



City of Richmond

Report to Committee

To: General Purposes Committee

Date: August 21, 2015

From: John Irving, P. Eng
Director, Engineering

File: 10-6125-11-01/2015-
Vol 01

Re: Richmond's Ecological Network Management Strategy

Staff Recommendation

That the Ecological Network Management Strategy, as described in the staff report titled "Richmond's Ecological Network Management Strategy" dated August 21, 2015 from the Director, Engineering, dated August 21, 2015, be adopted.

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

Att. 3

REPORT CONCURRENCE		
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER
Parks Department	<input checked="" type="checkbox"/>	
Development Applications	<input checked="" type="checkbox"/>	
Policy Planning	<input checked="" type="checkbox"/>	
Arts Services	<input checked="" type="checkbox"/>	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: 	APPROVED BY CAO

Staff Report

Origin

On November 9, 2012 Council adopted the *Richmond 2041 Official Community Plan (OCP)*. Chapter 9 of the OCP entitled “Island Natural Environment (and Ecological Network Approach)” provides direct support for the development of an Ecological Network in Richmond through Objective 1: “Protect, enhance and expand a diverse, connected and functioning Ecological Network.”

The Ecological Network Management Strategy – *Phase 1* report was presented to Council on April 28, 2014 and endorsed by Council for the purposes of public consultation. Public consultation took place between June and October 2014, while stakeholder engagement took place between Summer 2014 and Spring 2015.

The purpose of this report is to summarize the outcomes of engagement activities and present the final Ecological Network Management Strategy, which includes actions for the City to take over the long-term.

This report supports Council’s Term Goal #4 *Leadership in Sustainability*:

- 4.1 *Continued implementation of the sustainability framework*
- 4.2 *Innovative projects and initiatives to advance sustainability*

Analysis

The Ecological Network Management Strategy provides a comprehensive framework for managing and guiding the decisions regarding the city-wide system of natural areas in Richmond and the ecosystem services they provide on City, public and private lands. Many past and current City actions, initiatives and projects have enhanced Richmond’s natural environment. The Strategy provides a comprehensive approach to complement, align, and inform the City’s planning and regulatory context in order to continue strengthening and enhancing Richmond’s natural spaces. The Ecological Network Management Strategy is intended to be opportunistic and collaborative, setting out priority actions and initiatives for the ongoing enhancement and long-term implementation of the Ecological Network.

Ecological Network Vision and Goals

The following vision for the Ecological Network was developed in consultation with staff across City departments, and benefited from input from the public and stakeholders:

The Ecological Network is the long-term ecological blueprint for the collaborative management and enhancement of the natural and built environments throughout the City, within neighbourhoods, and across land-uses and development types in order to achieve ecologically connected, livable and healthy places in which residents thrive.

Four goals for improving and strengthening the Ecological Network over time guide actions in the Strategy:

1. Manage and Enhance our Ecological Assets
2. Strengthen City Green Infrastructure
3. Create, Connect, and Protect Diverse and Healthy Spaces
4. Engage through Stewardship and Collaboration

The Ecological Network Management Strategy is presented in four parts:

- Part 1: What is Richmond's Ecological Network
- Part 2: Ecological Network Management Context
- Part 3: Consultation
- Part 4: Strategy Areas and Actions

Part 1: What is Richmond's Ecological Network

The Ecological Network (EN) is comprised of Richmond's natural and semi-natural areas, including terrestrial (land-based) areas, shoreline, and riparian zones. The Richmond Nature Park, Terra Nova Rural Park, Sturgeon Bank, the South Arm Islands, Northeast Bog as well as smaller-scale natural areas such as backyards, parks, school yards, and old fields are all part of the Ecological Network. These areas of the EN support ecosystem services on which the City and its residents depend, including wildlife habitat, erosion protection, pollination and food production, water filtration, drainage, flood mitigation, recreation and aesthetics. Another key component of the EN is to incorporate more green infrastructure into developing and redeveloping neighbourhoods. Green infrastructure refers to natural or constructed features that support ecosystem services, such as habitat provision, flood protection, clean air and water, and rainwater management.

There are six (6) key components that form Richmond's EN:

- Hubs: the large natural areas in Richmond (> 10 hectares) that make up the core of the EN
- Sites: smaller, more discrete areas of 0.25-10 hectares of natural ecosystems, that provide 'stepping stone' connections between hubs
- Corridors and Connectivity: linkages between hubs that facilitate the movement of species, water, nutrients, and energy
- Shoreline and Riparian Areas: Buffers to sensitive watercourses and the edge of the Fraser River. Many also function as wildlife corridors and greenways.
- Parks and Greenways: Most developed parks lack sufficient natural vegetation to be considered hubs or sites, but they still provide ecosystem services and are priority sites for various degrees of restoration, especially given the majority are under City control
- Matrix: land lying between the other components of the EN outlined above, encompassing most of the City's land-base, many opportunities exist to restore ecological features and functions through the creation of green infrastructure on this land.

The Ecological Network components are illustrated in Attachment 1.

Part 2: Management Context

The Strategy approaches ecological management through the lens of collaboration and integration, and selectively integrates with other City structures and frameworks that already exist in order to strengthen them. The EN does not aim to create a series of new regulations and policies, but complement and where appropriate, inform the current planning and regulatory context in order to strengthen and enhance the City's natural spaces.

Currently, the EN is already supported by a range of regional and City policies, regulations and plans. The Richmond 2041 OCP directly lays the foundation for the EN through a series of objectives and policies. Other recent City strategies that directly support and influence the EN include the 2022 Parks and Open Space Strategy, the Garden City Lands Legacy Landscape Plan, and the Integrated Rainwater Resource Management Strategy (under development). The City's Environmentally Sensitive Areas, Riparian Management Areas, and certain bylaws (e.g. Watercourse Protection and Crossing, Pesticide Use Control and Pollution Prevention bylaws) also strengthen the EN. At a regional level, Metro Vancouver's *Ecological Health Action Plan* identifies the development of a regional green infrastructure network, and Richmond's EN positions the City as one of the leaders in shaping this regional network.

The EN also includes lands in Richmond outside of the City's ownership, including private lands and other public lands. Though some areas are under the jurisdiction of other landowners and senior governmental agencies, collaborative opportunities exist to establish connectivity between City, private and public EN lands.

Part 3: Consultation Process

To ensure that the Ecological Network Management Strategy remains a pragmatic and evolving strategic document, input and feedback was sought from internal and external stakeholders. The intent of consultation was to gather input to inform the development of the Strategy's action plan. The consultation process also served as a platform to deliver education and awareness about Richmond's environment and the Ecological Network.

Internal stakeholder consultation was conducted with the Advisory Committee on the Environment (ACE) and Agriculture Advisory Committee. A number of comments were received in particular from ACE members, supporting the focus on ecological protection in agricultural areas, reduction of habitat loss and fragmentation, review of existing bylaws, and collaboration across jurisdictions. Internal stakeholder consultation was also conducted with various internal City staff departments.

Public consultation was delivered between June and October 2014 through an online survey and an Ecological Network booth hosted at multiple community events. The Ecological Network booth was hosted by City staff, provided background materials and information on the Ecological Network, and gave residents the opportunity to talk with staff on ideas and issues related to Richmond's natural areas. The booth was present at a total of ten community events, including the Steveston Farmers & Artisans Market, Reptile Show, Blueberry Sale & Tea, Richmond Maritime Festival, Richmond Raptor Festival, Cambie Outdoor Movie Night,

Summer West Fest, Garlic Festival, Best Catch Sustainable Seafood Festival, and Culture Days. In addition, staff also delivered four Ecological Network-themed youth workshops to summer day camps at the Hamilton, West Richmond, and City Centre community centres.

The Ecological Network online survey was available between August to October 2014, and received over 130 responses. Common themes regarding Richmond's Ecological Network, that emerged from the survey responses, as well as conversations with residents include:

- Keep remaining natural areas in the city as they are and protect them from future growth and development;
- Strike a balance between accommodating development and preserving natural areas;
- Prevent habitat fragmentation and loss;
- Encourage development that incorporates green space, parks, greenways, and watercourses;
- Protect agricultural land from development, and limit construction that does not suit the rural environment;
- Integrate the environment as a strong consideration during planning and development;
- Acquire ecologically valuable lands to preserve and protect them from development pressures;
- More litter clean-ups; and
- More education and engagement about environmental stewardship.

Part 4 – Strategy Areas and Actions

In order to prioritize and guide future actions, the recommended action plan for the Ecological Network Management Strategy is structured around ten EN Strategy Areas. Strategy Areas are defined geographically by vegetation distribution, land-use, and stewardship and development opportunities. The purpose of using Strategy Areas is four-fold:

- To provide an overview of Richmond's current ecological assets;
- To identify and group the key areas of the City in order to focus future actions where most appropriate;
- To provide tailored guidance on how the Ecological Network can be strengthened by different vegetation/ land-use types within the City; and
- To identify the unique issues, opportunities and management objectives that pertain to the enhancement and enrichment of the Ecological Network in specific areas.

Strategy Areas are identified in Attachment 2.

The Ecological Network Management Strategy is intended to be implemented through an opportunistic, integrated and collaborative approach. Therefore, the Strategy's action plan seeks to integrate and align the Ecological Network into processes already occurring throughout many different City departments. Importantly, recommended actions and initiatives are designed to complement and build on many existing City processes, policies, and plans. This approach serves

to maximize current and future land-use and development policies, guidelines, partnerships, City-wide initiatives, and area-specific projects.

The recommended actions are tailored to each Strategy Area, addressing the unique issues, opportunities and Ecological Network management objectives for that area. The following actions are recommended to be prioritized in the short-term:

- Develop riparian management tools to further protect and restore riparian areas;
- Develop an Invasive Species Action Plan to guide early detection, mapping, priority management and restoration solutions for invasive plants and pests;
- Implement at least one showcase project per year for the Bath Slough Revitalization Initiative, and other sloughs when opportunities arise;
- Collaborate with other stakeholders to promote and support backyard naturalization and stewardship programming; and
- Seek ongoing integration of Ecological Network features into capital projects.

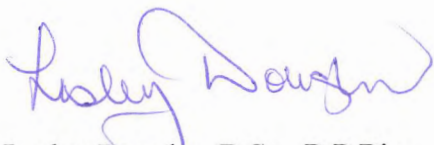
On an annual basis, staff will report out on completed and ongoing Ecological Network projects and confirm action priorities for subsequent years.

Financial Impact

No cost at this time. Potential costs to implement the *Ecological Network Management Strategy* would be addressed through staff time (e.g. outreach and engagement), while other actions (acquisitions, infrastructure) would be submitted for Council consideration in future budget processes.

Conclusion

Richmond's 2041 Official Community Plan has provided strong direction for an Ecological Network approach for the management of Richmond's ecological resources. While several City policies and plans are currently serving to guide ecological management, the Ecological Network Management Strategy provides more clarity for how the broad network can be managed for maximum community benefit. Public and stakeholder consultation provided direction on priorities for environmental management, and the resulting action plan developed for the Ecological Network Management Strategy provides a framework to align, collaborate and integrate City actions with respect to environmental management. The Strategy presents an opportunistic pathway forward to establish a foundation for the long-term preservation, enhancement and connectivity of ecological assets in Richmond.

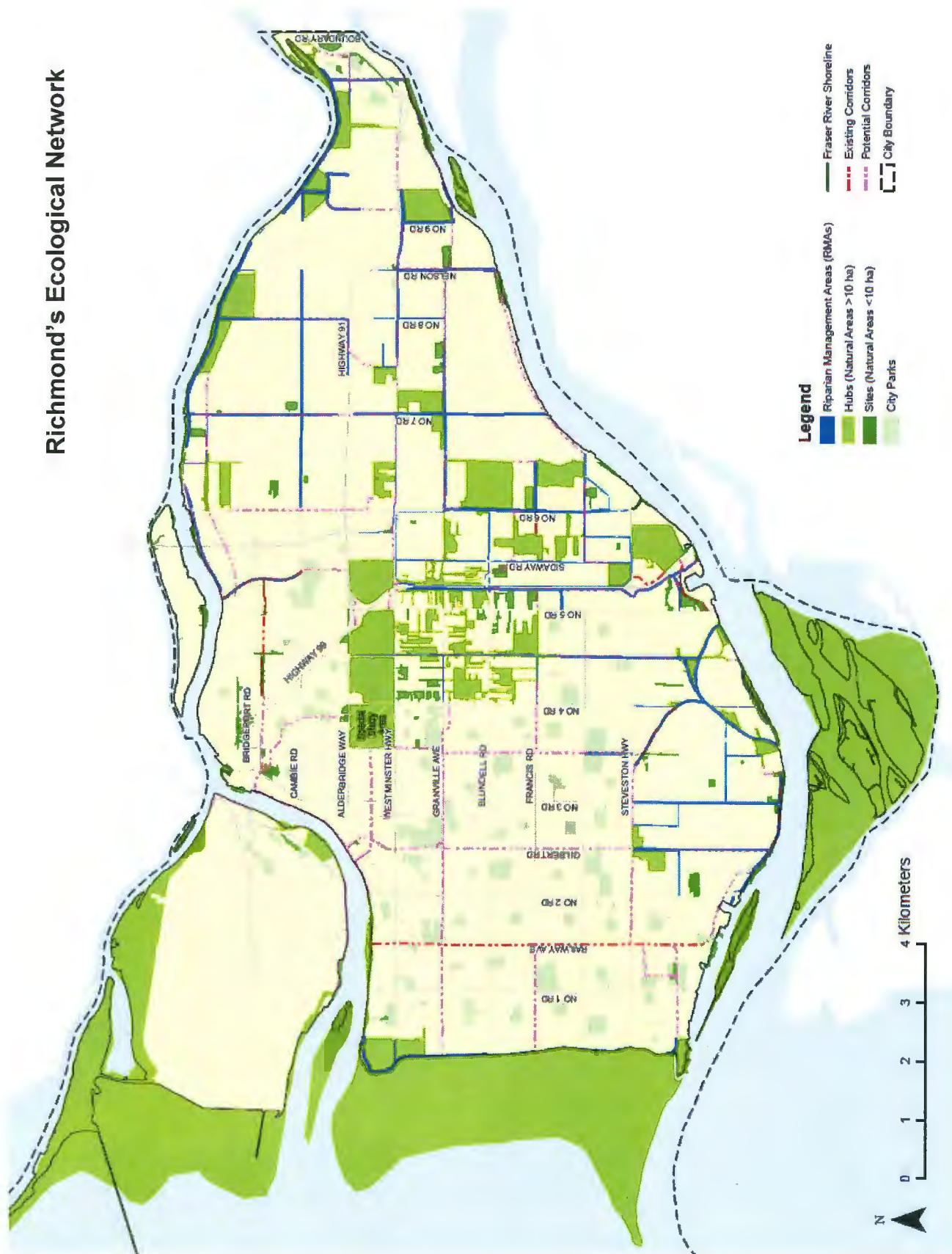


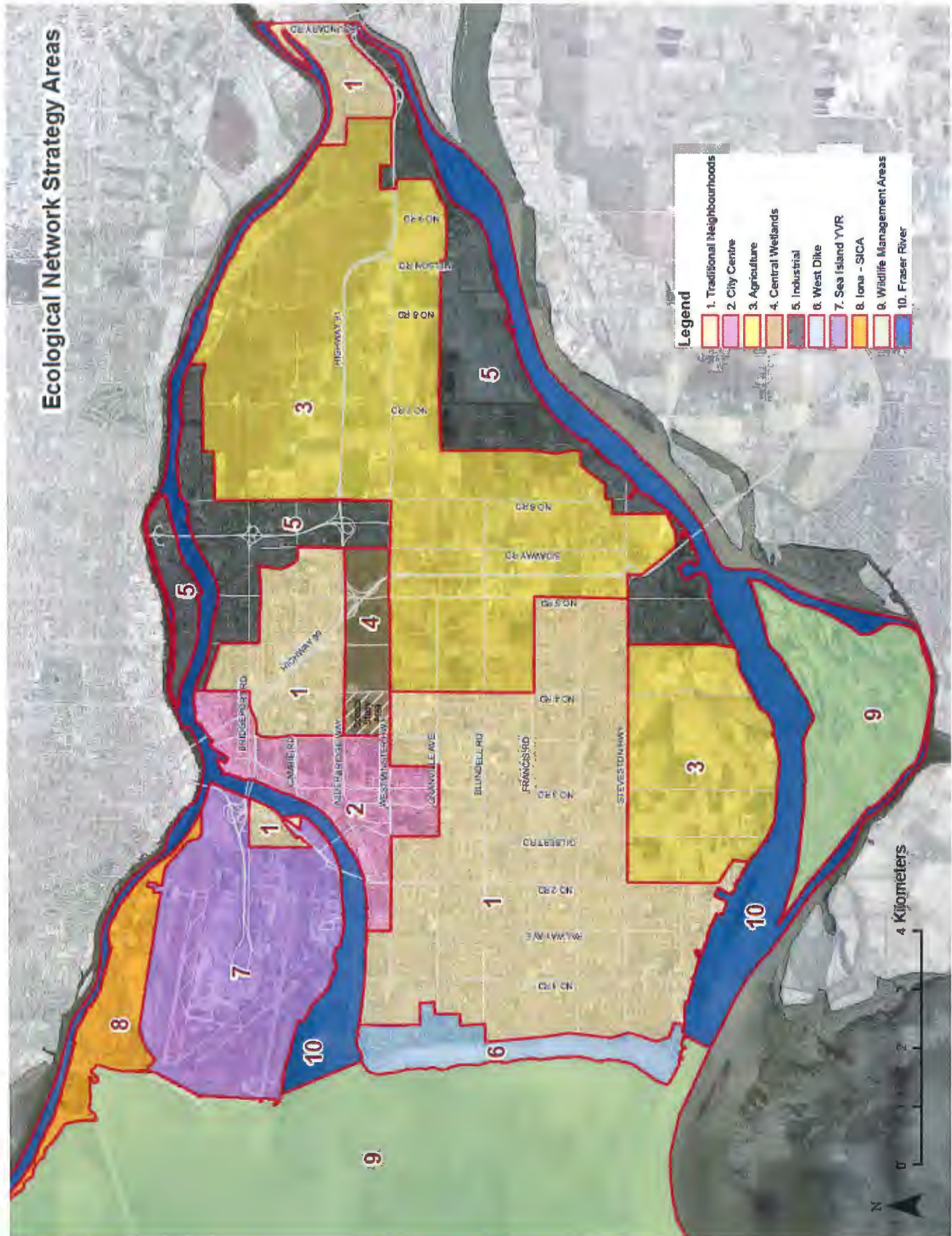
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LD:hst

