primary regulatory tools governing the sale and use of pesticides in BC. These tools establish conditions for the sale and use of pesticides in the province through a classification system and regulatory provisions for licences, certification, permits, Pest Management Plans and ministry responsibilities. The regulation also contains public notification, consultation, reporting and record keeping provisions – as well as standards for IPM programs and use of pesticides aimed to ensure protection of human health and the environment
City of Richmond	<i>Wildlife Act</i>	Purpose of regulation is to preserve habitats critical to wildlife species particularly those that are at risk.
	<i>Unightly Premises Bylaw</i> No. 7162, 2001	Requires that private property does not accumulate noxious matter or substances and be kept clear of weeds.
	<i>Solid Waste and Recycling Bylaw</i> No. 6803, 1999	Prohibits dumping garbage or other discarded material on any road, park or public place.
	<i>Pesticide Use Control Bylaw</i> No. 8514, 2009	Regulates the use of pesticides. Prohibits use for the purpose of maintaining outdoor trees, shrubs, flowers, other ornamental plants or turf on private residential property or City land. There are several exceptions including use of pesticide in response to a human or animal health issue.
	<i>Boulevard Maintenance Regulation</i> No. 7174, 2001	Requires that property owners keep boulevards free of noxious weeds.

¹ Pests regulated by Canada under the *Plant Protection Act* www.inspection.gc.ca/plants/plant-protection/pests/regulated-pests/eng/1363317115207/1363317187811

² Aquatic Invasive Species Regulations. www.dfo-mpo.gc.ca/acts-lois/rules-reglements/rule-reglement01-eng.htm



1.5 Municipal Policy Context

The **Invasive Species Action Plan** is congruent with the mandates of several Richmond policies, plans and objectives, including the:

- **2041 Official Community Plan**, updated in 2012, serves as the City of Richmond's overarching framework that lays out the community vision for the social, economic, land use, design, transportation and environmental future, with supportive guidelines and policies to achieve this vision. Chapter 9 *Island Natural Environment* of the OCP recognizes issues facing Richmond's natural environment such as loss of biodiversity due to climate change impacts, urbanization and proliferation of invasive species. Supportive policies are included within the OCP to reinforce the need to address invasive species issues. This includes a policy to establish an Invasive Species Management Program that includes community and institutional partners to reduce the spread of invasive species and consequent loss of biodiversity. Another policy speaks to the need for collaboration with partner agencies to reduce the impacts of invasive species expansion.
- **Ecological Network Management Strategy**, adopted by Council in 2015, provides the framework for managing and guiding decisions regarding the city-wide system of natural areas and the ecosystem services they provide. The strategy details out the ecological issues and opportunities that are unique to the distinct geographies within Richmond, and the issue of invasive species is identified as a challenge for many of Richmond's different landscapes. Reduction of invasive species is seen as critical to maintain public safety, preserve biodiversity and protect lands of high ecological value. Implementation of the strategy includes an action targeting the development of a plan to guide invasive species management.
- **2022 Parks and Open Space Strategy** was adopted in 2013 to guide the City's delivery of services in parks and open spaces. The strategy outlines the trends and challenges affecting the delivery of these services and defines the priorities for sustaining and expanding the system over time. The strategy recognizes the need for control of invasive plant species for reasons of public safety and parks with high ecological value, and one of the priority actions listed within the Green Network focus area is to develop a systematic approach to addressing invasive plant species.

1.6 Origins of Invasive Species Management in Richmond

Invasive species management in Richmond emerged out of the **Enhanced Pesticide Management Program (EPMP)**, adopted by Richmond City Council in 2009 as a response to community interest for a bylaw banning the use of pesticides for cosmetic purposes. The comprehensive EPMP contains a municipal bylaw (the *Pesticide Use Control Bylaw*) that restricts the use of pesticides for cosmetic purposes, and supportive outreach and educational resources to inform residents how to switch to pesticide-free practices. Richmond's *Pesticide Use Control Bylaw* is considered one of the most progressive in Metro Vancouver, and having an EPMP in place represents a pro-active municipal approach to regulating cosmetic pesticide use in the absence of a provincial ban on the use of pesticides for cosmetic purposes.

The EPMP facilitates the City to take a sustainable approach to reflect the Provincial's Integrated Pest Management Regulation and *Weed Control Act*, and City policies regarding the use of pesticides under the City's *Pesticide Use Control Bylaw*. As part of this approach, invasive species control is an integral part of the EPMP. The treatment of



Canada thistle is primarily an agricultural invasive, and can disperse widely due to its lightweight seeds

invasive species addresses issues affecting ecological integrity, economic disturbances and health and safety. The control of invasive species with chemical treatments for biodiversity or infrastructure risks is exempt from the City's *Pesticide Use Control Bylaw* as it is not for cosmetic purposes.

Since its inception, the scope of the EPMP has been broadened to enable the City to comprehensively manage and respond to the proliferation of invasive species. Under the EPMP, invasive species awareness grew dramatically from 2010 onwards as a direct result of media coverage for new invaders to the region such as giant hogweed and European fire ants. In addition, the City discovered the first known regional infestation of a new high-risk invasive plant species in 2011, the common reed. As a result, control and eradication measures for invasive species have expanded within the EPMP, with new initiatives and resources for invasive species management becoming an increasingly larger component of the program over time.

As Richmond experiences climate change and associated ecological shifts that influence the proliferation of invasive species, the EPMP enables Richmond to adapt and respond to these shifts, as well as to evolving senior and local government priorities. Under the umbrella of the EPMP, the City is able to identify, control, and monitor invasive species, with the aim of reducing exposure to costs and risks over time.

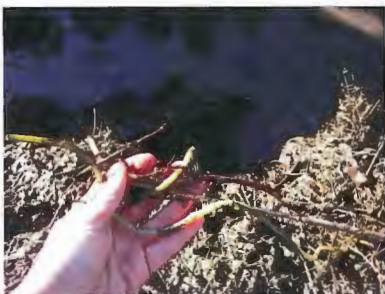
1.7 Richmond's Leadership in Invasive Species Management

Under the umbrella of the EPMP, the City has undertaken a broad range of initiatives in recent years to address invasive species on both public and private lands, positioning the City as a leader in the region for several aspects of invasive species response. Significant programs and initiatives that have contributed extensively to developing Richmond as a leader in its approach to invasive species are summarized below:

- A. Identification** is a prominent part of keeping an accurate inventory of invasive species in the environment, and is critical to determine management practices within the community. Timely and accurate identification relies on experts, City staff, and residents having up-to-date knowledge on invasive species characteristics, with a proper channel to report and verify the findings. The City's achievements in early identification include:
 - **Identification of Brazilian elodea**, a new aquatic invasive plant in Richmond, and subsequent establishment of a provincial partnership to guide early detection and rapid response to work towards treatment;
 - **Identification, treatment and control of the common reed** in Richmond, and partnership with the Province to treat and monitor the infestation site. City staff discovered and successfully identified the first known provincial infestation;
 - Identification and control of **all known giant hogweed sites** on City and private lands.
- B. Inventory & Monitoring** is critical to understand the evolving abundance and distribution of invasive species. By doing so, inventory and monitoring provide staff with tools to plan for and identify priorities over time. City activities to date include:
 - Undertaking of **GIS inventory and mapping for distribution of invasive knotweeds** (around the Lulu Island dike perimeter) and **parrot's feather** (within the storm drainage system);



The City of Richmond identified the first infestation of common reed (*Phragmites*) and annual control has been in collaboration with the Province



Parrot's feather roots extend into the substrate up to two feet, making control challenging and monitoring critical



Successful frost treatment trial for tackling parrot's feather in a riparian area on Kartner Road



Giant hogweed has been addressed through the City's EDRR response

- Initiation of **GIS inventory and mapping of purple loosestrife** (Terra Nova Rural Park, Garden City Community Park);
- **Identification and annual monitoring of known giant hogweed** infestations on private properties. The City has had a high success rate with this eradication program through collaboration with the Community Bylaws Department (i.e. Unsightly Premises Regulation);
- Ongoing monitoring and control of **invasives in City parks and trails**, including in Bath Slough, Richmond Nature Park, Terra Nova Park, Garden City Community Park, and King George Park;
- Ongoing monitoring of **Canada thistle**.

C. Ongoing Testing and Research Trials for Control Methods provide the opportunity to test out and modify innovative solutions targeting the containment and control of invasives that are actively impacting City-owned lands and infrastructure. To date, the City has undertaken various tests and trials including:

- Parrot's feather **control trials** within City watercourses to determine viable containment and control options;
- **Manual and chemical treatment trials** for knotweed infestations impacting the dike;
- **Wild chervil management** trials at Terra Nova Rural Park;
- Establishment of a **new City standard for the removal of knotweed** roots and stems for all dike upgrade projects.

D. Early Detection & Rapid Response (EDRR) is a proactive and cost-effective approach to managing invasive species that prevents establishment. Early detection of newly arrived invasive species, followed by a well-coordinated rapid response increases the likelihood of eradication or containment of new incursions. The Province administers the EDRR, and the City has an active partnership with the Province to guide EDRR best management practices for new and aggressive invasive species such as Brazilian elodea and common reed. The City has established its own EDRR program for giant hogweed, even though giant hogweed is not considered a provincial EDRR species.