- Att. 1: Richmond's Ecological Network
- Att. 2: Ecological Network Strategy Areas
- Att. 3: Ecological Network Management Strategy

Richmond's Ecological Network





Richmond's Ecological Network Management Strategy

August 2015

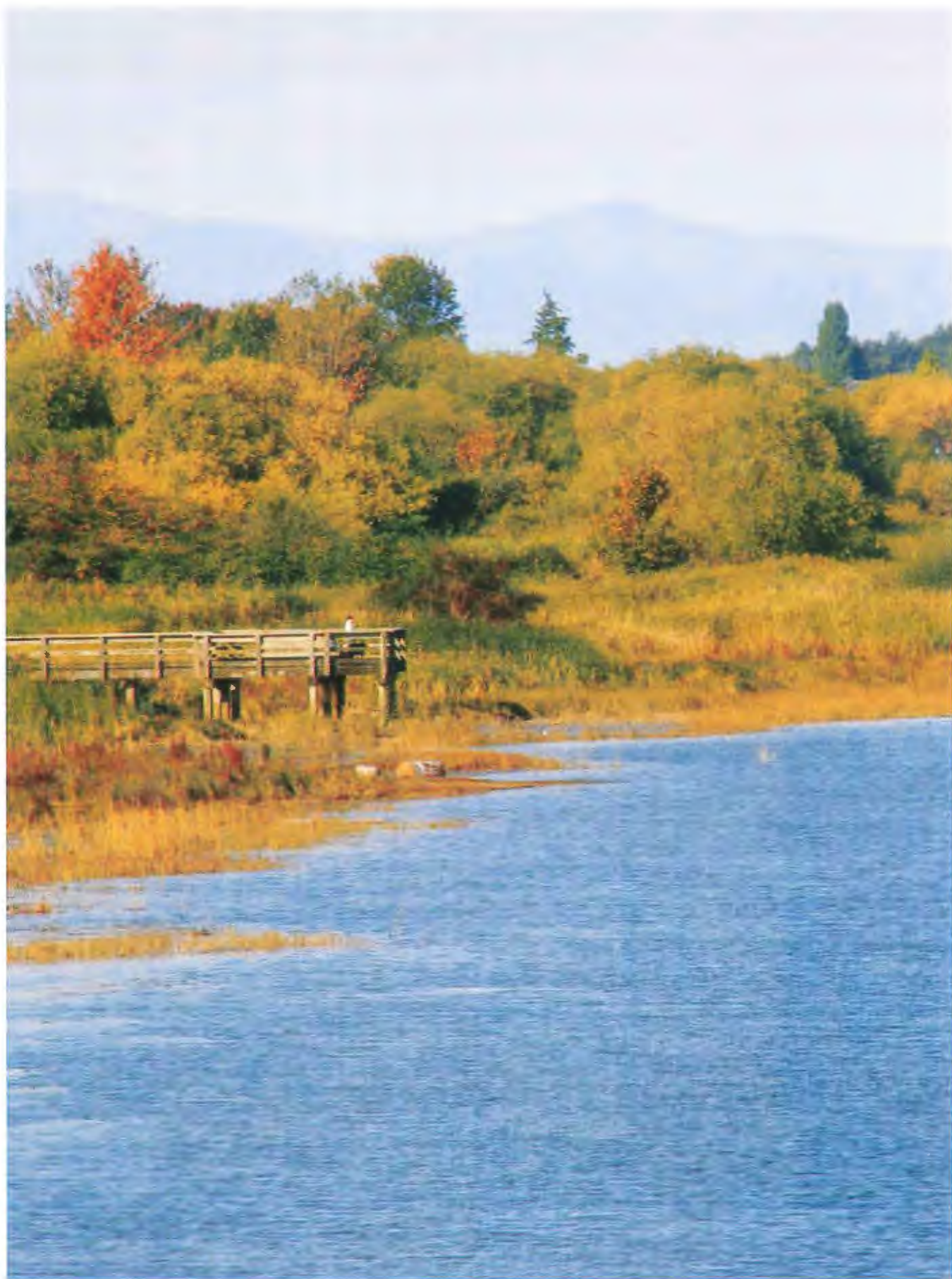


Acknowledgements

This document was prepared by the City of Richmond Engineering and Public Works Division—Sustainability & District Energy Section. We would like to acknowledge the contribution of Raincoast Applied Ecology in the development of this report. We would also like to thank the many staff across the City who have provided their insight and expertise into this strategy.

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EXECUTIVE SUMMARY

Richmond's neighbourhoods, parks, schools, and roads are interwoven with our natural landscape. Natural areas like Bath Slough, Terra Nova Rural Park, Iona Beach, and Richmond Nature Park are unique and essential parts of the city's landscape. Richmond's residents have a particularly strong connection to the dike trails, foreshore marshes, cottonwood forests, and sloughs which reflect the city's unique location at the mouth of the Fraser River. This system of natural areas—wetlands, forests, shorelines, and old fields - is the basis of the Ecological Network (EN). The principle underlying the use of the EN is that effective management of ecological systems must occur at the city-wide scale. Richmond's EN encompasses the whole city but emphasizes the importance of large natural areas such as provincial Wildlife Management Areas, regional parks, and private lands with significant natural areas such as large wetlands or old fields.

The EN was first introduced with the adoption of the Richmond 2041 Official Community Plan (OCP), within Chapter 9, entitled Island Natural Environment (an Ecological Network approach). The EN is consistent with the draft Metro Vancouver Regional Green Infrastructure Network, and is supported by a range of regional and City policies, regulations and plans.

The Ecological Network Management Strategy provides a framework for managing and guiding decisions regarding the city-wide system of natural areas and the ecosystem services they provide. The Strategy does not aim to create a series of new regulations and policies, but complement and where appropriate, inform the current planning and regulatory context in order to strengthen and enhance the City's natural spaces.

Why an Ecological Network Management Strategy in Richmond?

The Ecological Network is a strategic approach to managing Richmond's natural areas. As in nature, no component of the Ecological Network exists in isolation, every piece is connected and exerts impacts and influences on surrounding environments. By managing Richmond's natural areas as components of the same Network, synergies between natural and built environments, policies, regulation, and community vision can be identified and addressed. Also, this approach can strategically manage and coordinate actions in a manner that strengthens the network and ultimately, the ecological health and livability of Richmond. These synergies extend to reflect community values and support a vision of ecology, health, recreation and resilience - thus shaping a unique opportunity for a "made in Richmond" holistic approach to land use and liveability. Using a Ecological Network Management Strategy allows the City to identify tools and common goals that are mutually supportive, building on and connecting existing strategies with emerging priorities.

This Strategy is founded upon a suite of Ecological Network fundamentals that prioritize integration with existing City initiatives, processes, policies and projects rather than the initiation of anything new.

- Opportunistic pursuits and results. Building upon what is already happening in the City.
- Consistency, alignment and connectivity with existing City initiatives, processes, policies and projects
- Clarity of context and content. The EN builds upon City initiatives, processes, policies and projects that are already in place. Through the alignment, collaboration and integration of City action, the EN represents an opportunistic pathway forward to establish a pragmatic foundation for the preservation, enhancement and connectivity of ecological lands in Richmond.

Richmond's Ecological Network

The Ecological Network is defined as the inter-connected system of natural and semi-natural areas across Richmond's landscape, including terrestrial, marine (shoreline and intertidal), and riparian areas. Ecologically valuable areas, regardless of ownership, are identified as part of Richmond's EN, as they support habitat for birds and wildlife, and provide critical ecosystem services - the benefits that the city and its residents obtain from the environment. Based on size and land use characteristics, the natural areas of the EN are categorized as ecological hubs, sites, corridors, shoreline and riparian areas, and parks. Much of the EN is located outside of the dike, or within the Agricultural Land Reserve, highlighting the importance of collaborative actions with other levels of government to manage the EN.

In addition, green infrastructure is also a defining feature of the EN. Green infrastructure complements traditional 'grey infrastructure' (i.e. roads, sewers) by employing natural features that provide essential ecosystem services such as drainage, erosion protection, flood mitigation, water filtration, as well as cultural value, recreation and aesthetic beauty. Green infrastructure can include community gardens, rain gardens, bioswales, green roofs, and watercourses.

Effective management of Richmond's EN involves protecting and connecting the existing natural areas whenever possible, and incorporating more green infrastructure into developing and redeveloping neighbourhoods.



Vision & Goals

The following vision and four supporting goals were identified for improving and strengthening the Ecological Network over time:

Vision: *The Ecological Network is the long-term ecological blueprint for the collaborative management and enhancement of the natural and built environments throughout the city, within neighbourhoods, and across land-uses and development types in order to achieve ecologically connected, livable and healthy places in which residents thrive.*

Goal 1: Manage and Enhance our Ecological Assets

Goal 2: Strengthen City Infrastructure

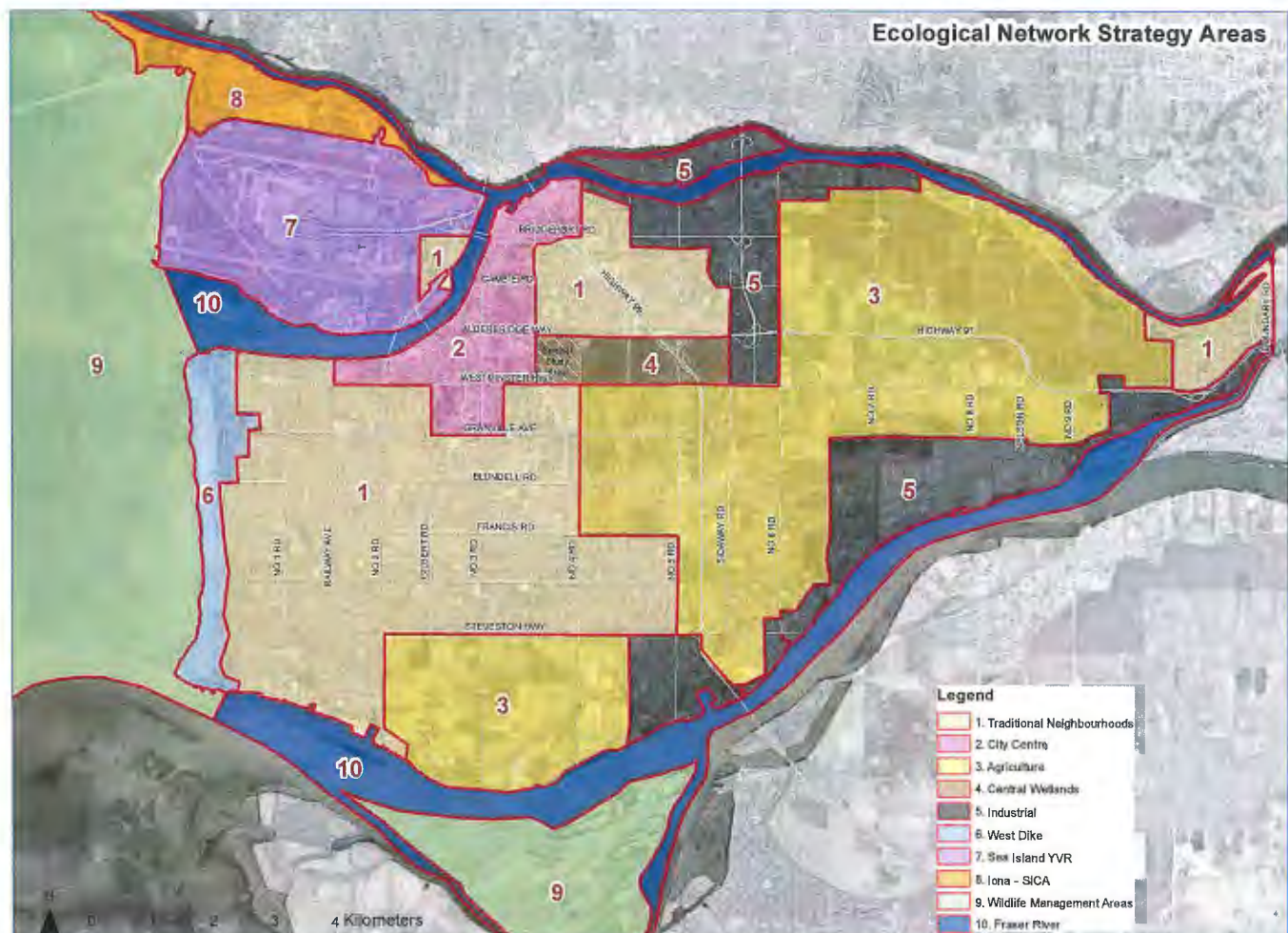
Goal 3: Create, Connect and Protect Diverse and Healthy Spaces

Goal 4: Engage through Stewardship and Collaboration

Strategy Areas

Ten (10) strategy areas are used to guide the application of the Ecological Network throughout the city. Strategy areas geographically characterize Richmond based on vegetation type, land-use, and stewardship and development opportunities. Strategy areas provide an on-the-ground guide that reflects the current condition of the EN, while also serving to identify priorities for the long-term evolution of the network. The purpose of using Strategy Areas is four-fold:

- To provide an **overview of Richmond's current ecological assets**;
- To **identify and group areas** of Richmond to focus future specific actions where most appropriate;
- To **tailor guidance on how the EN can be strengthened** within different vegetation and land-use types within Richmond; and
- To **identify the unique conditions** that pertain to the enhancement and enrichment of the EN in specific areas.



Actions

The implementation of the Ecological Network Management Strategy is articulated through a series of recommended actions and initiatives (detailed within Part 4). The actions are tailored specifically to each Strategy Area, building off the unique issues and opportunities and specific management objectives.

The actions seek to establish an implementation approach that integrates and aligns the Ecological Network into processes occurring throughout many different City departments. The actions are designed to complement and build on many existing City processes, policies, and plans. Actions within each Strategy Area are identified at both the local and city-wide scales to create a comprehensive approach to strengthening the EN.

Recommended actions are grouped into four (4) focus areas, which represent the EN's various areas of application within the City's planning, development, and operational context

- Green Infrastructure & Development
- Vegetation, Habitat & Wildlife
- Parks & Public Lands
- Stewardship & Collaboration

By using the framework of the Strategy Areas and supportive actions, it is clear that the EN has a role to play on public and private lands, in both natural and built environments, and as a catalyst for stewardship and community action.

This Strategy is intended to be implemented through an opportunistic, integrated and collaborative approach. The approach serves to maximize current and future land-use and development policies, guidelines, partnerships, City-wide initiatives, and area-specific projects. Plans, projects and processes which collectively implement the EN will demonstrate how this framework for on-the-ground action will be incorporated within the City's planning and development context.



Consultation & Engagement

To ensure that the Ecological Network Management Strategy is pragmatic and evolving, input and feedback on the EN was sought through consultation and engagement. The intent of consultation was to gather input to inform the recommended action plan. The consultation process also served as a platform to deliver education and awareness about the EN and Richmond's natural environment. Information gathered throughout consultation provided a snapshot of residents' concerns and priorities related to Richmond's natural areas and environmental stewardship.

Stakeholder consultation was conducted with various internal city staff departments and City advisory committees. Public consultation was carried out from June to October 2014, by the means of an Ecological Network booth, hosted by City staff at approximately 15 community summer events. An online survey was also made available from August to October 2014. It is estimated that several hundred people were engaged through these formats. Many common themes emerged from survey responses and conversations with residents regarding opportunities and issues for the Ecological Network:

- **Keep remaining natural areas** in the city as they are and protect them from future growth and development
- **Strike a better balance** between accommodating development and maintaining natural areas in the city
- **Prevent habitat fragmentation and loss** from development activities, emphasize preservation of native vegetation and wildlife corridors
- Encourage **development designs that incorporate green space**, parks, greenways, and watercourses
- **Protect agricultural land from development**, and limit construction that does not suit the rural environment
- **Plan holistically** to ensure the environment is a strong consideration during planning and development
- The City should **acquire ecologically valuable lands** to preserve and protect them from development pressures
- Organize **litter clean-ups in natural areas**, e.g. in waterways affected by illegal dumping, and pollution
- **Educate and engage residents** of all ages about stewardship and healthy environment benefits



An aerial photograph of a park area. A dark river or stream flows through the center-left. Several white, zig-zagging paths or bridges cross the water. To the right, there is a green baseball field. The surrounding area is filled with green trees and grass. The text 'PART 1' is overlaid in large white letters, and 'Richmond's Ecological Network' is overlaid in smaller white letters below it.

PART 1

Richmond's
Ecological
Network

What is the Ecological Network?

The Ecological Network is the inter-connected system of **natural areas** across Richmond's landscape. It is composed of both terrestrial and marine (shoreline and intertidal) areas. It includes prominent natural areas such as Richmond Nature Park, Sturgeon Bank and the South Arm Islands Wildlife Management Areas, as well as larger urban parks, the Fraser River foreshore, watercourses, and riparian areas. It also includes old fields, bog forests, and wetlands found in agricultural areas and other private lands with significant natural areas. The EN also comprises incorporating more **green infrastructure** into developing and redeveloping neighbourhoods.

Richmond's EN was identified using a science-based approach to mapping and assessment that recognizes the importance of a system of natural areas for protecting ecological features and functions across landscapes. The identification of the EN was completed using Geographic Information Systems (GIS) and the principles of landscape ecology, conservation biology and ecosystem services to identify lands and features critical to long-term ecological health. More detailed information on

this approach is provided in Appendix 2.

The EN approach has been used successfully to identify priorities for environmental management in other jurisdictions at both large (e.g., Metro Vancouver) and small scales (e.g., City of Edmonton, City of Surrey).

Woven into the EN is the emerging concept of **ecosystem services**, which both natural areas and green infrastructure provide. Simply put, ecosystem services are the benefits people obtain from ecosystems. In Richmond, examples of ecosystem services include the storage of rainfall in the pond in Garden City Park, foraging habitat for migrating sandpipers in the intertidal mudflats, the storage of carbon in plant material in the bog soils of Richmond Nature Park and the North-East Bog Forest, and the pollination of hundreds of hectares of blueberries by native bees and honeybees. Even the recreational value of parks and greenways is an ecosystem service provided to the residents of Richmond that helps maintain healthy neighbourhoods and increases the livability and land value of the city. Ecosystem services are enhanced through green infrastructure, the physical components of the natural and built environment that provide these services.



Vision & Goals

The Official Community Plan (OCP) states that Richmond's population is expected to increase by 80,000 people by 2041. While the City is preparing to accommodate this growth through infrastructure expansion and the updating of Area Plans, the City will also seek to enhance and expand the natural spaces and green infrastructure that currently make Richmond a healthy, liveable City.

In order for the EN to serve as a relevant and evolving tool for managing Richmond's natural areas, the EN must be future-thinking and set the course for implementation at various scales and through a diverse and flexible set of means. Chapter 9 of the OCP supports this course of action, and the following vision and goals will ensure the EN's continued relevance over time.

Vision: *The Ecological Network is the long-term ecological blueprint for the collaborative management and enhancement of the natural and built environments throughout the city, within neighbourhoods, and across land-uses and development types in order to achieve ecologically connected, livable and healthy places in which residents thrive.*

Goals

The EN is built upon four primary goals, each one contributing to the achievement of the vision, and each one lending itself to the opportunistic and collaborative approach outlined below.

1. Manage and Enhance our Ecological Assets

Richmond is home to a unique mix of diverse ecological places; many of which are managed through a range of municipal, provincial and federal levels of jurisdiction. The EN seeks to ensure that these protected areas remain so and are actively monitored and enhanced over time so they continue to provide the ecological services vital to community health.

2. Strengthen City Infrastructure

There is vast opportunity to expand the traditional approach to infrastructure in the City through the inclusion of green infrastructure. The EN seeks to not only identify priority areas where the incorporation of green infrastructure into the built environment will enhance building and street performance and efficiency, but also where it will positively contribute to the public realm in terms of ecosystem service provision, education and amenity. Green infrastructure ensures resilience of the built environment while strengthening its connection with the community.

3. Create, Connect and Protect Diverse and Healthy Spaces

Complimenting the management and enhancement of our current protected ecological assets (Goal #1), is the need to strategically identify unprotected ecological assets under threat and create a variety of new protected spaces that will be connected to and enrich the existing Network. The EN seeks to identify these areas in a manner that is opportunistic; working with the current and potential function of present ecology, the needs of the community, and future development processes.

4. Engage through Stewardship and Collaboration

Central to the continued success of the EN is the community's sense of stewardship over the Network at different scales and levels of participation. The EN seeks to ignite collaboration and stewardship through community involvement and engagement at all levels of EN delivery.



Components of the Ecological Network

The natural and semi-natural areas of the Ecological Network vary considerably in size, condition, and ecological value. The components of the EN are defined below:

HUBS are the largest natural areas in Richmond and are generally greater than 10 hectares. They are the core of the EN. Hubs are capable of supporting entire and diverse populations of animals and plants and associated ecological functions.



SITES are smaller (e.g., 0.25–10 hectares), more discrete non-linear areas of natural ecosystems which support smaller or less diverse populations of animals and plants. These lands play an important role in increasing the structural or functional connectivity of the network by providing “stepping stones” as connections between hubs.



CORRIDORS AND CONNECTIVITY ZONES provide linkages between hubs that facilitate movement of species, water, nutrients, and energy. Some may be linear corridors that are largely natural and functioning. Others may be zones of connectivity where there is not a single defined route.

As shown at right, Bath Slough connects King George Park with the Fraser River through a linear corridor composed of watercourse, shrubs, grass, and mixed forest. The fairways of Quilchena Golf & Country Club provide a connectivity zone which maintains wildlife movement along the West Dike, south of Terra Nova Rural Park.



SHORELINES provide important buffers to sensitive watercourses and the edge of the Fraser River. These ecosystems are included as part of the EN in recognition of their important role in protecting the function of adjacent aquatic ecosystems. Many shoreline and riparian areas are linear in form and also function as wildlife corridors or greenways. Stable shoreline zones help maintain the ecological health of adjacent intertidal marshes and mudflats. They are also important sites to manage during development and redevelopment when ecological features such as riparian vegetation can be protected or restored.

RIPARIAN AREAS are also an important part of the EN. The City's Riparian Management Areas are recognized as transitional areas between aquatic and terrestrial zones, with a broad range of ecological functions including shading watercourses, filtering runoff, providing nesting and feeding areas for birds and mammals, and acting as wildlife corridors in urban landscapes.

PARKS AND GREENWAYS often range widely in their naturalness and ecological function. However, as most are under City control, these public lands represent some of the best opportunities for future City-led ecological restoration or enhancement projects. Most developed parks lack sufficient natural vegetation to be considered hubs or sites, but they still provide ecosystem services and are recognized as high priority sites for various degrees of restoration. The City can play a leadership role in EN protection and improvement by further managing some of them for ecological enhancement.

MATRIX is the remainder of the land between the hubs, corridors, and other components of the EN. The Matrix is important because it encompasses most of the land base in the City. It includes many smaller ecological features and also provides many opportunities to restore ecological features and functions through restoration measures and the creation of green infrastructure. The matrix can contribute to the overall function and health of the EN.



GREEN INFRASTRUCTURE EN components are not limited to just natural and semi-natural areas, but another key component is 'green infrastructure'. Green infrastructure complements traditional infrastructure, such as roads and sewers, and it advances the sustainability of City infrastructure by employing natural features. Effective management of Richmond's EN requires incorporating more green infrastructure into developing and redeveloping neighbourhoods, as well as the protection and connection of natural areas whenever possible.

Green infrastructure encompasses the components of the natural and built environment that provide ecosystem services. Watercourses and wetlands are examples of green infrastructure - they can include both natural and constructed features, provide ecosystem services for drainage, erosion protection, flood storage, and water filtration, and can also support recreation and aesthetic benefits. Other examples of green infrastructure are the constructed wetland at the Richmond Oval, the Hollybridge canal enhancement, Railway Greenway stormwater and habitat provisions, and the large stormwater wetland in Garden City Community Park. The City's draft Integrated Rainwater Resource Management Strategy also supports the development of green infrastructure.



Ecological Network Highlights

- **About 23% of the City's total area, including intertidal and marine areas, is within the EN.** Almost 2/3rds of the EN is comprised of large hubs, of which over half are marine and intertidal areas. Sites account for <1% of the network, while shoreline and riparian zones make up about 5%.
- A total of **38 hubs and 103 sites** were identified in Richmond's EN.
- **Hubs range from well-known natural areas** such as Richmond Nature Park, Sturgeon Bank and South Arm Islands Wildlife Management Areas, Terra Nova Rural Park, and the Sea Island Conservation Area (SICA), to lesser known areas such as Horseshoe Slough, Northeast Bog Forest, cottonwood forests along River Road, and bog forest areas on either side of Shell Road.
- The **five largest hubs** within the EN are Sturgeon Bank (1,025 ha), South Arm Islands (807 ha), Sea Island Southwest (501 ha; predominantly the mudflats west of airport and south of Iona Jetty), Iona Island (269 ha), and Sea Island North (252 ha).
- **Most of Richmond's hubs are either outside of the dike (approx. 70%) or within Richmond's Agricultural Land Reserve (approx. 30%).** Less than 1% of Richmond's hubs are inside the dike and not in ALR lands. This highlights the importance of Richmond's agricultural areas in contributing to ecological values, especially those which have remained uncultivated and/ or representative of native bog forest environments. It is also an indicator of how few natural areas have been protected within the urban (non-agricultural) areas of Richmond.
- The **largest hubs on Lulu Island** are along River Road (82 ha; River Road between Kartner Road and Nelson Road), Fraser Lands West (72 ha; west of South Shore port between No. 6 Road and No. 7 Road), Terra Nova (66 ha), and Horseshoe and Finn sloughs (63 ha). With the exception of Terra Nova, all of these hubs are located within the Agricultural Land Reserve.
- **Sites are frequently located adjacent to foreshore areas, along watercourses, in agricultural areas, or along transitions between different land use types.** Sites include an area in the West Cambie neighbourhood, small foreshore parks such as the off-leash Dog Park (along South Arm of the Fraser River), and Hamilton Highway Park (along Highway 91).
- **Concentrations of sites** also exist within the Bridgeport, West Cambie, Broadmoor, and Hamilton neighbourhoods of Richmond.
- **Connectivity is generally poor because of the intensity of urban or agricultural land use throughout Richmond.** Many corridors were classified as non-functioning or impaired. However, some areas have better than anticipated connectivity (e.g., central Richmond), as well as areas where connectivity can be improved through the creation of greenways and linear parks.



Importance of Agricultural Lands within the Ecological Network

Richmond's agricultural lands play a critical role in maintaining the City's environmental values and ecosystem services. 30% of EN lands fall within the Agricultural Land Reserve, lands which are essential for food production and provide most of the City's green space. These areas include cultivated and natural wetlands, bog forest, remnant forest patches, and old fields. While some of these ecosystems are predominantly natural, most are the result of previous or current agricultural practices.

The City of Richmond recognizes the importance of farming. Farmers need to cultivate their lands to be successful, and they face many obstacles to be economically viable, often with few options to avoid farming in ecologically important areas. Examples of farming operations that protect and respect ecological areas and their beneficial services include maintaining headlands and hedgerows to protect habitat, apiculture (bee hives for honey and pollination purposes), the preservation of riparian setbacks around watercourses, and controlling runoff. Farmers often understand the ecological benefits of sound farming practices as they too benefit from clean water, unpolluted soils, and clean air. The Environmental Farm Plan Program (managed by the BC Agriculture Research & Development Corporation) is one way in which farmers can be supported in improving the ecological sustainability of their farming operations.

Complementing the ecological role of agricultural lands but at a much smaller and often more urban scale, community gardens provide opportunities to integrate food growing into a variety of areas. Community gardens have a range of benefits beyond food production, including recreation and pollinator and songbird habitat. They can also be used to restore green space in brownfield sites



The Delta Farmland and Wildlife Trust

is a non-profit organization that promotes the preservation of farmland and wildlife habitat through co-operative land stewardship with local farmers in the lower Fraser River delta. Each year the Trust provides local farmers with \$325,000 of cost-sharing funding through stewardship programs including the Grass-land Set-aside Program, the Winter Cover Crop Stewardship Program and the Hedgerow & Grass Margin Stewardship Programs. These programs provide farmers with tools and finances to enhance and sustain the natural areas on their properties that serve as habitat for beneficial insects, birds and wildlife, as windbreaks, as shade for livestock and for erosion control. Fostering these relationships with local farmers is key to ensuring a connected and thriving ecological network where the natural and working landscapes co-exist and support each other.

Ecological Network Examples

There are many examples of City and community initiatives, as well as existing green infrastructure, within Richmond that actively support and enhance the Ecological Network:



The City is incorporating the idea of ecosystem services into the design of Richmond's new municipal parks. The large pond in Garden City Community Park is more than a beautiful part of the park landscape; it also stores and filters runoff from the adjacent neighbourhood.



Bath Slough, within the Bridgeport Neighbourhood, not only stores and conveys stormwater, it also acts as an ecological corridor connecting the Fraser River to the interior of the island. The Bath Slough Revitalization Initiative, which is aimed at environmental enhancement and community stewardship focussed on Bath Slough, directly supports the Ecological Network. To support this Initiative, a pollinator pasture was established in Bridgeport Industrial Park in 2015 (pictured at left), which ecologically reactivates the park while integrating public art and public engagement.



Community gardens, provide a source for pollinators, and support food production and healthy plants.



Temporary and permanent public art installations has been used in various locations throughout Richmond to animate public spaces, and also to interpret local ecological features, such as the Fraser River, local flora and fauna.



The Railway Greenway provides an ecological connection from the Middle Arm of the Fraser River to Steveston, through the heart of west Richmond's residential neighbourhoods. The greenway hosts a multi-use pathway, and provides a corridor that facilitates the movement of animals, nutrients and energy throughout the environment. As the greenway develops, it is anticipated that a number of green infrastructure components will be implemented, enhancing this ecological link between the Middle and South Arms of the Fraser River.



The City purchased the last remaining piece of Richmond's northeast bog forest in 2011, recognizing the importance of preserving bog ecosystems. The purchase involves ecological, heritage and park land benefits. Acquiring natural areas such as the Northeast Bog Forest and the Grauer Lands significantly enhances the EN.

A photograph of a gravel path leading through a forest with autumn foliage and utility poles. The path is covered in fallen leaves and leads into the distance. On the left, there are several utility poles with power lines. The trees on the right have vibrant autumn colors, including reds, oranges, and yellows. The sky is overcast and hazy.

PART 2

Ecological Network Context

Ecological Network Management Context

The EN approach is currently supported by a range of regional and City policies, regulations and plans outlined below. The EN does not aim to create a series of new regulations and policies, but complement and where appropriate, inform the current planning and regulatory context in order to strengthen and enhance the City's natural spaces; a goal identified and endorsed by the City in a variety of contexts. Some of the key City and regional initiatives that influence the Ecological Network include:



The Richmond 2041 Official Community Plan (OCP) policies have directly resulted in the development of the Ecological Network Management Strategy. Chapter 9 of the OCP establishes guiding policies for the EN and green infrastructure, and directly lays the groundwork for the EN Strategy through a series of objectives and policies that call for the protection, enhancement and expansion of a diverse, connected and functioning EN. The OCP identifies an Ecological Network (see facing page) to be the innovative framework to manage Richmond's ecological resources, and sets out a variety of ways in which a meaningful and robust EN can be established and strengthened.



Metro Vancouver Ecological Health Action Plan describes how to maintain and improve the health of the region's ecosystems. Advancing a regional green infrastructure network is one of the main actions, which directly supports the EN and provides an opportunity for Richmond to serve a role as a key stakeholder in shaping the Regional Network.



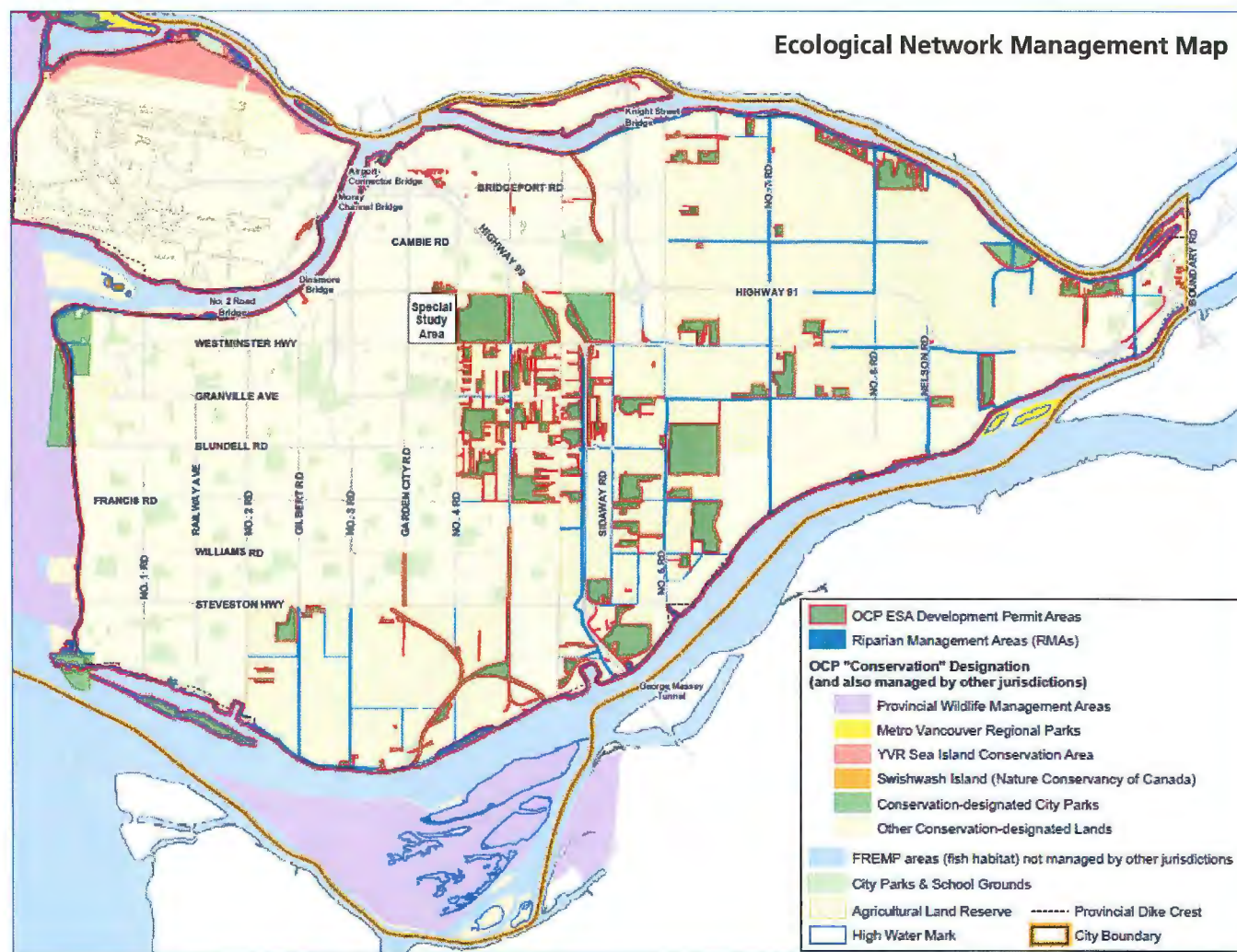
City of Richmond, 2022 Parks and Open Space Strategy supports various facets and components of the EN, particularly within the Green Network and Blue Network focus areas. Many of the supportive actions and initiatives under the Green and Blue networks contribute significantly to the conservation and enhancement of the EN.