E. Partnerships are a crucial step for information sharing in an ever-evolving field, and to improve coordination of invasive species response. In addition, invasive species spread regardless of jurisdictional boundaries, and partnerships can result in more effective and collaborative solutions. The City has extensively partnered with many local, regional, and provincial agencies to supplement invasive species management, including:

- Collaboration with the **Ministry of Forest, Lands and Natural Resource Operations** (FLNRO) to implement Richmond's EDRR Program, and to support pesticide applications when and if necessary. Richmond is one of three Metro Vancouver municipalities to receive annual funding from the Ministry for invasive species control;
- Collaboration with the provincial **Inter-Ministry Invasive Species Working Group** (IMISWG) to develop consistent European fire ant communication materials and protocols;
- Active participation on the **Invasive Species Council of Metro Vancouver** (ISCMV) and the **Invasive Species Council of British Columbia** (ISCBC);



Public notification sign at McDonald Beach, cautioning the public of the fire ant infestation



Volunteers contribute to a City-led invasives removal event as part of Earth Day festivities

- Member of the **BC Spartina Working Group**;
- Collaboration with **Thompson River University** specialists to confirm fire ant identification and to provide support for private landowners with fire ant infestations;
- Collaboration with a variety of provincial, regional and local partners to develop a **regional and local response plan** for European fire ant infestations;
- Collaboration with **local artists and the Richmond Weavers Guild to harvest invasive plant materials** from City parks to be utilized for community weaving projects. These efforts build community awareness regarding the risks and threats associated with invasive species as well using public art as the catalyst for the process;
- Ongoing **work with invasive plant specialists**, integrated pest management practitioners and horticultural specialists to inform prevention practices.

F. Education & Awareness must also be in place to spread information community-wide about invasive species and to promote practices that prevent their spread. Education is a considered a softer measure for invasive species response, is cost-effective, and is critical to supplement the City's efforts. The City has undertaken a broad range of education and awareness initiatives, including:

- Creation of a **reporting phone line and email** for residents to report invasive species;
- Dedicated **City webpage on invasive species** focused on identification and response for European fire ants, European chafer beetle, and giant hogweed;
- Internal **education and awareness initiatives** amongst City departments, including staff training on identification and management of invasive species;
- Delivery of ISCMV **best management practices training** for staff, held every two to three years;
- Establishment of a City **24-hour response program** for reporting of giant hogweed and European fire ants from the general public;
- **Engagement with landowners** to support the eradication of giant hogweed and knotweed species on private property;
- City-led **community invasive plant removal events** (i.e. King George Park, Terra Nova, Garden City Community Park);
- Development and presentation of **new EPMP 2014 and 2015 information sessions** for newcomer invasive pests to Richmond: the European chafer beetle (community workshop) and the European fire ant (staff workshop);
- Delivery of **presentations to Professional Pest Managers of BC** (*Challenges of Managing Invasive Species for Local Governments*) and Master Gardeners of BC (*European fire ants*);
- Earth Day and other public events for invasive plant removal (including Garden City Park, King George environmentally sensitive areas, west dike etc.).

2.0 Background Context



Terra Nova Rural Park, the foreshore, and the West Dike area all contain susceptible pathways for the introduction and spread of invasive species



Agricultural areas are affected by a distinct group of invasive species

This section provides an overview of the geographic vulnerabilities that make Richmond particularly susceptible to the introduction and spread of invasive species. A risk assessment of the invasive species currently present in the City is provided. The interaction of invasive species risk and stage of invasion is explained in the context of determining the appropriate level of response.

2.1 Geographical Vulnerabilities

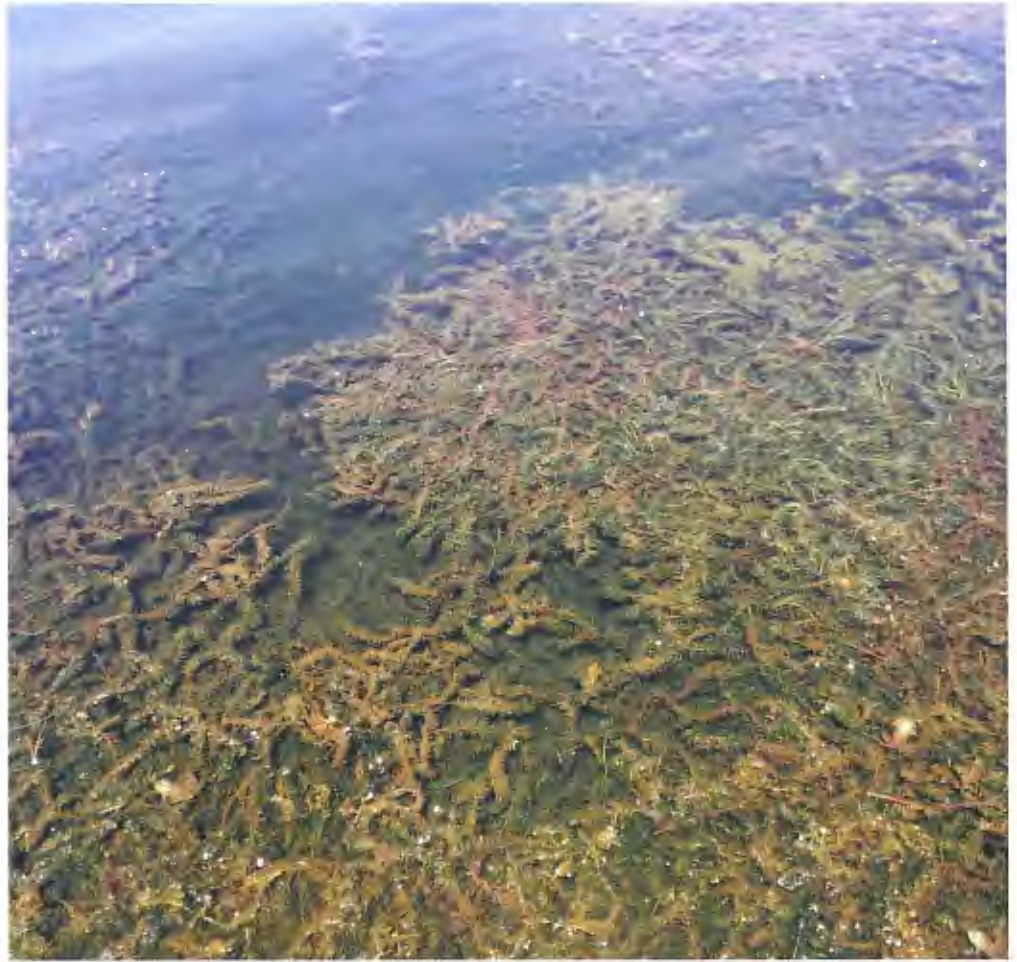
There are a number of factors that put Richmond at higher risk from invasive species compared to other areas of Metro Vancouver:

- **Wetlands, Watercourses, and Foreshore Areas are at Risk in Richmond:** Richmond is a city of islands surrounded by the channels and intertidal wetlands of the Fraser River estuary. Lowland aquatic habitats such as watercourses, canals and raised bog ecosystems within and around Richmond are susceptible to the introduction and spread of a suite of species associated with these habitats. For example, aquatic weeds such as parrot's feather, common reed, and Brazilian elodea, as well as American bullfrog, non-native fish (carp, bluegill, etc.) are present in Richmond. *Spartina*, a highly invasive marsh plant found in Boundary Bay, may also colonize Richmond's intertidal wetlands in the future.
- **Agricultural Lands are Hotspots for Invasive Plants:** Richmond has a higher proportion of agricultural land than any other urban municipality in Metro Vancouver. Agricultural lands are affected by a distinct group of invasive species such as wild chervil and bull thistle which can degrade pasture or forage quality. Cranberry and blueberry fields also support a distinct group of invasive plants that were introduced from eastern Canada or Europe and have now spread to natural bogs and fens in the region.
- **Non-forested Habitats are Susceptible to Invasive Plants:** Forests generally have fewer invasive species than open areas because of the lack of available light, soil, and moisture prevents new species from thriving. The predominance of open areas such as old fields, wetlands, ditches, watercourses and mowed dikes make Richmond more susceptible to invasive species establishment and spread compared to other areas of Metro Vancouver.
- **Urban Areas Contribute to Invasive Species Introduction:** Backyard gardens are also a source of invasive species and are an important dispersal route into some parks and riparian areas. For example, many infestations of yellow lamium and English ivy originated from dumping of garden waste, and parrot's feather was likely introduced from backyard ponds and home aquariums.
- **Higher Risks and Costs to City Infrastructure:** Dikes, ditches, and pump stations are an essential part of Richmond's drainage and flood protection infrastructure. Trails on the dikes provide recreation access to the city's shoreline. Aquatic weeds reduce the capacity of ditches and watercourses to drain water during winter storms, and the extensive root system of knotweed species can affect dike stability. Dense thickets of Himalayan blackberry also impede access to foreshore parks or trails. Operation activities to control invasive species through mowing, excavation, and other control methods are an increasing cost to the City.