City of Richmond, Garden City Lands Legacy Landscape Plan provides a land use framework for the 137 acre open space, east of City Centre. The Garden City Lands will become a new park with diverse uses, including urban agriculture, environmental preservation and interpretation, recreational and cultural uses. The Ecological Network is integrated into the Plan via ecological connectivity, green infrastructure, and enhanced wetland ecology.

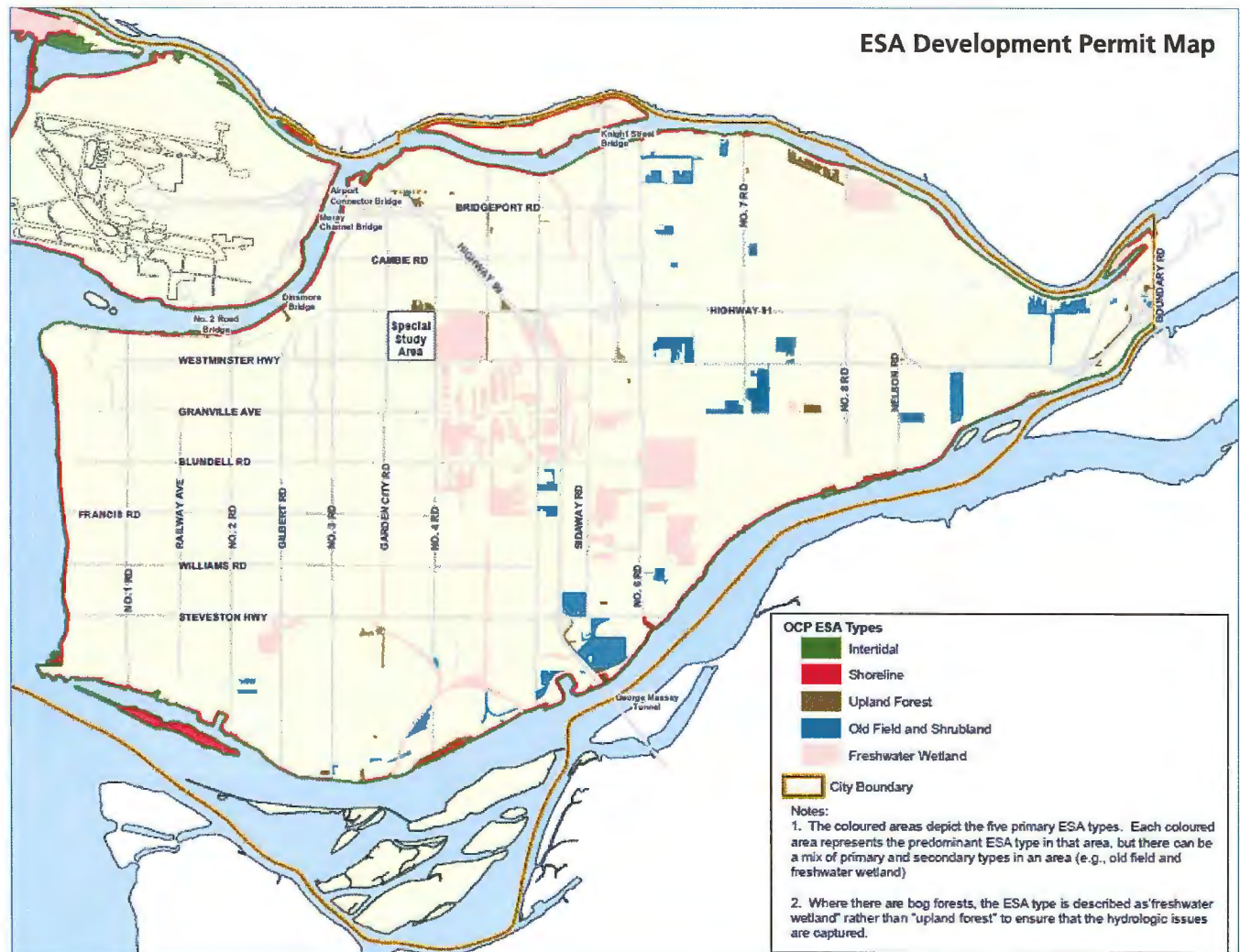
The Richmond 2041 Official Community Plan established foundational maps for the Ecological Network, within Chapter 9. Based off these maps, the updated Ecological Network Map (see page 7) was developed.

Chapter 9 of the Official Community Plan contains the **Ecological Network Management Map**, which indicates the areas of ecological importance within Richmond that have been incorporated into the Ecological Network. This map shows the varying jurisdictional ownership over ecological assets in Richmond, including Environmentally Sensitive Areas, riparian management areas, provincial and federal conservation areas, regional and City-owned parks, and the Fraser River shoreline.



As shown in the map above, the Garden City Lands are designated as a Special Study Area within the OCP, to indicate the intensive planning process associated with this city-owned property. Approval of the Garden City Lands Legacy Landscape Plan in 2014 was the first step in a lengthy process that will include the development of a resource management plan and further planning and consultation to develop various plan components.

Development Permit guidelines for designated Environmentally Sensitive Areas (ESAs) are intended to protect and enhance the environmental resources and ecosystem services in ESAs which are part of the Ecological Network. The ESA Development Permit Map shows the various ESA types where development permit guidelines apply, including intertidal, shoreline, upland forest, old field shrubland, and freshwater wetland areas.



Other City of Richmond documents, plans, and policies that influence the application of the Ecological Network in Richmond include:

Environmentally Sensitive Area (ESA) Management Strategy (2012)

This Strategy introduced the Ecological Network concept and served as a guiding document to update the ESA Development Permit guidelines for the Richmond 2041 OCP update.

Development Permit Areas

Richmond's OCP contains development permit (DP) guidelines for five types of environmentally sensitive areas, contributing to the quality of ecosystems in the EN. In addition, general development permit guidelines often contain provisions relating to vegetation, tree retention, rainwater collection, stormwater management and forms of green infrastructure.

Area Plans

Many area plans refer to the provisions within the OCP regarding the natural environment. Some plans for neighbourhoods which contain major EN hubs contain specific policies regarding natural open space or development permit guidelines that incorporate planting configurations and vegetation species that would increase biodiversity. The City Centre Area Plan is supportive of the EN through policies supporting interconnected ecological services, greenways, green infrastructure opportunities and public education.

Riparian Management Areas

In response to the Provincial legislation, in 2006 the City adopted a Response Strategy which designates riparian management areas, delineating 5 or 15 metre setbacks from the top of bank of certain watercourses throughout Richmond. No buildings, structures or vegetation removal are permitted within the setback, however planting of native species is encouraged. The RMA is currently not supported through Bylaws or Development Permits.

Bylaws

While there is no bylaw that specifically addresses the Ecological Network, there are several bylaws that support the maintenance and protection of various EN components including the Tree Protection Bylaw, the Pesticide Use Control Bylaw, the Pollution Prevention and Clean-Up Bylaw, Watercourse Protection and Crossing Bylaw, and the Green Roof Bylaw.

Integrated Rainwater Resource Management Strategy (Draft)

The IRRMS focuses on strategies for utilizing the resources contained in traditional waste streams such as the efficient use of energy, drinking water, nutrients in sewage and the re-use of rainwater after it falls on buildings and the ground. The strategy directly references the Ecological Network and it provides recommendations for green infrastructure and habitat enhancements for a variety of land-use types across the city. Recommendations focus on many of the challenges the Ecological Network seeks to address including water quality and habitat quality, impervious surfaces, bank erosion and slumping, and enhancement of green infrastructure to increase ecosystem services.

Roles and Responsibilities

Responsibility for managing Richmond's EN is shared by several levels of government, First Nations, private citizens, landowners, and stewardship groups. Below is a summary of the different jurisdictional roles and responsibilities involved in the management of the Ecological Network.

Component	Roles and Responsibilities
City of Richmond	Responsible for planning and regulating land use including enacting an Official Community Plan, zoning, regulating land use and buildings, and designating parks and other amenities. To protect the natural environment, the City has developed overarching policies, utilizes Development Permit Areas, various protection bylaws, and Riparian Management Areas.
Provincial Government	Responsible for the management of water, wildlife, contaminated sites, and other issues related to maintaining a healthy environment. The BC Ministry of Forests, Lands, and Natural Resource Operations (FLNRO) is responsible for managing foreshore areas throughout the province, including on the north, middle, and south arms of the lower Fraser River. The Ministry of Environment (MoE) is responsible for the regulation of watercourses and riparian areas through the Water Act and Fish Protection Act (Riparian Areas Regulation). MoE also manages the Sturgeon Bank and South Arm Islands Wildlife Management Areas. The Provincial Inspector of Dikes oversees dike maintenance and construction.
Federal Government	Has a diverse role in environmental management including fish, species at risk, and migratory birds. Fisheries and Oceans Canada manages fish and fish habitat, including the foreshore of the Fraser River and some inland watercourses.
Port Metro Vancouver	The Port has a variety of environmental management policies and programs, and it owns and manages land and water-based transportation and industrial lands throughout the region, including areas south of No. 8 Road in south Richmond.
Metro Vancouver	Plays a supporting role in the management of the EN. A variety of overarching Metro Vancouver initiatives provide guidance on regional green infrastructure, sensitive ecosystem inventory, storm water management, and regional parks.
Vancouver International Airport	The Vancouver International Airport (YVR) is owned by Transport Canada and is managed by the Vancouver Airport Authority. Most of its land base is developed and YVR has environmental management initiatives and policies to manage lands with ecological values.
First Nations	First Nations having been using Richmond for over 5,000 years. The Musqueam First Nation has a small undeveloped reserve on Sea Island, and is resolving land claims within an area that encompasses Richmond.
Farmers	Farmers play an essential role in the management of the EN, as farming practices influence ecosystem performance and resilience. Approximately 38% of Richmond's land area is within the Agricultural Land Reserve.
Private Landowners	Most lands in Richmond are privately owned and include residential areas, commercial and industrial lands, and agricultural lands. Private landowners have a critical role in protecting ecological values in the EN avoiding development in sensitive areas and managing stormwater runoff, and water and soil quality.
Land Stewards	Groups and individuals involved in volunteer-based stewardship of parks and other natural areas play a critical part of the management of the EN. They support restoration and management projects, monitor ecological health, and raise the profile of natural areas conservation.

Foreshore Jurisdictions

The foreshore of the Fraser River and the West Dike is jurisdictionally complex. Key components that influence the management of the EN are summarized below:

- The foreshore and sea- or river-bed outside Richmond's perimeter dike and below the high water mark (under the Land Act referred to as "natural boundary") is owned by the Province of BC (Crown);
- The public is able to use the foreshore; however, this only includes limited rights including navigation, anchoring, mooring, and fishing;
- The Province of BC grants leases for shellfish aquaculture, log storage, moorage, and other activities. It is also responsible for dike management;
- BC's Provincial Inspector of Dikes is responsible for the general supervision of dike maintenance and construction to protect public safety. However, local diking authorities, such as the City of Richmond, are responsible for dike operation and maintenance activities that include inspection and emergency response;
- The federal government owns and manages the water column and is responsible for the management of fish habitat (through Fisheries and Oceans Canada) and navigation (through Transport Canada);
- Port Metro Vancouver regulates marine traffic, owns and manages industrial and port-related lands; and
- BC's Ministry of Forests, Lands, and Natural Resource Operations is responsible for managing foreshore areas throughout the province, including coordinating environmental assessments of foreshore development within its jurisdiction.



Grauer Lands: Land Acquisition and Partnerships for Stewardship

In 2012, the City of Richmond, in partnership with Ducks Unlimited Canada purchased the largest remaining privately owned land along Sturgeon Bank. The 51 hectare area is comprised of tidal wetlands, significant for millions of migrating birds, and habitat that plays a crucial role in the life cycle of all five Pacific salmon species as well as Sturgeon, flounder and numerous estuarine species. This partnership represents an important opportunity for Richmond's Ecological Network as it not only secures privately-owned intertidal lands for ecological conservation, but also supports the connection to nearby trails, ensuring that the public will continue to experience the benefits of Richmond's foreshore natural ecology first-hand and inspire further stewardship actions and initiatives.



PART 3

Consultation Process

Overview

To ensure that the Ecological Network Management Strategy remains a pragmatic and evolving strategic document, input and feedback was sought from stakeholders and the public regarding the EN.

The overall intent of the consultation process was to gather input to inform the development of the Strategy's implementation plan. However, the consultation process also served as an important platform to deliver education and awareness about Richmond's natural areas and the EN in general. Though the EN was first introduced in the 2012 Official Community Plan, many local residents were unaware of the Ecological Network concept.

Information gathered throughout the consultation process allowed us to capture a snapshot of the community's concerns and priorities related to the City's natural areas and environmental stewardship.



Communication

The consultation process included public and stakeholder consultation. Stakeholder consultation was conducted with City committees such as Advisory Committee on the Environment and Agricultural Advisory Committee, as well as with various internal city staff departments.

The majority of public consultation was carried out in July to September 2014, through an Ecological Network booth hosted by City staff at multiple community events. The booth presented background materials and information on the Ecological Network, and provided the opportunity for residents to talk with City staff on the opportunities and issues related to Richmond's natural areas. It is estimated that a several hundred people were engaged through this format. The Ecological Network booth was present at the following 2014 community events:

- Steveston Farmers & Artisans Market
- Reptile Show (Nature Park)
- Blueberry Sale & Tea (Nature Park)
- Richmond Maritime Festival
- Richmond Raptor Festival
- Cambie Outdoor Movie Night
- Summer West Fest
- Garlic Festival
- Best Catch Sustainable Seafood Festival
- Culture Days

Delivering education to children and youth about the Ecological Network was also incorporated within the consultation process. A module on Richmond's natural environment was developed for children aged 5-12 years old, and was delivered in August 2014 to four summer camp groups at community centres in Hamilton, City Centre, and West Richmond.

An online survey was developed to gather feedback on issues and opportunities for the EN and environmental stewardship. The survey was available through the City's Let's Talk Richmond platform at letstalkrichmond.ca/econetwork.

The website hosted the survey, and provided supportive background information, reports, maps, and photos related to the EN. The survey was available from August to October 2014, and was promoted through the EN booth at public events, the City's website, advertisements, news releases, and community group newsletters.

What We Heard

Many common themes emerged from survey responses and conversations with residents regarding opportunities and issues for the Ecological Network:

- **Keep remaining natural areas** in the city as they are and protect them from future growth and development
- **Strike a better balance** between accommodating development and maintaining natural areas in the city
- **Prevent habitat fragmentation and loss** from development activities, emphasize preservation of native vegetation and wildlife corridors
- Encourage **development designs that incorporate green space**, parks, greenways, and watercourses
- **Protect agricultural land from development**, and limit construction that does not suit the rural environment
- **Plan holistically** to ensure the environment is a strong consideration during planning and development
- The City should **acquire ecologically valuable lands** to preserve and protect them from development pressures
- Organize **litter clean-ups in natural areas**, e.g. in waterways affected by illegal dumping, and pollution
- **Educate and engage residents** of all ages about stewardship and healthy environment benefits

Survey respondents were asked what natural areas they like to visit most often in Richmond, in order to understand what areas within the Ecological Network people most like to experience. Responses highlighted that people most commonly enjoy the shoreline and dike trails, followed by City parks, and greenways. Building on this question, survey respondents were then asked what aspects of natural areas they value the most, with components such as scenery, vegetation, clean air, and wildlife viewing coming out as the most common values.

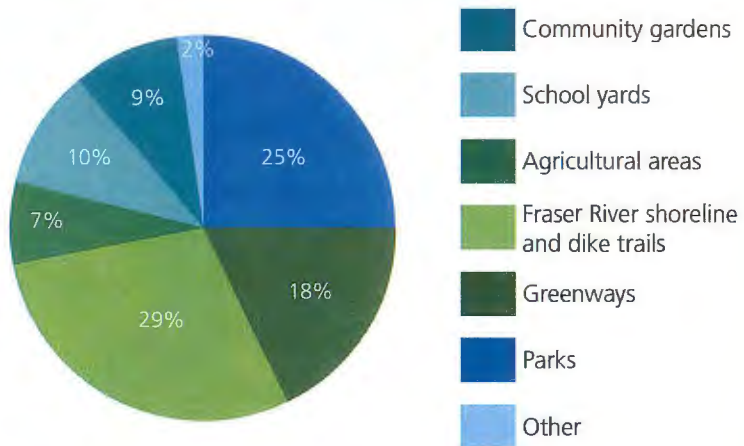
Survey respondents were asked what issues they felt are affecting Richmond's natural areas, and responses strongly emphasized the impact of growth and development activities, loss of wildlife habitat, and pollution as the top of mind issues.

Respondents were also asked to identify which of the four Ecological Network Management Strategy goals they think are the most important. The goals to manage and enhance ecological assets and create, connect and protect diverse and healthy spaces were both identified by 32% of respondents as the top importance. The remaining two goals, to engage through stewardship and collaboration was supported by 21% of respondents, while strengthen City infrastructure was selected by 14% of respondents.