2.2 Invasive Species Risk Assessment

Over two dozen invasive species are known to occur in Richmond, and all of these species have the potential to cause varying degrees of harmful ecological impacts (e.g. out-competing native species, reducing habitat value etc.). Eight of these species have the added potential to pose other serious impacts to infrastructure and/or human health, and are therefore considered **high risk** to the City of Richmond and priority species for management.

The eight **priority species** and their unique risk profiles are described in the table below.



Brazilian elodea, a submerged aquatic plant, spreads by fragmentation, impacting drainage systems and ecological integrity of watercourses

Risk profiles of priority invasive species in Richmond.

Common Name	Risk Profile
AQUATIC PLANTS	
Brazilian elodea**	<ul style="list-style-type: none">• Infrastructure: impedes flood control, storm drain systems and irrigation works; restricts water movement; traps sediment; increases municipal maintenance costs• Recreation: hinders activities (e.g. fishing, swimming, boating)• Ecological: spreads rapidly and displaces native aquatic vegetation and decreases biodiversity; alters aquatic habitats and food webs; reduces suitable habitat for wildlife; blocks passage of juvenile salmon and other fish
Eurasian water-milfoil	
Parrot's feather	
TERRESTRIAL PLANTS	
Giant hogweed*	<ul style="list-style-type: none">• Human health: sap on skin can cause severe burns and blindness in humans and animals when exposed to sunlight• Ecological: displaces native vegetation; reduces suitable habitat for wildlife and decreases biodiversity
Common reed* & **	<ul style="list-style-type: none">• Infrastructure: obstructs driver sight lines; alters hydrology; increases municipal maintenance costs• Recreation: impedes access• Ecological: displaces native vegetation; reduces suitable habitat for wildlife in wetlands and decreases biodiversity
Knotweed species*: Bohemian, giant, Himalayan and Japanese	<ul style="list-style-type: none">• Infrastructure: destabilize infrastructure, including dike system; increases erosion potential and impedes storm drain system; able to penetrate cement, asphalt, house foundations and walls (e.g. pump stations); obstructs driver sight lines; increases municipal maintenance costs• Ecological: displaces native vegetation; reduces suitable habitat for wildlife and fish and decreases biodiversity
Wild chervil*	<ul style="list-style-type: none">• Human health: sap on skin can cause severe burns in humans and animals when exposed to sunlight• Agricultural: reduces forage for grazing; contaminates crops (poor quality forage)
Fire ant (European and Impressive)	<ul style="list-style-type: none">• Human health: colonies swarm when disturbed and cause painful stings• Recreation: impedes access• Ecological: Potential to outcompete and displace native ant colonies

* Noxious weed regulated under the *BC Weed Control Act*.

** Proposed prohibited weed in BC.

Other invasive species present within Richmond have been classified as non-priority or moderate species for management; however they still have the potential to pose ecological risk. Many of these moderate risk species warrant control in specific circumstances, such as ecosystem restoration projects or volunteer stewardship events in parks. Residents and landscape contractors can help prevent their spread into parks and native ecosystems by avoiding planting these species in gardens and landscapes and by properly disposing of green waste. Refer to Appendix 1 for more information on the moderate risk invasive species in Richmond.

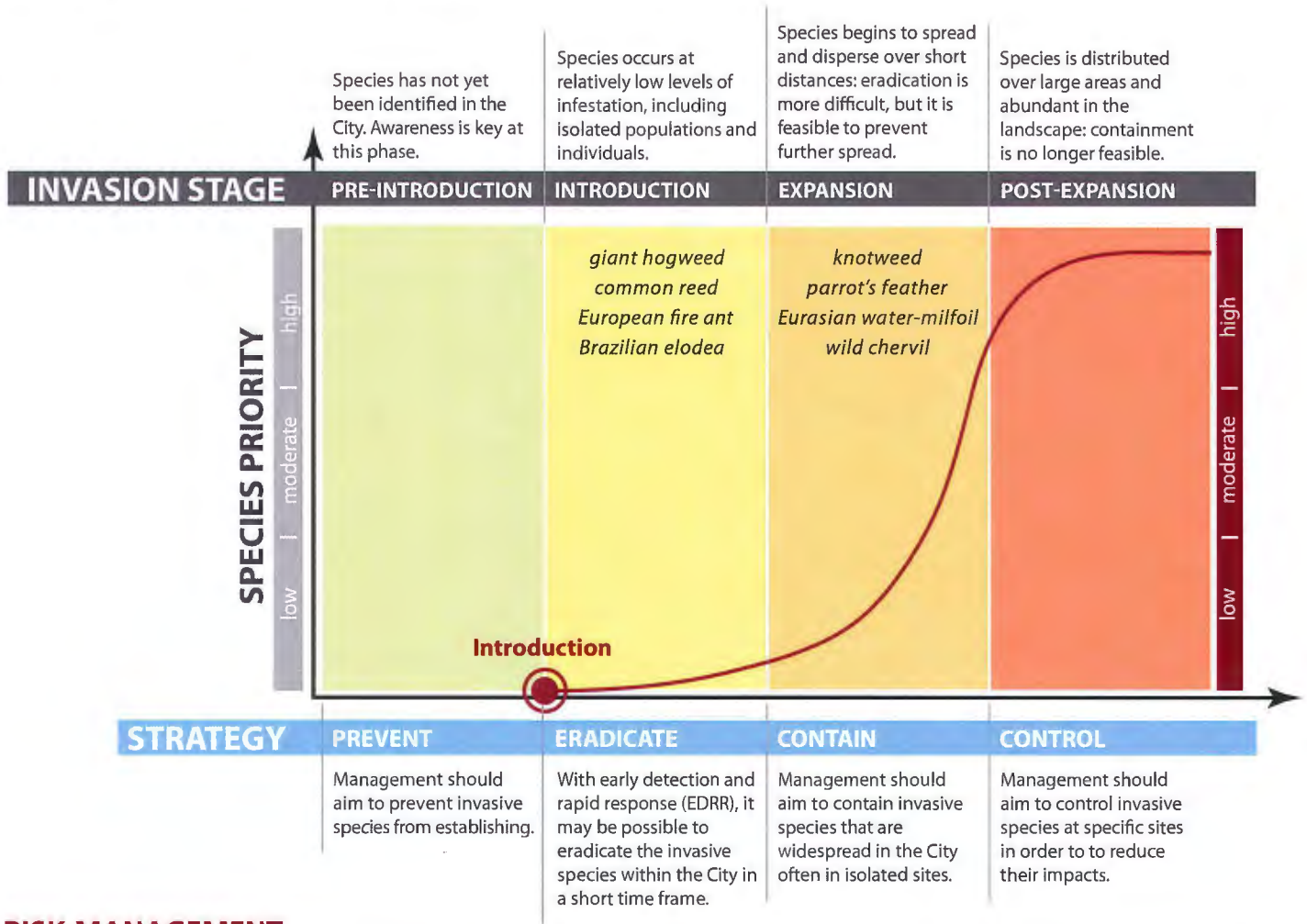
2.3 Stage of Invasion and Risk Management

The risk associated with an invasive species combined with its stage of invasion (current distribution and abundance) in the City provides a quantifiable way to determine the most appropriate and cost effective response.

There is only a small window of time after an invasive species is first introduced where eradication may be possible before the species actively spreads. Once invasive species have established and are actively spreading, the cost of treatment increases exponentially and the likelihood of eradication decreases. In comparison, the cost of preventing their establishment is low, hence the emphasis on prevention in this plan.

The risk management diagram, shown on the facing page, illustrates the relationship between stage of invasion and appropriate management strategy over time. Richmond's eight priority invasive species have been positioned on the graph based on their risk profiles and stage of invasion. The moderate risk species in Richmond (not shown) fall predominately within the expansion and post-expansion stages of invasion.

Risk management overview for priority species in the City of Richmond.



RISK MANAGEMENT

The risk of significant ecological, social and economic impacts grow with increased distribution and abundance of invasive species. That being said, it is not possible or necessarily desirable to eradicate all invasive species. A risk management approach forms the basis for setting priorities for operational activities in order to maximize the cost efficiency of efforts.

3.0 Management Strategies

To guide invasive species management in the City of Richmond, a series of management strategies are recommended as the approach to meet the Invasive Species Action Plan's goals. A number of actions further serve to describe how certain projects or initiatives can support the management strategies. The actions also seek to establish an implementation approach that integrates with current City processes, to build on and enhance existing practices, and to develop best management practices.

As invasive species management is an evolving field: recommended management strategies and actions may also change over time as new information and research becomes available, or new high risk invasive species emerge.

Strategy #1 Monitor and Map Invasive Species

In order to make informed, strategic decisions about which invasive species need to be treated in which locations, the City must have an understanding of species distribution and abundance. The data can be used to identify problematic locations for invasive plant introduction, prioritize control efforts, direct operations and monitor change over time to measure success.

ACTIONS:

1. Continue ongoing coordination and development of survey and mapping initiatives for infestations of aquatic (i.e. parrot's feather and Brazilian elodea) and terrestrial (i.e. knotweed and giant hogweed) invasive species.
2. Continue efforts to develop a standardized GIS field mapping platform and protocol for City staff.
3. Provide mapping/inventory training to City operations staff who are able to integrate the mapping of invasive species into their regular maintenance work (e.g. ditch and dike maintenance, park development and restoration, etc.).
4. Devise a monitoring protocol and schedule for treatment sites to ensure consistent records are kept and that appropriate follow-up treatment and maintenance occurs.