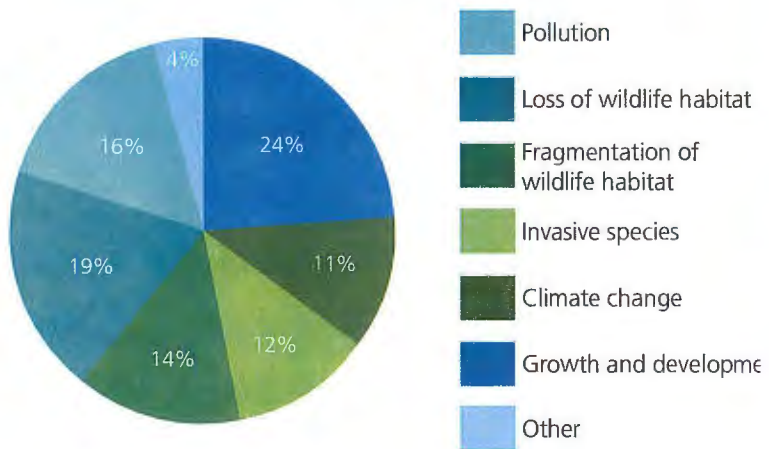


Richmond's Ecological Network Management Strategy

What natural areas in Richmond do you visit most often?



What are the issues that you feel are affecting Richmond's natural areas?



A photograph of a red and white birdhouse on a tall pole in a field of tall grass and trees. The birdhouse has a grey shingled roof and three small square windows. The pole is white and stands in a field of tall, dry grass. In the background, there are green trees and a wooden structure.

PART 4

Strategy Areas & Actions

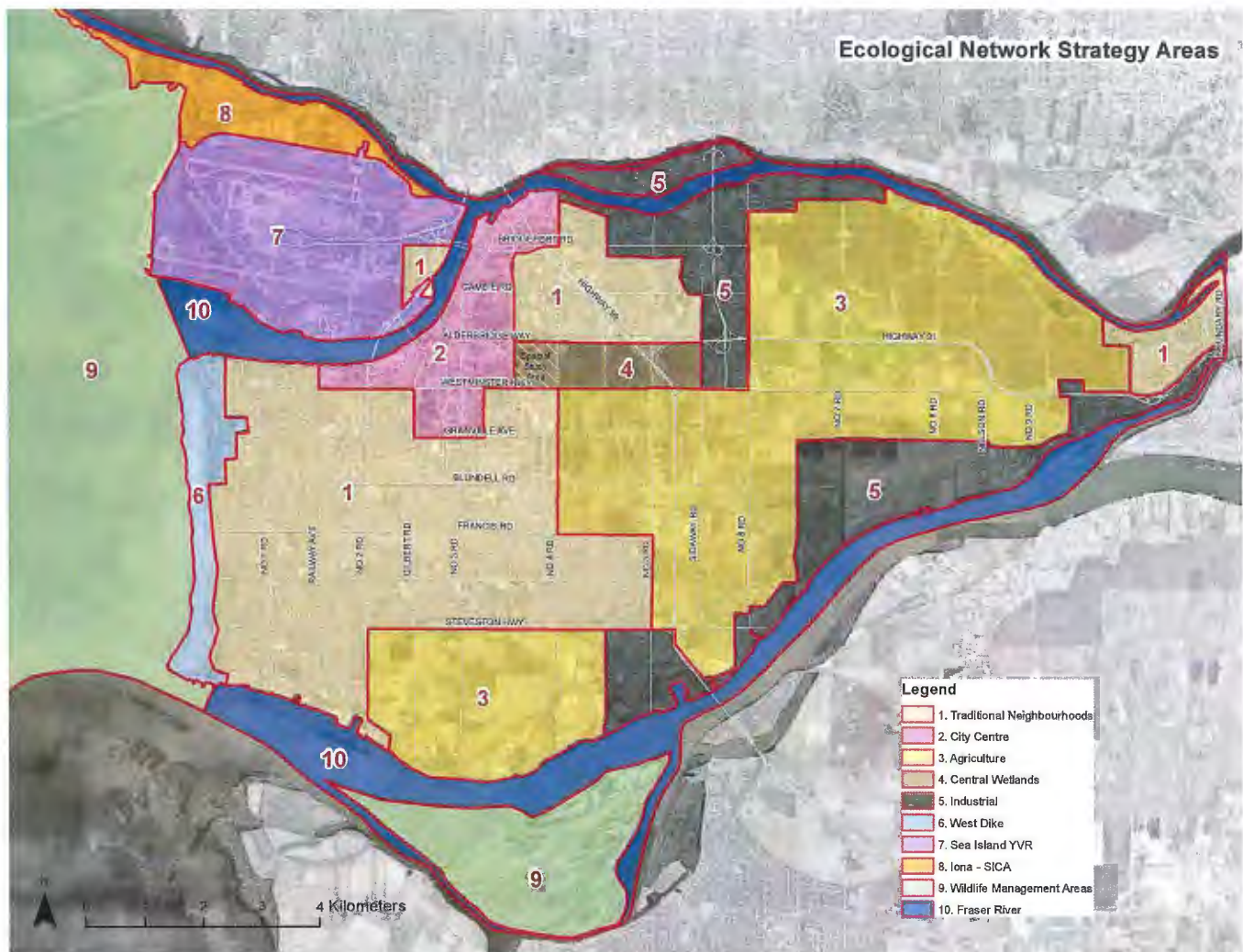
Ecological Network Strategy Areas

Ten Ecological Network strategy areas were identified, based upon vegetation distribution data, land-use, and current and future stewardship and development opportunities. The purpose of the strategy areas is four-fold:

- To provide an overview of Richmond's current ecological assets;
- To identify and group the key areas of the City in order to focus future specific actions where most appropriate;
- To provide tailored guidance on how the Ecological Network can be strengthened by different vegetation/land-use types within the City; and

- To identify the critical issues, key opportunities and stakeholder considerations that pertain to the enhancement and enrichment of the Ecological Network in specific areas.

This map presents the Ecological Network Strategy Areas as an on-the-ground guide that not only reflects the current condition of the Ecological Network, but identifies priorities in the direction of its long-term evolution. The intent is that as the Ecological Network is enhanced and expanded, this will be amended to reflect that detail and identify new opportunities.





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TRADITIONAL NEIGHBOURHOODS STRATEGY AREA



Richmond's traditional neighbourhoods are comprised primarily of West Richmond, Burkeville, Hamilton, Steveston and portions of the East Cambie, West Cambie and Bridgeport neighbourhoods. West Richmond and Burkeville are primarily single-family residential neighbourhoods, while East and West Cambie, Steveston, and Hamilton offer a range of housing types including single-family, townhouses and low-rise buildings. Ecologically, Richmond's traditional neighbourhoods offer the most opportunity for enhancement as they contain the majority of the City's neighbourhood parks, schools, community centres and backyards; areas ideal for stewardship activities and community engagement. In addition to these assets, Richmond's traditional neighbourhoods contain key features such as the Railway corridor, Queen Canal, and Alexandra Greenway.

Strategy Area Issues

- Loss of vegetation
- Increase in impermeable surfaces
- Auto-oriented development patterns
- Invasive species
- Tree removal
- Encroachment on City-owned lands, riparian areas

Strategy Area Opportunities

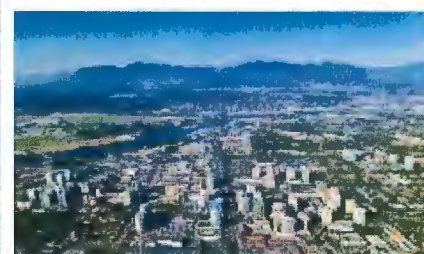
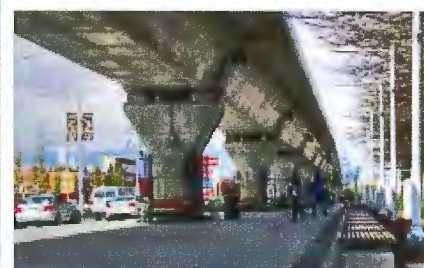
- Significant amount of backyards, school sites, and City-owned parks, community centres, and riparian areas
- Active stewardship groups
- Existing greenways and trails (ecological corridors)

Focus Areas	Objectives	Actions & Initiatives
Green Infrastructure & Development	Pursue rainwater management to reduce runoff and to improve quality of runoff water	<ul style="list-style-type: none"> 1.1 Implement rainwater management strategies for residential and commercial developments, parks, and public lands in this Strategy Area, including strategies to minimize impacts of future development, implement rainwater harvesting techniques, and enhance riparian corridors and green infrastructure 1.2 Develop riparian management tools to further protect and restore riparian areas, including enforcement tools 1.3 As the Hamilton area redevelops, enhance Queen Canal through the integration of green infrastructure as outlined in the Hamilton Neighbourhood Area Plan 1.4 Develop performance target types for development (i.e. potable water use, renewable energy etc) 1.5 Develop a tool within GIS that identifies Ecological Network components and triggers Ecological Network reviews for development application 1.6 Review and update bylaws as needed that contribute to the enhancement and protection of the Ecological Network (i.e. Pesticide Use and Control Bylaw, Watercourse Protection and Crossing Bylaw) 1.7 Develop an Invasive Species Action Plan to guide early detection, mapping, priority management areas and restoration solutions for invasive plants and pests
Vegetation, Habitat & Wildlife	Enhance ecological connectivity and habitat for plant and wildlife communities	<ul style="list-style-type: none"> 1.8 Develop native planting guidelines into site design and landscaping within residential areas in development permit areas 1.9 Maintain an inventory of significant wildlife trees in the city and develop policy guidance for development scenarios 1.10 Develop a Songbird and Raptor Initiative to identify issues facing bird and raptor survival (i.e. habitat loss, light pollution, building/car collisions) and strategies to allow wildlife to thrive
Parks & Public Spaces	Enhance the Ecological Network within and between City-owned properties	<ul style="list-style-type: none"> 1.11 Ensure integration of the goals and objectives of the Ecological Network into the future Urban Forest Management Strategy 1.12 As per the Parks and Open Space Strategy, establish a process equivalent to the Environmentally Sensitive Areas (ESA) Management Strategy to map, protect and manage ecological and natural areas within City parks and public spaces 1.13 Support the development of future resource management plans for City parks, and integrate Ecological Network objectives into the development of individual plans 1.14 Work with other City departments to encourage public art reflecting Richmond's local ecology 1.15 Incorporate ecological connectivity into area planning exercises by prioritizing and building upon opportunities such as enhanced natural spaces, and trail and corridor development
Stewardship & Collaboration	Increase backyard naturalization, stewardship and education opportunities in Richmond's neighbourhoods	<ul style="list-style-type: none"> 1.16 Promote and support backyard naturalization and stewardship programming, including through continued natural gardening and pest solution outreach to residents, and collaboration with other stakeholders on education and awareness. Coordinate with outreach and promotions for energy efficiency and renewable programs 1.17 Develop City and community stewardship programs to engage and enable partners to promote actions and funding for ecological enhancement within Traditional Neighbourhoods 1.18 Develop a stewardship recognition and funding program for local residents/groups to promote local stewardship action 1.19 Support the development and delivery of Metro Vancouver's Grow Green platform, a web-based tool to provide residents with sustainable lawn and garden care information

Desired Outcomes

Healthy traditional neighbourhoods where neighbourhood parks, school yards and community centres provide spaces for recreation, natural habitat, ecological stewardship and education. These local ecological nodes are connected via an evolving system of trails, greenways, developed urban tree canopies, and ecologically rich back-yard environments that serve as unique areas of rainwater filtration and management. Local residents are well connected to each other via a range of stewardship and education opportunities and feel empowered to be stewards of the natural environment that surrounds their homes, schools and places of work.

CITY CENTRE STRATEGY AREA



Richmond's City Centre is transforming into a high-density mixed-use urban environment characterized by the No. 3 Road commercial corridor. The area is undergoing a period of rapid development, with significant opportunity for green infrastructure interventions as these changes take place. Areas such as the Lansdowne corridor, the Lansdowne Mall site, and Minoru Park redevelopment represent unique opportunities for integration of green infrastructure into the landscape. Progressive rainwater management strategies, the re-introduction of native vegetation, the provision of appropriate habitat, reduction of the urban heat island effect, and trail and greenway links between pedestrians, cyclists and amenities, are all examples of green infrastructure opportunities in this Strategy Area. There is also ample opportunity to engage private developers in the incorporation of various green infrastructure features through the re-development process in City Center, including through tools such as the Green Roofs bylaw which enables increasing rooftop vegetation and stormwater retention in office and industrial buildings. The City Centre Area Plan provides additional detail on future parks, greenways and green links, as well as information about connectivity in an urban environment.

Strategy Area Issues

- Loss of native and non-native vegetation
- Increase in impermeable surfaces
- Pre-existing site contamination
- Water quality and run-off, sediment and erosion control

Strategy Area Opportunities

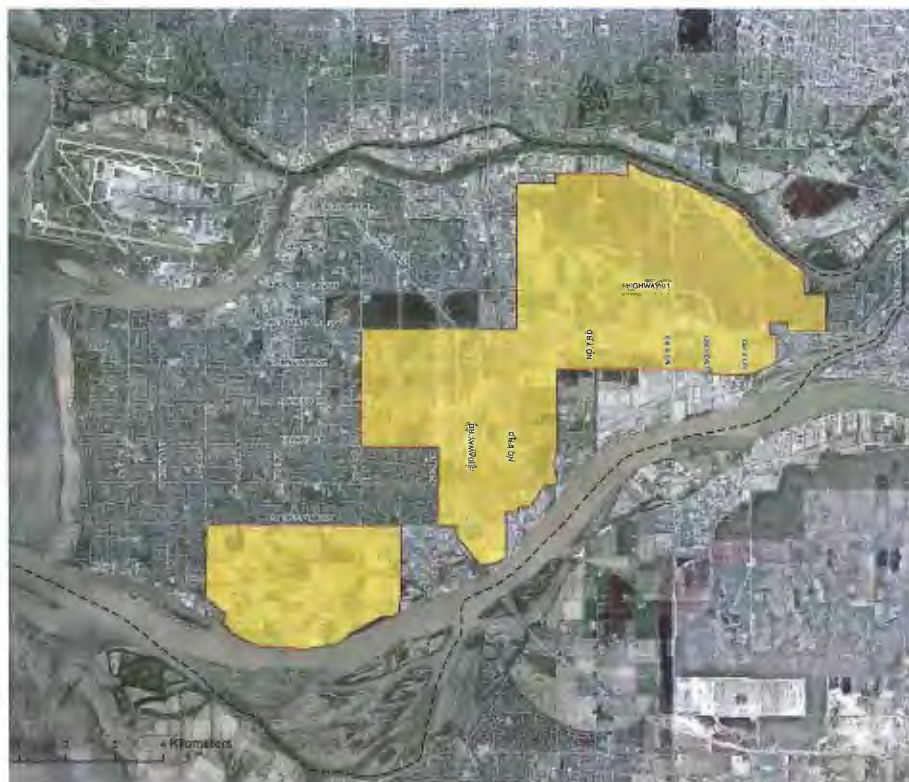
- Developing and redeveloping neighbourhoods
- Strong concentration of residents, local businesses, organizations, and academic institutions
- Redevelopment of large civic spaces and parks (i.e. Lansdowne Road, Minoru Park, Fraser River waterfront)

Focus Areas	Objectives	Actions & Initiatives
Green Infrastructure & Development	Incorporate green infrastructure and stormwater management into development and redevelopments	<p>2.1 Implement rainwater management strategies for multi-family, commercial and institutional developments within City Centre, including strategies to minimize impacts of future development, introducing raingardens, and enhance green infrastructure</p> <p>2.2 Develop guidelines for green infrastructure that provide a variety of options for rainwater management for commercial and mixed-use developments</p> <p>2.3 Review and update bylaws as needed that contribute to the enhancement of the Ecological Network within City Centre (i.e. Green Roofs Bylaw)</p>
Vegetation, Habitat & Wildlife	Retain and enhance existing vegetation and tree cover & Reintroduce vegetation and tree cover where local ecology has been most compromised	<p>2.4 Develop guidelines for the integration of ecological features and native plantings into site design and landscaping within commercial and mixed-use areas</p>
Parks & Public Spaces	Integrate and interpret the Ecological Network within parks, waterfront and other strategic public areas within City Centre	<p>2.5 Ensure integration of the goals and objectives of the Ecological Network into the future Urban Forest Management Strategy</p> <p>2.6 Support the development of future resource management plans for City parks to include ecological network objectives</p> <p>2.7 Work with other City Departments to encourage public art interpretation of the Fraser River Estuary and other aspects of Richmond's local ecology</p> <p>2.8 Integrate green infrastructure and Ecological Network interpretive features within the streetscape and park spaces of the Minoru Park redevelopment and Lansdowne Road transformation</p> <p>2.9 Enhance and integrate waterfront ecology into City Centre developments occurring adjacent to the Fraser River</p>
Stewardship & Collaboration	Partner with local stakeholders to increase opportunities for enhancing local ecology	<p>2.10 Develop City and community stewardship programs to engage and enable partners to promote actions and funding for ecological action</p>

Desired Outcomes

The dynamism of a highly urban environment is heightened through the incorporation of ecological function into the urban hardscape with innovative and educational stormwater management features such as swales, rain gardens and engineered wetlands. A continuous tree canopy benefits citizen health and well-being, and also provides significant shade, respite and habitat for wildlife. Continuous landscape elements are composed of native and drought tolerant species. Urban shoreline areas balance recreation with the ecological requirements needed to sustain highly sensitive habitats. Linear parks, urban parks and greenways not only connect pedestrians and cyclists with various amenities, but inherently provide ecological services such as water filtration, air purification, habitat, opportunities for education and natural beauty. Development and EN principles work in tandem to result in the creation of resilient infrastructure and ecologically healthy urban environments.