Strategy #2 Early Detection and Rapid Response

Once introduced, the most effective and efficient control of invasive species is to treat when still in the introduction phase by using an approach called "Early Detection and Rapid Response" (EDRR). The cost of implementing EDRR is very small compared to the cost of controlling an invasive species that has already established and spread. The Province has an EDRR Plan which outlines how new invasive plant incursions that are of risk to BC can be quickly and effectively addressed. EDRR relies on reports by citizens, staff, or professionals to detect and identify invasive species when they are first introduced; this can be a challenge given the complexity of taxonomic identification of many species.

Early detection of the common reed in Richmond in 2011, and the subsequent rapid response by the City is a noteworthy example of how quick response led to prompt treatment of a new invader, preventing spread and averting the need for a costly control program.

ACTIONS:

5. Continue to work in collaboration with the Province on delivery and protocol for the EDRR Program.
6. Provide education to residents on emerging invasive species to bolster identification and reporting on emerging species.
7. Provide immediate response to reports of emerging invasive species in Richmond.
8. Continue delivery of City's successful EDRR program for giant hogweed on both public and privately owned lands.



Dikes and pump stations on the perimeter of Richmond are essential for local flood protection, yet are susceptible to a multitude of aquatic and terrestrial invasives

Strategy #3 Manage and Control Knotweed

Knotweed forms extensive root systems which can penetrate asphalt and destabilize infrastructure. As an island municipality, Richmond is particularly at risk to the threat of knotweed species ability to weaken dike infrastructure, impede water flow in the storm drain system and destabilize watercourse banks. It also poses an ecological risk by out-competing native vegetation and degrading riparian habitat.

Knotweed is known to occur throughout the City on both public and private lands; in the dike and watercourse system, in streams and wetlands, along roadsides, disturbed sites, and in landscaped areas.

Knotweed spreads prolifically by root and stem fragments. Movement of knotweed contaminated soil, improper disposal of plant material, seasonal mowing and construction activities all contribute to spread across the City and region.

Priority Areas for Management:

1. Dike and pump stations
2. Watercourse system
3. Ecologically sensitive habitats
4. Construction sites (public and private)
5. City Parks and trails
6. Roadside rights-of-way which are mowed to maintain sight lines

ACTIONS:

9. Continue to develop a city-wide knotweed control program in collaboration with other City departments and staff.
10. Continue the use of City staff resources or contractors to continue knotweed control on priority sites using herbicide (stem injection or foliar application) or excavation (for small infestations and new dikes).
11. Develop best management practices for controlling knotweed near shorelines and watercourses.
12. Incorporate knotweed control and soil management and disposal guidelines into development permits and servicing agreements when knotweed is present.
13. Collaborate with FLNRO, ISCMV and ISCBC regarding up-to-date approaches for knotweed control, disposal, treatment, standards and practices.
14. Explore provincial permitting options for knotweed management in unique conditions.
15. Develop guidelines or protocol for disposal of excavated knotweed materials.



Japanese knotweed along Airport Road in Burkeville

Strategy #4 Manage and Control Aquatic Weeds

Richmond's inland watercourses are susceptible to the establishment and spread of aquatic weeds. Many watercourses do not have tree cover which increases the amount of light and raises water temperatures for plant growth; nutrients from runoff also promote growth. Floating, submerged, or emergent invasive plants are common in many of the city's watercourses. Priority aquatic species are parrot's feather, Brazilian elodea, Eurasian water-milfoil, and common reed.



City crews place a shading frame over a ditch to discourage growth of Parrot's feather, a sun-loving aquatic weed



Giant hogweed can grow up to 5 m, and spreads prolifically via seed if not controlled and monitored

Routine maintenance and dredging of the City's watercourses may inadvertently also contribute to the spread of some aquatic weeds, by fragmenting and dispersing plant roots and stems either by water or by the movement of plant material on maintenance vehicles. In addition, dumping of aquatic invasive plants from aquariums may also contribute to the rapid proliferation of aquatic weeds.

Priority Areas for Management:

1. Watercourse and drainage network
2. Ecologically sensitive habitats

ACTIONS:

16. Continue to enhance and modify ongoing trials for shading and excavation to control parrot's feather and Brazilian elodea at known infestation sites in the City.
17. Develop BMPs for the containment of aquatic weeds including a designated disposal site away from watercourses.
18. Implement best management practices to avoid dispersal of aquatic weeds during excavation or disposal.
19. Work with ISCBC *Don't Let it Loose* campaign focusing on the commercial sale and distribution of aquatic plants by retail nurseries and aquarium suppliers; provide information to reduce or eliminate their sale.

Strategy #5 Manage and Control Giant Hogweed

Giant hogweed is a very large invasive plant (reaching up to 5 meters in height) posing safety risks to human and animal health. Its sap can cause severe burns and blindness when exposed to sunlight. In addition, giant hogweed produces copious seeds which can persist in the soil for several years.

Through an engagement program with landowners and a public reporting line to report sightings, giant hogweed is a likely candidate for eradication within the next 5 years from both City and private property. Ongoing monitoring is critical to detect new occurrences sprouting from the existing seed bank or spreading from neighbouring jurisdictions.

Priority Areas for Management:

1. City wide

ACTIONS:

20. Support the efforts of private landowners to control and treat giant hogweed via manual digging or herbicide application.
21. Maintain dedication of staff resources through the EPMP and Community Bylaws department for the EDRR program.
22. Continue to actively monitor for giant hogweed and map its distribution.



European fire ants are aggressive when their territory is disturbed

Strategy #6 Monitor and Control Fire Ants

Fire ants, both European and Impressive, are a combative ant that will swarm humans or animals that invade their territory. They can establish multiple nests within a small area, making their territories very dense and in some cases impassable.

There is currently no proven, effective treatment for fire ants. Work is underway by the BC Inter-Ministry Invasive Species Working Group to test control methods through collaboration with Thompson Rivers University. Until there is an effective treatment for fire ants, best management practices are required to contain known colony infestations and to provide education or notification to the public or residents.

Priority Areas for Detection:

1. High value ecological areas (e.g. wildlife management areas, Northeast Bog, Terra Nova Rural Park, McDonald Beach)
2. City parks and trails
3. City Works Yard and soil storage areas
4. Lawn (i.e. turf) surfaces

ACTIONS:

23. Prevent spread of fire ants by avoiding movement of infested materials, using a combination of approaches including best management practices, web-based information, and education and outreach.
24. Maintain accurate inventory information on colony extent on City lands.
25. Continue to collaborate with Thompson Rivers University and the BC IMISWG to stay informed of the latest scientific research and BMP developments.
26. Continue to support property owners when fire ants are detected through education and awareness, site visits, and sampling.
27. Follow emerging science regarding confirmation and spread of the Impressive fire ant (*Myrmica specioidea*).



City crews apply best management practices for parrot's feather control, while maintaining a City watercourse

Strategy #7 Integrate Invasive Species Management into City Processes

Many capital and operational projects, as well as development activities have the potential to introduce and spread invasive species (e.g. mowing, soil movement, ditch dredging, dike maintenance, and construction, etc.). A consistent City wide approach to prevention and control of invasive species is critical to ensure efficient use of resources, prevent avoidable introduction and spread and increase the opportunity for successful outcomes. Knowledge and awareness of City operations staff and contractors leads to a greater likelihood of early detection and control of invasive species.

ACTIONS:

28. Continue to work collaboratively across City departments (including Drainage Operations, Parks, and Community Bylaws) to ensure effective delivery of invasive species management.
29. Ensure consistent delivery of up-to-date invasive species management training for City staff, including prevention and maintenance techniques.
30. Maintain up-to-date and accessible City resources on BMPs or all priority invasive species including web based materials for City Hall and the public.
31. Create an invasive species 'management calendar' to identify recommended timelines for invasive species removal and control methods.
32. Work with external organizations and agencies to stay current on recent technology advancements and testing related to invasive species management.
33. Integrate invasive species management into the City development process.
34. Investigate local government authority opportunities under the Province's Weed Control Act.

Strategy #8 Research Control Methods

One of the challenges of emerging invasive species is that effective control methods have not been determined, or rely on methods such as herbicides that are not approved for use in sensitive ecosystems. Parrot's feather and Brazilian elodea, for example, are new arrivals in BC and therefore there is limited local knowledge or experience with their management.

ACTIONS:

35. Continue to test control methods that are suitable for Richmond's conditions.
36. Develop partnerships with other jurisdictions across North America which already have control programs in place in order to learn from their successes and fill gaps in local knowledge.
37. Support research by academic institutions on the ecology and control of invasive species including providing access to city sites, resources, or small-scale funding.
38. Collaborate with the ISCMV, ISCBC the Province, other local governments, and the stewardship community to test control strategies and methods.
39. When possible, share the results of research, test projects, and other technical experience using the internet and other forums. Specifically, publish or present the results of treatment trials when possible.

Strategy #9 Promote Invasive Species Education and Awareness

Public education and awareness are important components of a successful invasive species management program. Residents can contribute to the detection of priority species, prevent introduction and spread by responsibly disposing green waste (including aquarium plants) in green waste collection bins and joining control efforts by volunteering at stewardship events. Citizens need to be aware of safety risks posed by some invasive species (e.g. giant hogweed and European fire ants) and need access to information on how to properly manage invasive species problems on their land.

ACTIONS:

40. Continue to actively utilize tools such as the City's invasive species webpage and social media platforms to regularly inform residents about information, guidelines, and City initiatives focused on invasive species.
41. Continually educate and inform City staff on emerging information and protocols around invasive species in Richmond.
42. Continue to deliver Environmental Sustainability public workshops with topics such as backyard naturalization and invasive species management for landowners.
43. Continue to actively promote the Enhanced Pesticide Management Program, *Pesticide Use Control Bylaw*, the invasive species reporting phone line, and other available City and regional resources at local community events.
44. Incorporate key messages into communications about invasive species:
 - a) Awareness, detection, and identification of priority species;
 - b) Individual and community involvement opportunities;
 - c) Ecological impacts of illegal dumping of invasive species.
45. Monitor and provide necessary updates to City staff and the public regarding the provincial Integrated Pest Management Act.



Strategy #10 Support Community Stewardship

Many effective projects for invasive species control have involved volunteers organized formally or informally by stewardship groups across City lands. Volunteers are the "boots on the ground" for a variety of invasive stewardship activities, including pulling ivy, removing blackberry, and restoration through planting native species.

Stewardship activities can also include "citizen science": the involvement of citizens in the collection of data for surveys, assessment, or monitoring. Citizen science initiatives can be particularly effective for EDRR where more observers greatly increase the chance of detecting invasive species when they are rare and sparse.



Participants at the Richmond Earth Day Youth Summit learn about invasive species in Richmond

ACTIONS:

46. Work with City partners and local stewardship groups (e.g. Green Ambassadors, Parks department programs, Richmond School District, etc.) to expand the delivery of invasive species related stewardship initiatives (e.g. invasive species pulls, restoration projects etc.).
47. Provide information, guidance, and other resources to local stewardship groups for invasive species related initiatives within City parks and other City-owned lands.
48. Review opportunities to support citizen science initiatives for EDRR species and other invasive related opportunities.
49. Explore recognition programs for community groups who have undertaken invasive species control initiatives through the Parks Department *Partners for Beautification* program.
50. Promote community engagement and stewardship through the Bath Slough Revitalization Initiative and other supportive projects within the City's Ecological Network.
51. Continue to support stewardship and invasive species awareness through community events including Earth Day, Rivers Day, Richmond Earth Day Youth (REaDY) Summit.

Strategy #11 Collaboration and Partnerships

Invasive species cross municipal and jurisdictional boundaries making collaboration between all levels of government in the management of invasive species essential. Collaboration at a regional level disseminates technical experience, shares the successes and failures of control projects, and increases public awareness through media coverage. Collaboration can also occur at the international level as local and state governments in Washington and Oregon work on many of the same invasive species that occur in Richmond.

ACTIONS:

52. Encourage staff to participate in regional working groups, committees, and other organizations that contribute to invasive species management (e.g. Metro Vancouver).
53. Collaborate with municipalities which share similar environmental conditions to Richmond (i.e. Delta, Surrey, and New Westminster) to exchange invasive species related information.
54. Participate in ISCMV and ISCBC forums and conferences.
55. Establish an Invasive Species corporate interdepartmental team to coordinate invasive species control among City of Richmond departments.

4.0 Implementation Plan

The implementation plan serves to guide the management and control of invasive plants and pests within the City over time. The implementation plan is articulated through a series of recommended actions, each tailored to a particular strategy, building off the unique issues and opportunities facing each high priority invasive species. Each action within the implementation plan has been assigned a time-frame for implementation, within a short, medium, or long term horizon based on their priority level.

Timeframe:

- **Short-term:** 1–2 years
- **Medium-term:** 3–5 years
- **Long-term:** 5 years +
- **Ongoing** (refers to initiatives regularly undertaken within City processes)

An annual review of the implementation plan and priority actions will be undertaken to address emerging needs and issues, and to measure progress toward achieving the plan's outcomes.

Currently, City of Richmond staff resourcing for invasive species management is funded through the Enhanced Pesticide Management Program. An additional \$150,000, secured through annual capital requests in 2015 and 2016, have augmented the capacity for City staff to manage and deliver invasive species initiatives. Additional funding (capital and/or operating) from various City departments is anticipated in the future to meet the needs of invasive species management.

As information and management guidance on invasive species is constantly evolving, recommended management strategies and priority actions may also change over time—particularly as new information and research becomes available, or new high risk invasive species emerge.

Strategy	Actions / Programs / Initiatives	Timeframe
Strategy #1 Monitor and Map Invasive Species	1. Continue ongoing coordination and development of survey and mapping initiatives for infestations of aquatic (i.e. parrot's feather and Brazilian elodea) and terrestrial (i.e. knotweed and giant hogweed) invasive species.	Ongoing
	2. Continue efforts to develop a standardized GIS field mapping program and protocol for City staff.	Short-term
	3. Provide mapping/inventory training to City operations staff to integrate the mapping of invasive species into their regular maintenance work (e.g. ditch and dike maintenance, park development and restoration, etc.).	Medium-term
	4. Devise a monitoring protocol, linked to the GIS mapping and schedule treatment of sites to ensure consistent records are kept and that appropriate follow-up treatment and maintenance occurs.	Medium-term

Strategy	Actions / Programs / Initiatives	Timeframe
Strategy #2 Early Detection and Rapid Response	5. Continue to work in collaboration with the Province on delivery and protocol for the EDRR program.	Ongoing
	6. Provide education to residents on emerging invasive species to bolster identification and reporting on emerging species.	Ongoing
	7. Provide immediate response to reports of emerging invasive species in Richmond.	Ongoing
	8. Continue delivery of City's successful EDRR program for giant hogweed on both public and privately owned lands.	Ongoing
Strategy #3 Manage and Control Knotweed	9. Continue to develop a city-wide knotweed control program in collaboration with other City departments and staff.	Medium-term
	10. Continue the use of City staff resources or contractors to continue knotweed control on priority sites using herbicide (stem injection or foliar application) or excavation (for small infestations and new dikes).	Short-term
	11. Develop BMPs for controlling knotweed near shorelines and watercourses.	Short-term
	12. Incorporate knotweed control and soil management and disposal guidelines into development permits and servicing agreements when knotweed is present.	Long-term
	13. Collaborate with FLNRO, ISCMV, and ISCBC regarding up-to-date approaches for knotweed control, disposal, treatment, standards and practices.	Ongoing
	14. Explore provincial permitting options for knotweed management in unique conditions.	Short-term
Strategy #4 Manage and Control Aquatic Weeds	15. Develop guidelines or protocol for disposal of excavated knotweed materials.	Ongoing
	16. Continue to enhance and modify ongoing trials for shading and excavation to control parrot's feather and Brazilian elodea at known infestation sites in the City.	Ongoing
	17. Develop BMPs for the containment of aquatic weeds including a designated disposal site away from watercourses.	Ongoing
	18. Implement BMPs to avoid dispersal of aquatic weeds during excavation or disposal.	Short-term
Strategy #5 Manage and Control Giant Hogweed	19. Work with ISCBC Don't Let it Loose campaign focusing on the commercial sale and distribution of aquatic plants by retail nurseries and aquarium suppliers; provide information to reduce or eliminate their sale.	Ongoing
	20. Support the efforts of private landowners to identify, control and treat giant hogweed via manual digging or herbicide application.	Ongoing
	21. Maintain dedication of staff resources through the EPMP and Community Bylaws department for the EDRR program.	Ongoing
Strategy #6 Monitor and Contain Fire Ants	22. Continue to actively monitor and map giant hogweed distribution.	Short-term
	23. Prevent spread of fire ants by avoiding movement of infested materials, using a combination of approaches including BMPs, web-based information, and education and outreach.	Ongoing
	24. Maintain accurate inventory information on colony extent on City lands.	Long-term
	25. Continue to collaborate with Thompson Rivers University and the BC IMISWG to stay informed of the latest scientific research and BMP developments.	Long-term
	26. Continue to support property owners when fire ants are detected through education and awareness, site visits, and sampling.	Ongoing
	27. Follow emerging science regarding confirmation and spread of the Impressive fire ant (<i>Myrmica specioidea</i>).	Medium-term