AGRICULTURE STRATEGY AREA



Agriculture is a significant land-use within the City of Richmond, and this Strategy Area contains a diverse patchwork of vegetation types and land use patterns. The Northeastern portion of this area sits atop very moist peat soils and thus comprises the majority of Richmond's peat-based agriculture (cranberries and blueberries). The central and south western agricultural areas contain field crops, fallow areas, and permitted residential and commercial development. Key ecological features include the North East Bog Forest, a large portion of Richmond's Environmentally Sensitive Areas and Riparian Management Areas, Horseshoe and Bath Sloughs and shoreline areas along the North and South arms of the Fraser River. As the majority of the area is privately held and within the Agriculture Land Reserve (ALR), there are limited ecological requirements that the City can place upon such lands, however key opportunities exist to ensure that the ecosystem services inherent to agricultural lands are enhanced and connected over time.

Strategy Area Issues

- Habitat loss and fragmentation
- Impacts to Environmentally Sensitive Areas and Riparian Management Areas
- Conversion of useable farmland, loss of productive soil, and increase in impervious developments
- Long-term soil productivity impacted by large scale developments
- Other agencies' control over agricultural land limits City's jurisdiction (i.e. Agricultural Land Commission, Port Metro Vancouver)
- Inadvertent encroachment onto City land
- Proliferation of invasive species

Strategy Area Opportunities

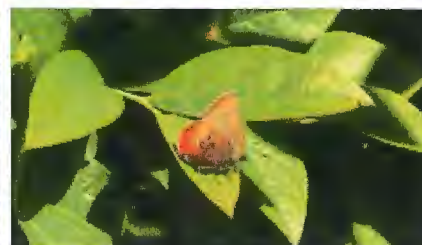
- Agricultural lands support significant ecosystem services
- Requirements for Environmentally Sensitive Areas and Riparian Management Areas
- Synergies between farming practices and environmental health
- Incentive programs and voluntary initiatives can be developed to encourage environmental practices

Focus Areas	Objectives	Actions & Initiatives
Green Infrastructure & Development	Encourage water filtration and retention, and healthy soil on agricultural lands	<p>3.1 Explore strategies to enhance riparian corridors and green infrastructure within the ALR</p> <p>3.2 Enhance the habitat value and rainwater management function of roadside ditches by enhancing soils and vegetation</p> <p>3.3 Maintain and monitor the Riparian Management Areas within agricultural lands to minimize encroachment on City land</p> <p>3.4 Develop riparian management tools to further protect and restore riparian areas, including enforcement tools</p> <p>3.5 Expand future trails, corridors and land acquisition of ecological hubs and sites within the agricultural strategy area, where feasible</p>
Vegetation, Habitat & Wildlife	Encourage riparian area protection and habitat provision on agricultural lands	<p>3.6 Maintain Environmentally Sensitive Areas within agricultural areas to ensure habitat features are preserved</p> <p>3.7 Develop agricultural hedgerow and buffer strip trials in order to enhance habitat and wildlife corridors within agricultural areas</p> <p>3.8 Work with farmers and agriculture land owners on restoration solutions for invasive plants and pests on agricultural lands</p> <p>3.9 Develop a Songbird and Raptor Initiative to identify issues facing bird and raptor survival and strategies to allow wildlife to thrive</p> <p>3.10 Explore solutions to reduce habitat loss and fragmentation in agricultural lands from development, encroachment, and invasive species</p>
Parks & Public Spaces	Enhance ecological connectivity on and within City-owned lands adjacent to ALR	<p>3.11 Develop Shell Road Trail and Horseshoe Slough Trail as Ecological Network demonstration projects, with potential inclusion of green infrastructure, native plantings, and features to enhance habitat</p> <p>3.12 Preserve and enhance the bog forest ecosystem within the City-owned Northeast Bog</p>
Stewardship & Collaboration	Create programming and incentives to promote ecological protection on agricultural lands	<p>3.13 Work with the Agricultural Land Commission, and organizations such as the Delta Farmland and Wildlife Trust to develop options for ecological protection and enhancement between farm and non-farm land use</p> <p>3.14 Develop a voluntary and/or incentive program to encourage landowner stewardship and habitat enhancement within agricultural areas (i.e. voluntary setback program, Environmental Farm Plans)</p> <p>3.15 Develop an award program to recognize successes in environmental farm management</p>

Desired Outcomes

Agricultural lands play a significant socio-ecological role within the City of Richmond. Farming livelihoods are supported through EN initiatives and contribute to healthy environments while remaining viable. Significant natural habitats are identified and protected via a range of mechanisms including conservation leases, incentives programs and strategic land acquisitions.

CENTRAL WETLANDS STRATEGY AREA



Forming the largest contiguous in-land system of EN Hubs in Richmond, the Central Wetlands are comprised of the Richmond Nature Park, the Department of National Defence (DND) lands and the Garden City Lands. These wetlands represent the remaining pieces of what was once the Greater Lulu Island Bog and are characterized by peat soils, bog forest (most prevalent in the Richmond Nature Park) and species such as blueberry, heather, birch, pine, Labrador tea, willow and hemlock as well as a rich communities of mosses, lichens and fungi. The central Wetlands also provide critical habitat to a host of wildlife including the Garter snake, the Pacific Chorus Frog, coyotes, Mule Deer, voles, shrews and a variety of birds of special interest such as Great Blue Heron, Barn Owl and Pileated Woodpecker. The central wetlands are fragmented, and are threatened by adjacent development, road expansion and invasive species; however, they continue to play a key role in maintaining residual wildlife populations in Richmond. In addition, the peat soils of these wetlands could serve as significant areas for carbon sequestration if managed and enhanced over time.

Strategy Area Issues

- Invasive species proliferation
- Lack of baseline data for hydrological regime
- Habitat loss and fragmentation
- Surrounding urban development is impacting bog ecology
- While City owns 3 out of 4 parcels, the future status of DND lands is unclear

Strategy Area Opportunities

- High profile natural areas in Richmond
- Largest in-land hubs within the Ecological Network,
- Garden City Lands Legacy Landscape Plan outlines strong synergies with the Ecological Network
- Existing educational programming in the Richmond Nature Park
- Active, existing environmental stewardship initiatives and groups

Focus Areas	Objectives	Actions & Initiatives
Green Infrastructure & Development	Use green infrastructure to further connect the Central Wetland parcels	<p>4.1 Explore strategies to enhance riparian corridors and green infrastructure within the Richmond Nature Park and Garden City Lands</p> <p>4.2 Monitor hydrology of the Central Wetlands to establish management strategies for the long-term sustainability of the wetlands</p>
Vegetation, Habitat & Wildlife	Protect and enhance remaining bog ecology	<p>4.3 Develop an Invasive Species Action Plan to guide early detection, mapping, priority management areas and restoration solutions for invasive plants and pests on the three City-owned parcels within the Central Wetlands</p> <p>4.4 Develop an inventory of significant wildlife trees in the City, including within the Richmond Nature Park, and develop management tools for development scenarios</p>
Parks & Public Spaces	Incorporate Ecological Network connections into Richmond Nature Park and Garden City lands enhancements	<p>4.5 Integrate the goals and objectives of the Ecological Network into the future Urban Forest Management Strategy</p> <p>4.6 Incorporate ecosystem services, green infrastructure and habitat enhancement into the management strategy for the Richmond Nature Park and the Garden City Legacy Landscape Plan planning process</p>
Stewardship & Collaboration	Support on-going education and stewardship related to Richmond's bog ecosystems	<p>4.7 Work with local institutions and conservation groups to support the on-going community education and participation in ecological management for the bog ecosystems within the Central Wetlands</p> <p>4.8 Develop and implement tools for 'Citizen Scientists' that encourage local residents to inventory, monitor and protect the central wetlands environment (i.e. monitoring of wildlife activity, removal of invasive plants)</p>

Desired Outcomes

The Central Wetlands continue to play a significant role in habitat provision, hydrological function and ecosystem services for the City of Richmond. Ecological enhancements, including the removal of invasive species and the management of wildlife to ensure that these remnant wetlands remain ecologically productive, serve as reminders of our natural history, and provide areas for on-going education, stewardship and local identity. No longer considered as a separate discrete area, the Central Wetlands are maintained through strong ecological and cultural connections to the rest of the City.

INDUSTRIAL STRATEGY AREA



Industrial areas in the City comprise of a variety of land uses including Industrial/ Office Business Park, Industrial only, and Industrial/ Office/ Limited Retail. In general, impervious paving and coverage tend to dominate these areas with very few pockets of natural or pervious space. Ecologically, Richmond's industrial strategic areas abut extensive portions of the Fraser River, thus creating significant opportunities for ecological management and restoration in addition to those outlined in the ESA DPA for Shoreline and Intertidal areas. The Industrial strategic area presents an important opportunity for stewardship, restoration and enhancement through the Bath Slough Revitalization Initiative. The initiative builds on the upgrading of the Bath Slough pump-station in 2015 and will revitalize one of Richmond's last remaining sloughs through a series of actions and programs including; invasive species removal, native vegetation planting, and bank stabilization. In addition, the area provides ample opportunity for the development of green infrastructure interventions such as green roofs, innovative stormwater management measures (especially in managing areas with significant impervious paving), pervious paving, rainwater collection and on-site re-use.

Strategy Area Issues

- Habitat loss (terrestrial and foreshore)
- Increase in impervious surfaces
- Encroachment of materials (storage) onto City lands
- Invasive species
- Contamination, dumping, storage of hazardous materials
- Jurisdictional challenges with a large portion of industrial areas owned by Port Metro Vancouver

Strategy Area Opportunities

- High potential for restoration and green infrastructure interventions
- Promotion of industrial stewardship to improve environmental practices
- Council approved Bath Slough Revitalization Initiative in 2014

Focus Areas	Objectives	Actions & Initiatives
Green Infrastructure & Development	Promote green infrastructure solutions (i.e. rainwater management, retention of native plants, eco-hedgerows, sediment and erosion control)	<p>5.1 Integrate tidal gates into Bath Slough and Woodward Slough pump station where feasible during station upgrading</p> <p>5.2 Implement rainwater management strategies for industrial developments, including strategies to minimize impacts of future development, introduce rainwater harvesting techniques, erosion and sediment control, and enhanced riparian corridors and green infrastructure</p> <p>5.3 Maintain riparian management tools to further protect and restore riparian areas in industrial areas</p> <p>5.4 Develop guidelines for green infrastructure that provide a variety of options for rainwater / run-off management for industrial developments, aligning with recommendations in the draft IRRMS</p>
Vegetation, Habitat & Wildlife	Restore and enhance riparian and foreshore zones in industrial areas	<p>5.5 Maintain Environmentally Sensitive Areas within industrial areas to ensure habitat features are preserved and enhanced</p> <p>5.6 Promote native plantings and integration of ecological features into industrial site design and landscaping</p>
Parks & Public Spaces	Highlight the Ecological Network strategically in industrial areas, including advancing the Bath Slough Revitalization Initiative	<p>5.7 Work with other City Departments to encourage public art interpretation of the Fraser River Estuary and other aspects of Richmond's local ecology</p> <p>5.8 Through the Bath Slough Revitalization Initiative, bring more awareness to the Ecological Network through expansion of the Bridgeport Industrial Park pollinator pasture, stewardship, education and enhancement within Bath Slough</p> <p>5.9 Implement at least one showcase project per year for the Bath Slough Revitalization Initiative (within the Bridgeport neighbourhood)</p>
Stewardship & Collaboration	Engage in education and outreach with local business and other agencies regarding eco-industrial initiatives	<p>5.10 Maintain stewardship educational material for industrial areas that serves as an accessible reference for creating and maintaining healthy habitats;</p> <p>5.11 Continue industrial business outreach and engagement for stormwater pollution prevention. Coordinate industrial outreach and engagement efforts with energy efficiency and renewable programs.</p> <p>5.12 Promote eco-industrial opportunities that encourage adjacent industrial businesses to share resources and collaborate for more efficient delivery of services and products.</p> <p>5.13 Engage with Port Metro Vancouver to explore collaborative opportunities for enhancing local ecology</p>

Desired Outcomes

Richmond's industrial areas serve as important sources of employment while also serving as progressive examples of successful and functional green infrastructure integration within industrial, highly altered environments. The shoreline areas abutting the industrial strategy area are enhanced habitat environments, and the Bath Slough corridor, including the Bridgeport Industrial Park pollinator pasture, serve as a premier example of successful habitat, amenity enhancement and restoration in the heart of industrial lands. The City's industrial partners feel engaged and have a strong understanding of the role of industrial stewardship in contributing to ecological and community health.

WEST DIKE STRATEGY AREA



The West Dike is a key location for leisure activities in Richmond and is regularly identified as one of the City's most significant waterfront destinations. As the beauty and aesthetic value of the area derives from its natural assets, careful management of the area is required. This unique north-south dike provides an important public amenity while providing community protection at the same time. The West Dike acts as a transition zone between the extensive foreshore marsh habitats and adjacent inland residential neighbourhoods and park lands. The area is defined by the adjacent Sturgeon Bank Wildlife Management Area (WMA) and the adjacent Grauer Lands that were recently purchased by the City and Ducks Unlimited. A Riparian Management Area runs along much of the inner flank of the West Dike providing drainage and refuge for waterfowl and other fresh water aquatic species. Recognizing the significant impacts of climate change and sea level rise on the Richmond foreshore, the City will continue to investigate strategies and solutions that address the needs for dike upgrades and the associated tidal marsh habitats along Sturgeon Bank. Residential developments adjoin much of the west dike and have a direct role to play in its health and connection with the rest of the City.

Strategy Area Issues

- Climate change and sea level rise
- Protection of Riparian Management Areas and Environmentally Sensitive Areas
- Invasive species
- Critical intertidal / foreshore habitat
- Growing population increases use / access

Strategy Area Opportunities

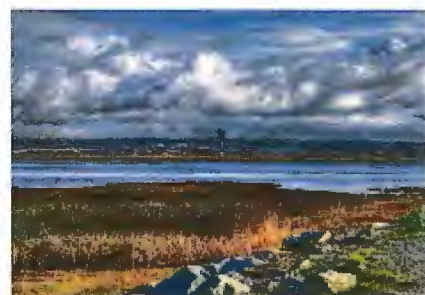
- Area of focus for Dike Master Plan
- City ownership of Grauer Lands
- Critical ecological and recreational corridor

Focus Areas	Objectives	Actions & Initiatives
Green Infrastructure & Development	Improve upland watercourses of the West Dike to enhance ecological health	<p>6.1 Implement strategies to enhance riparian corridors and green infrastructure in areas adjacent to and along the West Dike</p> <p>6.2 Explore options for restoring freshwater or intertidal wetlands as part of dike upgrading</p> <p>6.3 Implement best practices to guide wetland protection and restoration</p> <p>6.4 Support the retention of watercourses upland of the West Dike as significant habitat features</p> <p>6.5 Ensure Ecological Network interests are addressed through dike management and habitat restoration initiatives</p> <p>6.6 Work with partners and senior government to implement measures to mitigate the ecological effects of sea level rise on the Sturgeon Bank foreshore and sandflats</p> <p>6.7 Seek ongoing integration of Ecological Network features into capital projects</p>
Vegetation, Habitat & Wildlife	<p>Restore and enhance habitat, riparian and foreshore areas around the West Dike</p> <p>& Explore innovative best management practices for vegetation and drainage management</p>	<p>6.8 Maintain Environmentally Sensitive Areas and Riparian Management Areas in intertidal areas, foreshore zones, and areas adjacent to the West Dike to ensure habitat features are preserved</p> <p>6.9 Develop an Invasive Species Action Plan to guide early detection, mapping, priority management areas and restoration solutions for invasive plants and pests on City-owned lands on and adjacent to the West Dike. Prioritize invasives treatment within the riparian management area adjacent to West Dike as an Ecological Network demonstration project.</p> <p>6.10 Integrate ecological features and native plantings into site design and landscaping occurring along the West Dike. Include guidance on mowing regimes respecting bird nesting and other wildlife considerations.</p> <p>6.11 Develop an inventory of significant wildlife trees in the City, including along the West Dike, and develop policy guidance for development scenarios</p> <p>6.12 Conduct a base-line study to determine species utilization of urban areas, particularly with regard to Species at Risk and birds of prey (raptors) in Terra Nova and the West Dike area</p> <p>6.13 Develop a Songbird and Raptor Initiative to identify issues facing bird and raptor survival and strategies to allow wildlife to thrive.</p>
Parks & Public Spaces	Enhance ecological assets along the waterfront and Terra Nova	<p>6.14 Continue to encourage public art features along the waterfront that interpret and reflect Richmond's local ecology</p> <p>6.15 Identify ecological enhancement opportunities within the resource management plan for Terra Nova Rural Park</p>
Stewardship & Collaboration	Continue active stewardship initiatives occurring in this area	6.16 Work with community partners and groups to continue advancing environmental stewardship opportunities along the West Dike, Terra Nova, and in adjacent residential areas. Carry out periodic reviews (i.e. surveys) of opportunities for further collaboration.

Desired Outcomes

On-going research, innovation and continued improvement to the dike public amenity have resulted in this area serving the dual roles of maximizing the foreshore, riparian habitats and ecosystem services of Sturgeon Bank and maintaining the protection of City infrastructure. The West Dike is a critical amenity corridor and a significant recreational venue. The corridor is managed to accommodate anticipated population increases while implementing management strategies specific to the West Dike. The health of the area depends not only on the habitat outside the dike but also the dike itself and the community bordering it. The ecological health of the West Dike is supported through the on-going improvement of upland watercourses and through innovative Best Management Practices such as vegetation and drainage management. On-going engagement with the adjacent community instills a sense of ownership and pride in the community's continued stewardship of the area.