Strategy	Actions / Programs / Initiatives	Timeframe
Strategy #7 Integrate Invasive Species Management into City Processes	28. Continue to work collaboratively across City departments (including Drainage Operations, Parks, and Community Bylaws) to ensure effective delivery of invasive species management.	Ongoing
	29. Ensure consistent delivery of up-to-date invasive species management training for City staff, including prevention and maintenance techniques.	Ongoing
	30. Maintain up-to-date and accessible City resources on BMPs for all priority invasive species, including web-based materials for City staff and the public.	Long-term
	31. Create an invasive species 'management calendar' to identify recommended timelines for invasive species removal and control methods.	Short-term
	32. Work with external organizations and agencies to stay current on recent technological advancements, scientific research and practices related to invasive species management.	Short-term
	33. Integrate invasive species management into the City development process.	Long-term
	34. Investigate local government authority opportunities under the Province's Weed Control Act.	Short-term
Strategy #8 Research Control Methods	35. Continue to test invasive species control methods suitable to Richmond's conditions.	Long-term
	36. Develop partnerships with other jurisdictions across North America with control programs in place in order to learn from their successes and fill gaps in local knowledge.	Long-term
	37. Support research by academic institutions on the ecology and control of invasive species including providing access to city sites, resources, or small-scale funding.	Long-term
	38. Collaborate with the ISCMV, ISCBC, Province of BC, other local governments, and the stewardship community to test control strategies and methods.	Ongoing
Strategy #9 Promote Invasive Species Education and Awareness	39. When possible, share the results of research, test projects, and other technical experience using the internet and other forums. Specifically, publish or present the results of treatment trials, when possible.	Long-term
	40. Continue to actively utilize tools such as the City's invasive species webpage and social media platforms to regularly inform residents regarding information, guidelines, and City initiatives focused on invasive species.	Ongoing
	41. Continually educate and inform City staff on emerging information and protocols around invasive species in Richmond.	Ongoing
	42. Continue to deliver Environmental Sustainability public workshops with topics such as backyard naturalization and invasive species management for landowners.	Long-term
	43. Continue to actively promote the Enhanced Pesticide Management Program, Pesticide Use Control Bylaw, the invasive species reporting phone line, and other available City and regional resources at local community events.	Long-term
	44. Incorporate key messages into communications about invasive species: a) Awareness, detection, and identification of priority species; b) Individual and community involvement opportunities; c) Ecological impacts of illegal dumping of invasive species.	Short-term
	45. Monitor and provide necessary updates to Council, City staff and the public regarding the provincial Integrated Pest Management Act.	Ongoing

Strategy	Actions / Programs / Initiatives	Timeframe
Strategy #10 Support Community Stewardship	46. Work with City partners and local stewardship groups (e.g. Green Ambassadors, Parks department programs, Richmond School District) to deliver invasive species related stewardship initiatives (e.g. invasive species pulls, etc.).	Ongoing
	47. Provide information, guidance, and other resources to local stewardship groups for invasive species related initiatives within City parks and other City-owned lands.	Short-term
	48. Review opportunities to support citizen science initiatives for EDRR species and other invasive related opportunities.	Medium-term
	49. Explore recognition programs for community groups who have undertaken invasive species control initiatives through the Partners for Beautification programming in the City's Parks Department.	Long-term
	50. Promote community engagement and stewardship through the Bath Slough Revitalization Initiative and other supportive projects within the City's Ecological Network.	Ongoing
	51. Continue to support stewardship and invasive species awareness through community events including Earth Day, Farmers Market, Richmond Earth Day Youth (REaDY) Summit.	Ongoing
Strategy #11 Collaboration and Partnerships	52. Encourage staff to participate in regional working groups, committees, and other organizations that contribute to invasive species management (e.g. Metro Vancouver).	Long-term
	53. Collaborate with municipalities which share similar environmental conditions to Richmond (i.e. Delta, Surrey, and New Westminster) to exchange invasive species related information.	Ongoing
	54. Participate in ISCMV and ISCBC forums and conferences.	Long-term
	55. Establish an Invasive Species corporate interdepartmental team to coordinate invasive species control among City of Richmond departments.	Short-term

Appendix 1 | Moderate Risk Invasive Species in the City of Richmond

Moderate risk species which are currently not priority species for management in the City of Richmond are listed in the table below. Although they are non-priority species, they still have the potential to pose ecological risk. Many of these species are controlled in specific circumstances such as ecosystem restoration projects or volunteer stewardship events in parks. Residents and landscape contractors can help prevent their spread into parks and native ecosystems by avoiding planting these species in gardens and by properly disposing of green waste.

Moderate risk invasive species in the City of Richmond.

Common Name	Scientific Name
INVASIVE PLANTS	
Blueberry (non-native, cultivated)	<i>Vaccinium corymbosum</i>
Butterfly bush	<i>Buddleja davidii</i>
Canada thistle	<i>Cirsium arvense</i>
Cherry laurel (English laurel)	<i>Prunus laurocerasus</i>
English holly	<i>Ilex aquifolium</i>
English ivy	<i>Hedera helix</i>
Himalayan balsam (policeman's helmet)	<i>Impatiens glandulifera</i>
Himalayan blackberry	<i>Rubus armeniacus</i>
Lamium (yellow archangel)	<i>Lamium galeobdolon</i>
Periwinkle	<i>Vinca minor</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Reed canarygrass	<i>Phalaris arundinacea</i>
Scotch broom	<i>Cytisus sciparius</i>
Spurge laurel (daphne laurel)	<i>Daphne laureola</i>
Yellow flag-iris	<i>Iris pseudacorus</i>
INVASIVE ANIMALS & INSECTS	
American bullfrog	<i>Rana catesbeiana</i>
Eastern gray squirrel	<i>Sciurus carolinensis</i>
European chafer beetle	<i>Rhizotrogus majalis</i>
European rabbit	<i>Oryctolagus cuniculus</i>
Eastern cottontail rabbit	<i>Sylvilagus floridanus</i>

Appendix 2 | Invasive Species Resources

Topic	Resource
Agricultural Weed Identification	Ministry of Agriculture-Weeds BC www.weedsbc.ca/
Best Practice Guides	Invasive Species Council of BC bcinvasives.ca/resources/publications/
Cordgrass/Spartina	BC Spartina Working Group www.cmnbc.ca/atlas_gallery/invasive-species-spartinaca
Ecosystem Restoration	The South Coast Conservation Program is currently developing restoration guidelines for forest, wetland, and stream and riparian restoration. Check their website for this and other guides: www.sccp.ca/south-coast-bc-guidelines
EDRR Candidate Species Profiles	BC Inter-Ministry Invasive Species Working Group www.for.gov.bc.ca/hra/invasive-species/candidate.htm
Fire ants (European and Impressive)	BC Inter-Ministry Invasive Species Working Group www.for.gov.bc.ca/hra/invasive-species/fire_ants.htm#FAQ Thompson Rivers University Research www.faculty.tru.ca/rhiggins/myrmica_rubra_index.htm
Pesticide Regulation	Ministry of Environment – Integrated Pest Management Act and Regulations: www.env.gov.bc.ca/epd/ipmp/regs/pdf/leg_summary.pdf
Pesticide Use	A Citizen's Guide to Pesticide Use and the Law in BC (West Coast Environmental Law publication) www.dnv.org/upload/documents/A%20Citizen's%20Guide%20to%20Pesticides%20and%20BC%20Law.pdf
TIPS Factsheets	Invasive Species Council of BC bcinvasives.ca/resources/tips/

Appendix 3 | Glossary

Best Management Practice (BMP): Approach based on known science which results in the most effective outcome for application of maintenance procedures and management practices to prevent the spread of invasive species and disturbance.

Dike: An embankment or any other structure that is constructed to prevent the flooding of land. The City of Richmond maintains a 49 kilometre dike network, and the City's dikes are managed in accordance with the Provincial Diking Authority requirements.

Early Detection Rapid Response (EDRR): A proactive response to newly arrived invasive species which prevents their establishment and proliferation.

Enhanced Pesticide Management Program (EPMP): The City of Richmond adopted the EPMP in 2009, as a response to community interest for a bylaw banning the use of cosmetic pesticides. The EPMP is modeled upon reporting by the Canadian Centre for Pollution Prevention that placed emphasis upon regulatory cosmetic pesticide bylaws that are coupled with strong education and community outreach programs.

Inter Ministry Invasive Species Working Group (IMISWG): A provincial government working group founded in 2004 to employ science-based, innovative strategies to protect the health and diversity of BC ecosystems and minimize negative impacts of invasive species.

Invasive Species: Non-native organisms (including plants, animals, and insects) introduced to areas outside of their natural range which cause negative health, ecological and/or economic impacts.

Invasive Species Council of British Columbia (ISCBC): A registered charity and provincial non-profit society that helps co-ordinate and unite a range of concerned stakeholders in the management of invasive species in BC. ISCBC targets all aspects of invasive species management and works with a variety of partners, with the goal to reduce the spread and impact of non-native species in BC. ISCBC targets education for behaviour change in gardeners, outdoor recreation enthusiasts, and resource industry and horticultural professionals.

Invasive Species Council of Metro Vancouver (ISCMV): Formerly known as the Greater Vancouver Invasive Plant Council, ISCMV is a regional non-profit society founded in 2006. The Council works closely with the public, land managers, and decision-makers throughout Metro Vancouver on invasive species issues. The ISCMV raises the profile for invasive species in the region, and provides a broad range of educational materials on specific species of interest in the region, control methods, ISCMV services, and invasive species updates. The ISCMV is one of 13 regional invasive species committees across BC.

Inventory: A spatial record (map) of an invasive species which shows its distribution and abundance (size of infestation).

Ministry of Forests, Lands and Natural Resources (FLNRO): BC government ministry which administers the provincial Invasive Plant Program.

Monitoring: Activities and practices required to determine environmental quality and identify changes over time (e.g. monitoring for re-growth of an invasive plant after it has been removed or chemically treated).

Restoration: The act of returning a damaged ecological system back to its former state. It is recommended to remove invasive plants, replant with native species, and monitor the site for at least 3 years

Riparian Area: The transition zone between aquatic and upland ecosystems.

Watercourse: Natural streams and rivers, as well as ditches, canals, lakes, creeks, wetlands, springs, ravines, swamps or gulch.

Appendix 4 | Priority Species – Best Management Practices Factsheets

This appendix provides species specific Best Management Practices (BMPs) for priority invasive species in Richmond. It is recommended that regular updates take place for the BMPs as new knowledge is acquired or best management practices change. Invasive species are in alphabetical order by common name. Information has been compiled from the sources cited on each factsheet.

The management of invasive species on City land must adhere to the Province's Integrated Pest Management Act, the City's Pesticide Use Control Bylaw No. 8514 and all other applicable acts and regulations (refer to page 6). All methods of control (i.e. mechanical, biological and cultural methods) are to be explored before chemical treatments. Notification and consultation in advance with City of Richmond Environmental Sustainability staff is essential to ensure successful management of the priority invasive species within Richmond.

Brazilian elodea

Egeria densa



R. Videcki



Identification

Growth form: Aquatic plant which forms dense mats up to 4 meters deep.

Leaves: Bright green, 2 cm long; 4 leaves per whorl (arranged around the stem).

Mistaken Identity: Looks similar to Hydrilla (another freshwater invasive plant) which has leaves in whorls of 5. Native elodeas have only 2 to 3 leaves per whorl. Report if leaves are in whorls of more than three.

Habitat

Freshwater streams, ditches, canals, sloughs, ponds, lakes and watercourses.

Risk/Impact

Infrastructure: Impedes flood control, storm drain systems and irrigation works; restricts water movement; traps sediment; increases municipal maintenance costs.

Recreation: Hinders activities which require access to water (e.g. fishing, swimming, boating).

Ecological: Displaces native aquatic vegetation; alters aquatic habitat food webs; reduces suitable habitat for wildlife; blocks passage of fish.

How it Spreads

Reproduces by plant fragments.

Grown in home aquariums and garden ponds. Likely introduced to Richmond by improper disposal of aquariums and green waste in watercourses.

Dredging and maintenance of Richmond's watercourses may inadvertently contribute to spread by fragmenting and dispersing plant roots and stems either by water or being carried on maintenance equipment.

Prevention

Purchase alternative non-invasive aquarium or pond plants (e.g. native Canadian elodea).

Dispose of unwanted plants in green waste collection bins. Never dump aquarium contents into any type of watercourse.

Minimize disturbance near infested areas.

Remove plant material from boats, anchors, trailers, fishing gear etc. before leaving the watercourse.

Ensure equipment used in water infested with Brazilian elodea is thoroughly cleaned and inspected before moving to a new location.

How to Remove/Control

Harvesting has been found to be ineffective and typically leads to further spread. The City is currently working in partnership with the Province to determine an effective control method.

More Information

State of Washington Department of Ecology

General Info:
www.ecy.wa.gov/programs

Technical Info:
www.ecy.wa.gov/programs/wq/plants/weeds/aqua002.html

Common reed

Phragmites australis subsp. australis



B. Klinkenberg



N. Page

Identification

Size: Erect, perennial grass, 2-5 m tall.

Flowers: Feathery, plume-like flower clusters, 15-35 cm long.

Mistaken Identity: Easily confused with native subspecies (*Phragmites australis* ssp. *americanus*) which is found in the lower Fraser Valley. Identity must be confirmed by an expert. Samples can be sent to Provincial EDRR coordinator.

Habitat

Freshwater and brackish tidal wetlands, coastal shorelines, wetlands, sloughs, canals, ponds, ditches and watercourses.

Risk/Impact

Infrastructure: Alters hydrology including ditch flows; obstructs driver sight lines; increases municipal maintenance costs.

Recreation: Impedes access and obstructs sight lines.

Ecological: Displaces native vegetation; reduces suitable habitat for wildlife in wetlands; alters wetland hydrology, reducing the amount of shallow open water.

How it Spreads

Reproduces by seed and root fragments.

Seeds and plant fragments may be carried in water, contaminated soil and on vehicles and equipment.

Mowing/roadside maintenance will lead to spread.

How to Remove/Control

Mechanical: Can be treated by excavation or cover treatments (mulching with black plastic);

Chemical: Has been successfully controlled using both imazapyr (Arsenal), and glyphosate (Roundup and related formulations); glyphosate-based VisionMAX (Monsanto) is now registered for common reed treatment in non-wetted areas in Canada. A small infestation in Richmond was treated successfully with herbicide in 2011.

Disposal: Treated plants are left on site to decompose; seed heads should be removed when treating small infestations.

Monitoring/Follow-up: In the first year, inspect every two months following initial treatment. Inspect annually in subsequent years for remnant plants and new seedlings.

More Information

BC EDRR Status Report

www.for.gov.bc.ca/HRA/invasivespecies/Publications/EDRR_statusreport_Phragmites.pdf

Eurasian water-milfoil

Myriophyllum spicatum



A. Fox



Dr. Richard Old

Identification

Size: Usually 1-4 m but up to 10 m long.

Flowers: Reddish spikes with small yellow flowers, 5-10 cm above water

Leaves: Bright green feathery leaves, 3 cm long; whorls of 3 or 4.

Stem: Reddish brown, long, slender, branching and hairless; leafless toward plant base.

Mistaken Identity: Parrot's feather has white flowers and longer petioles. Native Northern water-milfoil has 11 or fewer leaf segment on each axis whereas Eurasian milfoil has 12 or more segments.

Habitat

Still or slow moving freshwater streams, canals, ponds, lakes.

Risk/Impact

Infrastructure: Impedes flood control, storm drain systems and irrigation works; restricts water movement; traps sediment; increases municipal maintenance costs.

Recreation: Hinders activities which require access to water (e.g. fishing, swimming, boating).

Ecological: Displaces native aquatic

vegetation; alters aquatic habitat food webs; reduces suitable habitat for wildlife; blocks passage of juvenile salmon and other fish.

How it Spreads

Reproduces by seed, root and plant fragments.

Seeds and plant fragments may be carried in water, animals, boats, trailers and fishing gear and on vehicles and equipment.

Dredging and maintenance of Richmond's watercourses may inadvertently contribute to spread by fragmenting and dispersing plant roots and stems either by water or being carried on maintenance equipment.

Prevention

Minimize disturbance near infested areas.

Remove plant material from boats, anchors, trailers, fishing gear etc. before leaving the watercourse.

Ensure equipment used in water contaminated with water-milfoil is thoroughly cleaned and inspected before moving to a new location.

How to Remove/Control

Mechanical removal (by hand, raking, or mechanical harvesters and chopping machines) is only recommended if all plant fragments can be removed.

Cover treatments and root removal by rototilling have also been used in BC.

More Information

ISCBC TIPS Factsheet

bcinvasives.ca/documents/Eurasian_Watermilfoil_TIPS_Final_02_18_2015.pdf

BC Ministry of Environment brochure

www.env.gov.bc.ca/wat/wq/brochures/milfoil.html

European fire ant (EFA)

Myrmica rubra

Impressive fire ant (IFA)

Myrmica speciosus



European fire ant
Rob Higgins



Impressive fire ant
Sean McCann

Identification

Colonies: EFAs can have up to four nests per square metre. IFAs nests are less dense.

Mistaken Identity: Both are easily confused with native ant species and look very similar to each other. Collect a sample and send in for confirmation (refer to BC IMISWG link provided below).

Habitat

Moist environments; irrigated lawns and gardens are ideal.

Risk/Impact

Human health: Colonies swarm when disturbed and cause painful stings. Occasionally stings cause allergic reactions requiring medical treatment.

Recreation: Impedes access.

Ecological: Displaces native ant species. Full impact as yet undetermined.

How it Spreads

Movement and spread is through infested garden and landscape material (e.g. soil, mulch, potted plants, etc.).

Prevention

Minimize disturbance near infested areas. Do not move soil, mulch, plants or other materials from infested areas.

Make conditions less favourable by avoiding or minimizing lawn and garden watering, and removing objects that trap heat and moisture. Control is more difficult for IFAs since they undergo mating flights.

How to Remove/Control

The BC IMISWG is currently working with experts and local government and non-government organizations to determine the best options for prevention and control.

More Information

BC Inter-Ministry Invasive Species Working Group – European Fire Ant Information

www.for.gov.bc.ca/hra/invasive-species/fire_ants.htm

Thompson Rivers University, Dr. Robert Higgins Research
faculty.tru.ca/rhiggins/myrmica_rubra_index.htm

Giant hogweed

Heracleum mantegazzianum



F. Steele



F. Steele

Identification

Size: Very large, up to 5 m tall.

Flowers: White flowers; produced in umbrella-like clusters called umbels at top of plant; up to 1.5 m in diameter; blooms as early as May.

Leaves: Large with coarse, jagged edges, cut into 3 large segments; stiff, dense hairs on underside.

Stem: Hollow, dark reddish spots, and stiff bristly hairs.