SEA ISLAND–YVR STRATEGY AREA



Situated on Sea Island, Vancouver International Airport (YVR) is the second busiest airport in Canada. Located at the mouth of the Fraser River estuary, the airport is surrounded by large tracts of ecological lands included within the Iona/SICA and Sturgeon Bank WMA strategy area. Vancouver International Airport is owned by Transport Canada and managed by the Vancouver Airport Authority. The Vancouver Airport Authority has an overarching Environmental Management Plan, and also has a comprehensive wildlife program to maintain aviation safety and to protect important wildlife values in the vicinity of the airport.

Strategy Area Issues

- Jurisdictional complexities - federally owned
- Protection of significant bird habitat while supporting aeronautical safety areas
- Invasive species

Strategy Area Opportunities

- Other key stakeholders, organizations, and agencies to be engaged for environmental initiatives
- Sea Island Slough revitalization initiatives

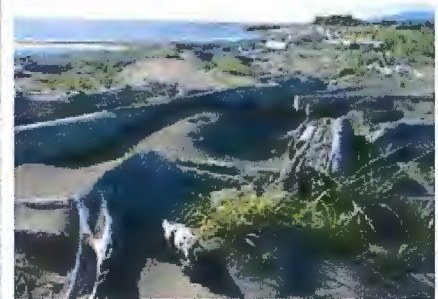
Focus Areas	Objectives	Actions & Initiatives
Green Infrastructure & Development	Seek opportunities to strategically manage rainwater and runoff on Sea Island	7.1 Collaborate with Vancouver Airport Authority to determine opportunities for coordination of rainwater management approaches
Vegetation, Habitat & Wildlife	Seek to enhance the integrity of plant and wildlife communities that move between YVR and City boundaries	7.2 Support early detection, mapping, and restoration solutions for invasive plants and pests on City lands and adjacent lands on Sea Island. Work with other jurisdictions and agencies operating within Sea Island to advance invasive species management 7.3 Identify collaborative opportunities for wildlife monitoring and management, with agencies such as Canadian Wildlife Services, Metro Vancouver, Vancouver Airport Authority, and Port Metro Vancouver
Parks & Public Spaces	Enhance connections within and between ecological lands under various jurisdictional control	7.4 Explore opportunities for greater ecological connectivity between City owned lands and Sea Island areas under the control of Vancouver Airport Authority, Port Metro Vancouver, and Metro Vancouver
Stewardship & Collaboration	Partner and participate within Vancouver Airport Authority processes to align ecological goals and objectives	7.5 Work with Vancouver Airport Authority to restore and enhance Sea Island Slough 7.6 Participate as a member of the YVR Environmental Advisory Committee

Desired Outcomes

Existing partnerships between the City, YVR and other agencies are built upon and strengthened to address burgeoning ecological challenges and opportunities. Sea Island is ecologically connected to the rest of the city.

IONA–SICA (SEA ISLAND CONSERVATION AREA) STRATEGY AREA

8



The Iona/SICA Strategy Area occupies lands within the jurisdiction of the Canadian Wildlife Service (Sea Island Conservation Area), Metro Vancouver (Greater Vancouver Sewerage & Drainage District and Metro Vancouver Park lands), YVR and the City of Richmond (Macdonald Beach Park). Bounded by the Fraser River Macdonald Slough and the foreshore, these estuarine lands, including the Iona Spit, provide a contiguous network of protected habitat that include remnant dune habitat, foreshore and slough marshes, remnant forest patches, upland open fields, saline marshes and open water ponds. The Metro Vancouver Sewage Treatment Plant lands, the jetty and other leased businesses including log booming and other non conservation activities that occur in this area.

Strategy Area Issues

- City's powers are limited due to jurisdictional complexities (multiple jurisdictions present)
- Invasive species proliferation

Strategy Area Opportunities

- Significant intertidal and foreshore habitat
- High profile ecological and recreational amenities
- Significant ecosystem services present

Focus Areas	Objectives	Actions & Initiatives
Vegetation, Habitat & Wildlife	Enhance ecological resiliency and connectivity of lands where there is a diversity of tenure	<p>8.1 Support early detection, mapping, and restoration solutions for invasive plants and pests on City lands and other lands in Iona-SICA area . Work with other jurisdictions and agencies to advance invasive species management in this strategy area</p> <p>8.2 Establish Champion the establishment of a working group to consider a broad ecological enhancement plan for the area.</p> <p>8.3 Identify collaborative opportunities for wildlife monitoring and management with other agencies involved in wildlife and foreshore management, including Canadian Wildlife Services, Metro Vancouver, Vancouver Airport Authority, and Port Metro Vancouver</p> <p>8.4 Participate in the Port Metro Vancouver (PMV) habitat enhancement considerations for the SICA lands to the west of Macdonald Beach.</p>
Stewardship & Collaboration	Foster community stewardship and education initiatives	<p>8.5 Support the provision of information on stewardship opportunities in the estuary.</p> <p>8.6 Develop partnerships with non-profit organizations that focus on the Fraser River (Fraser Basin Council, Fraser River Discovery Centre, Pacific Salmon Foundation, etc.) to develop Richmond-tailored programming.</p>

Desired Outcomes

Ecological resiliency, ecosystem services and green infrastructure functions are enhanced when large, contiguous tracts of land can be assembled and managed with a common ecological goal. The Iona/SICA Strategy Area represents a unique assemblage and Hub. The Fraser River riparian, dune, slough and foreshore habitats fall within different jurisdictions, yet are managed for their overall ecological connectivity. These lands continue to contribute significantly to the community as a public amenity for wildlife viewing and recreation due to the unique estuarine setting.

WILDLIFE MANAGEMENT AREAS STRATEGY AREA



As an estuarine municipality, Richmond is home to two provincially designated Wildlife Management Areas (WMAs), Sturgeon Bank and the South Arm Marshes. These large hub areas provide critical foreshore marshes and island habitat that support a diversity of ecological habitats that are integral to our estuarine island City. These WMAs are also part of a recently expanded and renamed Ramsar site called the Fraser River Delta. This international designation recognizes critical migratory habitat for shorebirds, migrating and wintering waterfowl and critical feeding and rearing for anadromous salmon during their transition between river and marine stages of their life cycle.

Strategy Area Issues

- Habitat impacts from external development and waterfront activities within the Fraser River, Gulf of Georgia
- WMA health key to ecosystem services such as wildlife habitat, dissipation of wave energy and sea level rise protection
- Invasive species
- Major infrastructure projects for oil, coal, and gas transport

Strategy Area Opportunities

- Largest aquatic hub areas within the Ecological Network
- Wildlife viewing and nature interpretation
- Designation of Fraser River Delta as Ramsar Wetland of International Significance
- City-owned Grauer Lands
- Province reviewing original WMA management plans
- Significant ecosystem services present

Focus Areas	Objectives	Actions & Initiatives
Vegetation, Habitat & Wildlife	Protect foreshore habitat for a diversity of waterfowl, shorebirds and salmon & Collaborate with stakeholder agencies and organizations to enhance protection of WMAs and minimize impacts to the foreshore	<p>9.1 Champion greater communications with stakeholders to discuss ongoing baseline monitoring and management of WMAs.</p> <p>9.2 Support early detection, mapping, and restoration solutions for invasive plants and pests within the WMAs. Work with other jurisdictions and agencies to advance invasive species management in this strategy area.</p> <p>9.3 Identify collaborative opportunities for wildlife monitoring and management, with external agencies involved in foreshore and wildlife management, including Canadian Wildlife Services, Metro Vancouver, Vancouver Airport Authority, and Port Metro Vancouver</p> <p>9.4 Continue to work with Port Metro Vancouver feasibility assessments for enhancement in Sturgeon Bank.</p> <p>9.5 Work with external agencies involved in foreshore management to protect and enhance the ecological values of the Fraser River, foreshore areas and Sturgeon Bank.</p> <p>9.6 Work with other City departments to encourage public art interpretation of Richmond's local ecology, including the WMAs and the Fraser River Estuary.</p>
Stewardship & Collaboration	Foster community stewardship and education initiatives focused on the Fraser River Estuary and foreshore	<p>9.7 Work with community partners and non-profit organizations that focus on the Fraser River Estuary to develop Richmond-tailored programming.</p> <p>9.8 Support the provision of information on stewardship opportunities in the estuary.</p>

Desired Outcomes

The long term ecological resiliency of the WMAs is maintained over time. Retention of the ecological resiliency assures that the WMAs continue to provide the essential wildlife/conservation values and ecosystem services that are critical for the estuary. Expanded linkages with adjacent ecological lands (e.g., Grauer Lands), habitat restoration, enhancement projects and ongoing research within the WMAs continue to support their long term ecological resiliency.

FRASER RIVER STRATEGY AREA



The Fraser River created the islands that are now Richmond and continues to define the City and its setting. Richmond lacks conventional watersheds; instead it is located in the estuary of the largest river in western Canada. Surrounded by the Fraser and its exceptional natural values, Richmond's EN is inextricably linked to the river. The Fraser River Strategy Area is defined by extensive wetlands critical for many species, particularly migratory birds. The Fraser River estuary serves as critical habitat for all five species of Pacific Salmon, and the Fraser River itself is one of the largest salmon-bearing rivers in the world. The 2041 Richmond Official Community Plan (OCP) contains several policies that speak to the need to protect the Fraser River. Some of these pertain to prioritization of the protection and enhancement of the Fraser and West Dike foreshore habitat. This is identified through compliance with Environmentally Sensitive Area (ESA) and Riparian Management Area setbacks. In addition, the OCP provides guidance in show-casing Richmond's waterfront by linking the river with the community through recreational opportunities as well as by protecting, enhancing and connecting ecological values and public amenities, and providing educational and interpretive programming.

Strategy Area Issues

- The Fraser River is a 'living working river' and the challenge is to balance demands of waterfront activities with high value estuarine habitat
- Jurisdictional complexities
- Major infrastructure projects for oil, coal, and gas transport

Strategy Area Opportunities

- Significant portion of the Ecological Network's hubs occur on the Fraser River
- High profile and well-recognized component of Richmond's ecological network
- Existing City guidelines and process related to habitat protection and development of the Fraser River foreshore
- Significant ecosystem services present

Focus Areas	Objectives	Actions & Initiatives
Green Infrastructure & Development	Protect ecological productivity of the Fraser River	<p>10.1 Implement rainwater management strategies in order to improve water quality delivered to the Fraser River via the drainage network</p> <p>10.2 Develop riparian management tools to further protect and restore riparian areas conveying water to the Fraser River</p> <p>10.3 Identify opportunities for landowner engagement and habitat restoration where encroachment onto city-owned property adjacent to the river has occurred</p> <p>10.4 Integrate tidal gates and riparian restoration into pump stations where feasible during station upgrading</p> <p>10.5 Monitor environmental assessments for major infrastructure projects on the Fraser River, provide input and update Council</p> <p>10.6 Seek ongoing integration of Ecological Network features into capital projects</p>
Vegetation, Habitat & Wildlife	Support the ecological services associated with healthy foreshore habitat and vegetation	<p>10.7 Maintain foreshore Environmentally Sensitive Areas to ensure adjacent habitat features are protected and enhanced</p> <p>10.8 Support early detection, mapping, control, and restoration solutions for invasive plants and pests affecting foreshore habitats</p> <p>10.9 Continue to collaborate with senior government agencies (i.e. FLNRO, MoE, Department of Fisheries and Oceans) to ensure transparent and effective communication with the City for foreshore protection, restoration, and development approval processes</p>
Parks & Public Spaces	Seek opportunities to further protect and enhance ecological assets through parks and public spaces adjacent to the foreshore	<p>10.10 As part of the waterfront experience, work with other City departments to encourage public art interpretation of Richmond's foreshore and Fraser River Estuary</p> <p>10.11 In partnership with other agencies involved in foreshore management, identify priority areas for the protection, enhancement, and creation of foreshore habitat features such as marshes</p>
Stewardship & Collaboration	Provide education and interpretive programming to increase environmental awareness about the Fraser River ecosystem	<p>10.12 Expand and update interpretive and stewardship materials for the Fraser River Estuary in collaboration with other agencies and organizations.</p> <p>10.13 Develop partnerships with non-profit organizations that focus on the Fraser River (Fraser Basin Council, Fraser River Discovery Centre, Pacific Salmon Foundation, etc.) to develop Richmond-tailored programming.</p> <p>10.14 Continue to work with and liaise with other local and regional governments regarding environmental management best practices</p>

Desired Outcomes

The north, south and middle arms of the Fraser are places of high-functioning ecological health, increased water quality, and are valued as Richmond's most important assets with development enhancing the environment and exerting a light-footprint upon the City's most significant ecological asset. The City will use the EN structure to be a responsible steward of the Fraser River. The EN will function to protect and enhance the foreshore and riverine environment while accommodating anticipated development. The EN directions are intended to provide tactical and site-level actions that will guide development on the foreshore.



APPENDIX 1

Glossary & References

Glossary

Agricultural Land Reserve (ALR): means agricultural land designated as an agricultural land reserve under the Agricultural Land Commission Act and includes an agricultural land reserve under a former Act.

Connectivity Zone: a non-linear area that provides connectivity for biodiversity and other ecological components between habitat patches; for example a large old field may be a connectivity zone between adjacent wetlands but the movement route does not follow a linear feature such as watercourse.

Corridor: is a linear feature such a watercourse and adjacent riparian zone that allows the movement of wildlife or other biodiversity components between habitat patches.

Ecological Network: is the inter-connected system of natural areas across Richmond's landscape. It is composed of both terrestrial and marine (shoreline and intertidal) areas.

Ecosystem Services: the benefits the city and its residents obtain from the environment. These services contribute to ecological health of water, air and soil and the wellbeing of city residents. Ecosystem services include rainwater storage and filtration, areas for wildlife foraging, food production, pollination, and recreational and scenic areas.

Environmentally Sensitive Area: an ecologically important area identified and mapped by the City of Richmond within the Official Community Plan; most are protected as development permit areas.

Foreshore: the sea or river-bed outside of Richmond's perimeter dike and below the high water mark. Under the Land Act, the foreshore is referred to as a "natural boundary" and is owned by the provincial government.

GIS (Geographic Information System): a system of organizing, analyzing, and displaying spatial (map) data; it can be thought of as digital map with many layers including features that are points, lines, or shapes.

Green Infrastructure: encompasses the components of the natural and built environment that provide ecosystem services such as drainage, water filtration, green space, and wildlife habitat; they are often smaller than components of the EN.

Greenway: is a linear corridor for improving environmental quality and outdoor recreation or transportation; the Railway Avenue Greenway is an example in Richmond.

Highwater Mark: a line defining the highest elevation of inundation from water under normal tides or floods; it is often the lowest point for rooted woody vegetation; it defines the boundary between the terrestrial and intertidal or marine realms.

Hub: a component of the EN that is greater than 10 ha in size

and naturalness >3; it may be forest, wetland, or other type of ecosystem; hubs are the most important part of the EN.

Matrix: in an EN, the matrix is the developed portion of the landscape (e.g., houses, farms, developed parks) that surrounds the main components of the EN; it also provides some ecological values and ecosystems services and influences the function of the network.

Official Community Plan: reflects the overall values of the community by establishing a vision, goals, objectives, and policies for topics such as sustainability, development and servicing, and urban design. The Ecological Network concept was introduced in the 2041 OCP, adopted in 2012.

Riparian Management Area (RMA): a 5 or 15- metre wide zone (depending on watercourse size and fish habitat value) on both sides of a watercourse (measured from the highwater mark) which is used to maintain watercourse health; RMAs were implemented in response to provincial requirements under the BC Fish Protection Act.

Riparian Zone: the land area bordering watercourses or shorelines with distinctive vegetation, topography, and soils related to its proximity to watercourses; riparian zones are important for biodiversity, watercourse health, and other values (shading, bank stabilization, etc.).

Shoreline Zone: areas within 30 m of the highwater mark of the Fraser River or the Strait of Georgia; it includes developed and natural areas.

Site: a component of the EN between 0.1 and <10 hectares in size and naturalness >3; it may be forest, wetland, or other type of ecosystem; sites are important for maintaining connectivity within development landscapes.

Strategy Area: used to guide the application of the Ecological Network into the future strategy areas characterize areas of Richmond based on vegetation type, land use, and stewardship and development opportunities.

Watercourse: a water feature with a defined channel formed by the regular movement of water; in Richmond, watercourses are mainly man-made or modified features such as ditches and canals.

Wildlife Management Area: an area of land designated under section 4(2) of the Wildlife Act for the benefit of regionally to internationally significant fish and wildlife species or their habitats. Conservation and management of fish, wildlife and their habitats is the priority in a WMA, but other compatible land uses may be accommodated.