Mistaken Identity: Often confused with native cow parsnip which is smaller to 1.5-2.5 m tall, does not have reddish-purple spots on stems and leaves are not as sharply toothed.

Habitat

Riparian areas, roadsides, agricultural land, disturbed areas.

Risk/Impact

Human health: Leaves and stem contains toxic sap that causes extreme skin dermatitis in the presence of sunlight. Contact can lead to welts, rashes, blistering, and scarring. If sap gets into the eyes, it can lead to temporary or permanent blindness.

Ecological: Displaces native vegetation; reduces suitable habitat for wildlife.

How it Spreads

Perennial herb that produces copious winged seeds (100,000 seeds per plant) viable for up to 15 years. Dense taproot will keep producing re-growth for 2 to 4 years until a flower stem is produced. Plant usually dies after flowering.

Prevention

Do not grow giant hogweed in gardens. Bag or tarp plants to avoid spread and contact during transport to disposal site.

How to Remove/Control

Due to health risk, giant hogweed is best removed by a professional. Wear protective water resistant clothing, gloves and eye protection leaving no exposed skin.

Mechanical Control: Bag the flower head to avoid seed dispersal. Cutting the root crown 8-12 cm below soil with a sharp blade is an effective control method for small infestations

Chemical Control: Pesticides may be used in situations where mechanical control methods are not effective, feasible or are considered to be more harmful to the environment than the use of pesticides. Treat in spring using foliar application or stem injection of glyphosate (Roundup). Treat re-growth in summer.

Disposal: Do not compost or dispose in green waste bin. Bag and dispose in landfill. Cut material or chemically treated plants can be left on site to decompose if there is no risk of contact with plant for three weeks AND there are no seeds.

Follow-up: Monitor twice annually (spring and summer) until no re-growth or new seedlings appear (seed lasts up to 15 years).

More Information

ISCBC TIPS Factsheet

bcinvasives.ca/documents/Giant_Hogweed_TIPS_Final_08_06_2014.pdf

Work Safe BC Toxic Plant Warning

www.worksafebc.com/publications/health_and_safety/bulletins/toxic_plants/assets/pdf/tp0602.pdf

Knotweed species Japanese, bohemian, giant, and Himalayan knotweed

Fallopia japonica

Fallopia x bohemica

Fallopia sachalinensis

Polygonum polystachyum



Japanese knotweed
F. Steele



Himalayan knotweed
F. Steele

Identification

Size: Large, woody bamboo-like shrubs, 1-5 m tall.

Flowers: Small, white/green in plume-like clusters.

Leaves: Heart to spade-shaped for all except Himalayan which are lance-shaped, pointy. 8-10 cm wide and 15-20 cm long except giant which are double the size.

Stem: Hollow, reddish-brown speckles.

Habitat

Riparian areas, roadsides, disturbed sites, landscapes. Will grow almost anywhere.

Risk/Impact

Infrastructure: Destabilizes infrastructure, including dike system; increases erosion potential and impedes storm drain system; able to penetrate cement, asphalt, house foundations and walls; obstructs driver sight lines; increases municipal maintenance costs.

Ecological: Forms dense, impenetrable thickets which displace native vegetation; reduces suitable habitat for wildlife and fish; dominates stream banks, increasing erosion and sedimentation potential.

Recreation: Reduces access for recreation; obstructs sight lines along roadways and trails.

How it Spreads

Spreads by seed, root and stem fragments carried in water, contaminated soil and on vehicles and equipment. Bohemian knotweed produces seeds viable up to 25 years.

Extensive root system capable of re-sprouting even after many years of treatment.

Mowing will lead to spread.

Prevention

Minimize soil disturbance near infested areas.

Avoid movement of contaminated soil, gravel or other fill materials.

Remove plant material from tools, vehicles and equipment before leaving infestation area.

How to Remove/Control

Mechanical: Manual removal via mowing or cutting is not recommended due to increased risk of spread and poor results. Excavation is possible (particularly for Himalayan) however great care must be taken to remove the full extent of roots. Soil must be

disposed at an approved disposal site or quarantined on site and treated with herbicide. Deep burial under compact fill is also an option however long-term monitoring for re-growth would still be necessary.

Chemical: Herbicide can be applied via stem injection or foliar application. Glyphosate (Roundup) is most commonly used. Stem injection with glyphosate is permitted to within 1 meter of the high water mark of any watercourse, wetland, or shoreline. Initial treatment should occur in July or August, with a follow-up treatment 6 or more weeks later.

Disposal: Pesticide killed material can be left on site to decompose. Cut material can be dried completely then disposed in regional green waste bins. Do not compost in home compost bin. Due to the high risk of spread, if possible avoid cutting or transporting live knotweed.

Follow-up: Monitor at least twice annually. Continue monitoring for several years even after no re-growth appears.

More Information

ISCBC TIPS Factsheet

bcinvasives.ca/documents/Knotweeds_TIPS_Final_08_06_2014.pdf

Parrot's feather

Myriophyllum aquaticum



F. Steele



N. Loewenstein

Identification

Size: Up to 1.5 m long.

Flowers: Pinkish-white flowers, 1.6 mm long.

Leaves: Submerged leaves are 1.5-3.5 cm long, 20-30 divisions per leaf; often limp and appear to be decaying. Emergent leaves are bright green, 2-5 cm long, 6-9 divisions per leaf; resemble small fir trees.

Stem: Submerged, brownish stems create dense mats.

Mistaken Identity: Often confused with Eurasian water-milfoil which has yellow flowers and shorter petioles (<2 mm long or absent).

Habitat

Freshwater streams, ditches, canals, sloughs, ponds, lakes.

Risk/Impact

Infrastructure: Impedes flood control, storm drain systems and irrigation works; restricts water movement; traps sediment; increases municipal maintenance costs.

Recreation: Hinders activities which require access to water (e.g. fishing, swimming, boating).

Ecological: Displaces native aquatic vegetation; alters aquatic habitat food webs; reduces suitable habitat for wildlife; blocks passage of juvenile salmon and other fish.

How it Spreads

Reproduces by plant fragments.

Grown in home aquariums and garden ponds. Likely introduced to Richmond by improper disposal of aquariums and green waste in watercourses.

Dredging and maintenance of Richmond's watercourses may inadvertently contribute to spread by fragmenting and dispersing plant roots and stems either by water or being carried on maintenance equipment.

Prevention

Purchase alternative non-invasive aquarium or pond plants (e.g. native Canadian elodea).

Dispose of unwanted plants in green waste collection bins. Never dump aquarium contents into any type of watercourse.

Minimize disturbance near infested areas.

Remove plant material from boats, anchors, trailers, fishing gear etc. before leaving the watercourse.

Ensure equipment used in water contaminated with Parrot's feather is thoroughly cleaned and inspected before moving to a new location.

How to Remove/Control

Mechanical removal (by hand, raking, or mechanical harvesters and chopping machines) is only recommended if all plant fragments can be removed. The City of Richmond is conducting trials for shading and excavation at known infestation sites.

More Information

ISCBC TIPS Factsheet

bcinvasives.ca/documents/Parrots_Feather_TIPS_Final_02_18_2015.pdf

Wild chervil

Anthriscus sylvestris



Identification

Size: 0.3–1.8 m tall

Flowers: White flowers; produced in umbrella-like clusters called umbels at the top of the plant.

Leaves: Leaves are fern-like, triangular in outline, finely divided and smooth to softly hairy.

Stem: Branched, hollow and furrowed; soft-hairy below, smooth above; fringe of hairs at stem nodes; deep taproot.

Mistaken Identity: Wild carrot or Queen Anne's lace (*Daucus carota*); Bur chervil (*Anthriscus caucalis*); Salad chervil (*Anthriscus cerefolium*); poison-hemlock (*Conium maculatum*)

Habitat

Wild chervil grows under a variety of conditions but prefers moderately-disturbed moist or mesic sites, and thrives in rich soils. It is found exclusively in open habitats and is not found under forest canopy. Often found along roadsides, ditches, fencelines, on forest edges, waste areas, abandoned hay fields and some pastures.

Risk/Impact

Human health: Sap on skin can cause severe burns to humans and animals when exposed to sunlight.

Agricultural: Reduces forage for grazing; contaminates crops (poor hay and forage quality).

How it Spreads

Dispersed by both seed and plant fragments. Each plant produces between 800 and 10,000 seeds. Vegetative growth occurs from the root buds and largely responsible for the local expansion of existing patches.

How to Remove/Control

Mechanical: Tillage works to control wild chervil by bringing the taproots to the surface where they dry out and no longer sprout. Some studies have reported population decreases from mowing while others have found population increases or little effect. Digging can be effective for small populations, although care must be taken to remove most of the taproot and prevent re-sprouting the following year.

Chemical: Herbicides achieved between 50% and 95% control in trials in Washington State. The most effective herbicides were imazapyr (Habitat, Arsenal) at 95% efficacy and glyphosate (Roundup, Aquamaster), at 64–83% efficacy.

More Information

BC Wild Chervil Weed Alert

www.agf.gov.bc.ca/cropprot/chervil

King County Noxious Weeds – Wild Chervil

www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/wild-chervil.aspx

Weeds BC

www.weedsbc.ca/weed_desc/wld_chervil.html

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