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APPENDIX 2

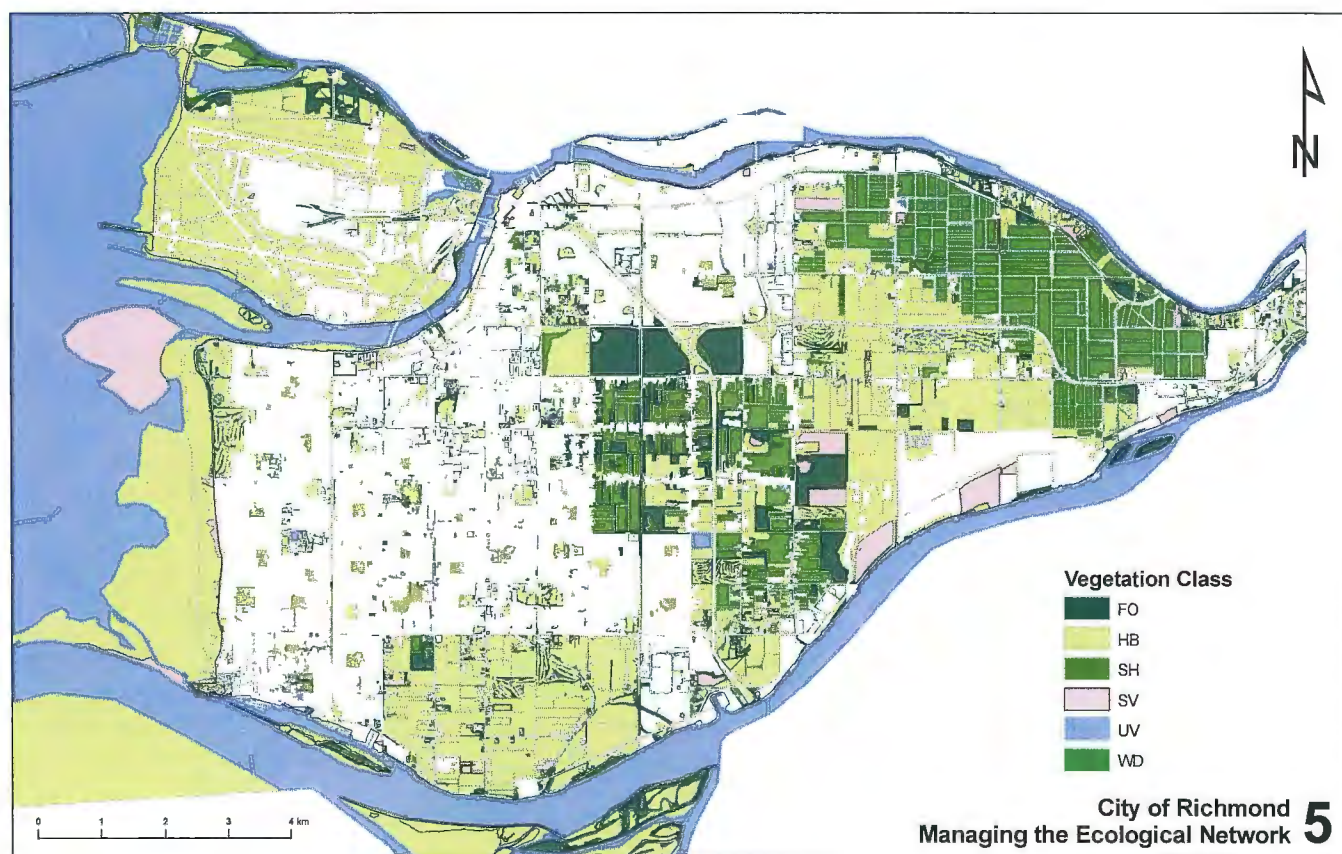
Methodology for Mapping Richmond's Ecological Network

Overview

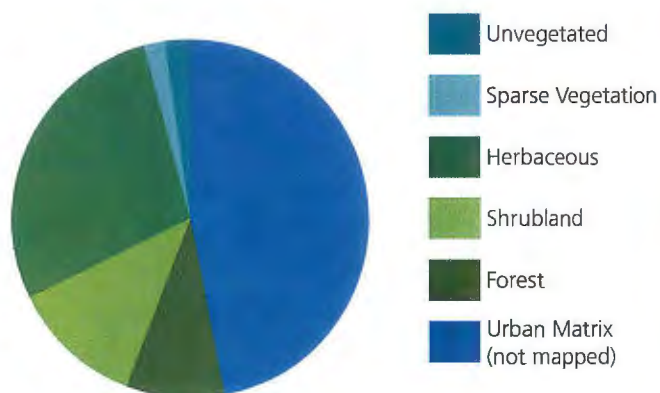
Richmond's Ecological Network was identified using a science-based approach to mapping natural and semi-natural vegetation, assessing the size, distribution, and relative value of natural habitats, and examining the potential connections between them. Vegetation was used as the primary indicator of ecological value and function because it is easily mapped from air photos, and its structure, composition, and condition can be used as a surrogate for a broad range of ecological values including biodiversity. A summary of analysis methods are provided in this section. The resultant maps for this Strategy build upon the mapping developed for the EN within the 2041 Official Community Plan - the Ecological Network Management Map and the ESA Development Permit Type Map.

Mapping of Natural and Semi-Natural Vegetation

Natural and semi-natural vegetation in the City of Richmond was mapped using spring 2009 air photos. Vegetation was divided into five structural classes, and more detailed attributes based on vegetation structure and composition were assigned to each vegetation unit. Larger wetlands, agricultural fields, and developed vegetation types such as lawns and gardens were also mapped. A limited field review was conducted to verify the accuracy of vegetation mapping.



Vegetation classes in Richmond
(% of total land area)



Vegetation Classes and Subclasses

Class	Subclass
Forest (FO)	<ul style="list-style-type: none"> Evergreen Forest Deciduous Forest Mixed Evergreen-Deciduous Forest
Shrubland (SH)	<ul style="list-style-type: none"> Evergreen Shrubland Deciduous Shrubland Mixed Evergreen-Deciduous Shrubland
Herbaceous (HB)	<ul style="list-style-type: none"> Perennial Graminoid Vegetation Hydromorphic Rooted Vegetation Annual Graminoid or Forb Vegetation
Sparse Vegetation (SV)	<ul style="list-style-type: none"> Boulder, Cobble, Gravel, Sparse Vegetation Unconsolidated Material Sparse Vegetation
Unvegetated (UV)	<ul style="list-style-type: none"> Unvegetated Unconsolidated Material Unvegetated Water

The key results of the vegetation assessment are summarized below:

- A total of **6,841 ha** of Richmond's terrestrial land area (inside the high water mark) and another 13,861 ha of its marine and intertidal areas (outside the high water mark) were mapped as part of the study.
- About 9% of Richmond is forested.** Forested plant communities include bog forests composed primarily of shore pine and birch, mature black cottonwood stands along ditches and the banks of the Fraser River, and red alder stands which have regenerated in areas that were previously cleared. Some areas identified as forest are made up of planted ornamental trees and have low naturalness value.
- Herbaceous vegetation is the dominant vegetation class in Richmond,** covering 28% of Richmond's land area. Most of the herbaceous cover is comprised of agricultural fields, rough grass areas that are not actively cultivated, and playing fields and lawn areas in parks. Old fields (abandoned or fallow agricultural lands with a mix of grass and shrub vegetation) are also present.
- Shrub cover accounts for 12% of Richmond's vegetation.** This includes shrub communities in bogs (composed of Labrador tea, bog blueberry, and salal), agricultural fields in cranberry or blueberry production, hardhack and willow thickets in moist sites (such as along watercourses), and areas of Himalayan blackberry and other predominantly non-native shrubs along ditches, railway rights-of-way, roadsides, fence lines, and field margins.
- Only a small area of Richmond's land area, approximately 4%, is covered by sparse vegetation or is unvegetated.** Sparse vegetation includes habitats like the sand dunes at Iona Beach. In contrast, 90% of intertidal and marine areas are either sparsely vegetated (e.g., mudflats) or unvegetated (mostly river channel). More natural sparsely vegetated sites include beaches and mudflats while less natural sites include dyke faces and recently cleared development sites.

Assessing Naturalness

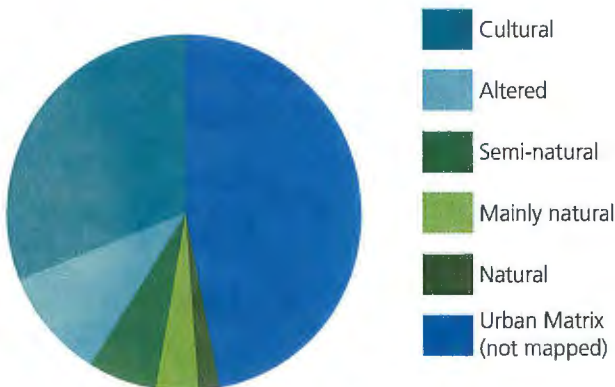
Vegetation naturalness is an important attribute for assessing ecological function and value, particularly for biodiversity. Naturalness describes how altered a landscape or area is from its natural state. This attribute was assessed on a scale from 1 (least natural) to 5 (most natural) for each unit. For example, maintained non-native shrubs in a landscaped bed in an urban park generally have lower value for biodiversity than native shrub vegetation. Similarly, natural wetland vegetation is indicative of functioning hydrology and water quality relative to constructed landscape ponds without aquatic vegetation.

Naturalness characteristics of Richmond are summarized below:

- Of the 20,702 ha of area mapped in Richmond's boundary (land and water), **58% was classified as having some natural characteristics** (Naturalness 3, 4, and 5).
- **Only 12% of Richmond's land area has natural or mainly natural characteristics** (Naturalness 4 and 5). Most is intertidal wetland, designated as ESA within the OCP.

- Within Richmond's terrestrial land area, approximately:
 - 560 ha (6%) is classified as semi-natural (Naturalness 3);
 - 558 ha (4%) of vegetation is classified as mainly natural (Naturalness 4); and
 - 283 ha (2%) was classified as natural (Naturalness 5).
- Terrestrial areas mapped as mainly natural (Naturalness 4) were predominantly remnant bog forest such as Richmond Nature Park.
- The **average naturalness value of Richmond's municipal parks was 1.8** which indicates a general lack of ecological features. Comparatively speaking, this is similar to the park network in the City of Vancouver, but lower than City of Surrey.
- Because of Richmond's natural and cultural history (most of Richmond was originally part of the Fraser River delta, and most land was diked to allow for settlement and farming), **the only vegetation classified as natural (Naturalness 5) are the foreshore marshes and mudflats** on Sturgeon Bank and the western perimeter of Sea Island.

Naturalness of Vegetation in Richmond
(% of total land area)



Natural Values for Vegetation in Richmond

Naturalness	Definition
1. Cultural	Vegetation that is regularly maintained.
2. Altered	Heavily disturbed vegetation that is often a mix of native and non-native species; may be recovering or rapidly changing.
3. Semi-natural	Disturbed vegetation; predominantly native species but lacking some species and structures associated with natural vegetation.
4. Mainly Natural	Disturbed historically (logged) by sufficient time to restore native species and structure.
5. Natural	Undisturbed by direct human activity.

Identifying the Ecological Network

Several analyses using the vegetation mapping, watercourse, shoreline, and park system information were undertaken to identify the components of the EN.

The main analysis focused on identifying the largest areas of natural vegetation. These were termed “hubs” because of their essential role in sustaining the EN. Hubs are essential for sustaining urban biodiversity, as well as providing other ecosystem services such as capturing, storing and infiltrating rainfall. Smaller natural areas were called “sites” and connections between EN were called either “corridors” or “connectivity zones” depending on their size and configuration. Shoreline and riparian areas, as well as parks and greenways were added to the EN because of their importance as green space for both biodiversity and people.

Hubs

- Vegetation comprised of semi-natural or natural vegetation (naturalness ≥ 3) and 10 ha in size or greater.
- Areas 10 ha were selected as the size threshold for hubs because they can support populations of many native wildlife species, particularly if there are other natural areas nearby.

Sites

- Sites are areas of semi-natural to natural vegetation (naturalness ≥ 3) between 0.25 ha and 10 ha in size.

Shoreline

- Lands within 30 m (landward) of the high water mark, added to the EN regardless of their land use, vegetation, or naturalness.
- Shoreline areas contribute to the health of the adjacent intertidal zone and provide important habitat for wildlife. Stable shoreline zones help maintain the ecological health of adjacent intertidal marshes and mudflats.
- Shoreline areas are important sites to manage during development and redevelopment when ecological features such as riparian vegetation can be protected or restored.

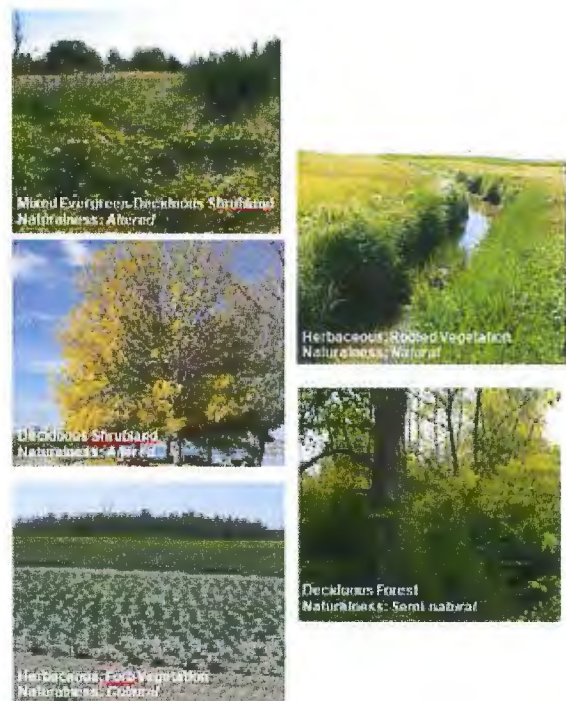
Riparian Areas

- Watercourses and their associated Riparian Management Areas (RMAs; 15 m and 5 m setbacks around selected watercourses in Richmond) are also an important part of Richmond's EN.
- Riparian areas are recognized as transitional areas between aquatic and terrestrial zones and have a broad range of ecological functions including shading watercourses, filtering runoff, providing nesting and feeding areas for birds and mammals, and acting as wildlife corridors in urban landscapes.

Parks and Greenways

Public parks and greenways were added to the EN for two reasons.

- Are publically-owned lands which offer opportunities for City-led restoration and enhancement focusing on green infrastructure.
- Most of Richmond's public parks and greenways contain only small amounts of natural ecosystems. The City can play a leadership role in EN protection and improvement by further managing some of them for ecological enhancement. Public parks and greenways cover 668 ha, just over 5% of the land area of Richmond. This represents significant opportunity for further hub and site acquisitions and ecological corridor linkages.



Assessing Connectivity within the Ecological Network

Connections between different parts of the EN are essential for creating an inter-connected system. Two complimentary methods were used to assess connectivity within the terrestrial components of the EN:

1. **Corridor analysis** using a landscape impedance model; and
2. Landscape permeability using **Circuitscape analysis**.

Both methods assess potential areas that allow for the movement of biodiversity through the complex ecological landscape that characterizes Richmond. The main differences are that corridor identification delineates specific routes between each hub in the EN, while the Circuitscape analysis identifies a broader range of routes or movement zones.

They are complimentary analyses that assist in understanding how biodiversity may move through the landscape and identifying potential corridors and connectivity zones.

It should be noted that both these methods served as tools to aid in understanding the highly complex nature of species movement across a complex landscape; a difficult thing to quantify and display.



Corridor Analysis

Corridor analysis involves incorporating the permeability (or, conversely, impedance) of Richmond's landscape for the movement of biodiversity to identify potential corridors. Vegetation mapping was combined with existing land use, roads, and other data layers to map how the landscape affects biodiversity movement. The analysis delineated paths offering the least resistance (e.g., preferred land cover types for wildlife species, lowest number of barriers) to wildlife movement between hubs. Potential corridors were classified qualitatively according to their function:

- A **functioning corridor** is a linear area of habitat with continuous or near-continuous natural vegetation cover along its length. This type of corridor offers an existing pathway for wildlife movement between hubs. Functioning corridors are designated as 'existing corridors' within the Ecological Network.
- An **impaired corridor** has some natural vegetation cover along its length but contains significant gaps that are currently compromising its function as a pathway for wildlife movement between hubs. As a result, actual use of the corridor in its current state may be limited. This type of corridor has a high potential for restoration, and is designated a 'potential corridor' within the Ecological Network.
- A **non-functioning corridor** has little to no natural vegetation along its length and does not function as pathway for wildlife movement between hubs in its current state. Non-functioning corridors were identified based the corridor analysis and are shown where connectivity would significantly benefit the integrity of the EN but is currently lacking. Larger-scale restoration efforts would be required to restore connectivity in these areas. Non-functioning corridors are identified as 'potential corridors' within the Ecological Network.

The corridor analysis highlighted the following results:

- 74 km of corridors were identified within Richmond's EN. 29 km (39%) of these corridors are along foreshore areas within the Agricultural Land Reserve. 17 km (23%) of these corridors are located along foreshore areas.
- 12 km of corridors (17%) were identified as functioning and currently provide connectivity between adjacent hubs within the network. 45 km of corridors (60%) were classified as impaired and, while providing some connectivity currently, could be improved with minor restoration and enhancement.
- 17 km of corridors (23 %) were identified as non-functioning. Non-functioning corridors currently do not provide connectivity but represent opportunities to improve connectivity during large-scale City planning.



Circuitscape Analysis

Circuitscape is a computer model that applies the concepts of electrical circuit theory to ecological landscapes. Simulated electrical current, representing the movement of biodiversity, finds the path of least resistance between different habitat areas.

Areas of good habitat will have low resistance to the current's movement and areas of poor habitat will have higher resistance which will slow the flow of current, and in extreme cases will block the current all together.

Circuitscape analysis was used to model four different habitat types (forest, wetland, shrubland, and old fields), and compared for species with high (e.g., birds) and low (e.g., amphibians) mobility.

Circuitscape analysis has two advantages. First, it does not constrain connectivity to a single path or corridor. Current is free to flow anywhere and multiple pathways will often be identified as well as dead ends where a pathway meets resistance and cannot continue. This is more realistic of how biodiversity uses the landscape; mobile wildlife often use a range of possible routes or corridors rather than the single path identified (as in the corridor analysis described previously). Second, the flow of current in Circuitscape is based on the resistance a species encounters as it randomly moves across the landscape. Again, this is more realistic than corridor analysis because side routes or splits in the path are possible.

In general, the Circuitscape analysis provided complimentary results but was more difficult to interpret. The circuitscape analysis highlighted three important results:

- Distance is important for connectivity. Habitat patches that are close together, such as the bog forests, old fields, and forests of central Richmond, are better connected than patches that are more isolated.
- Where there is a well-defined route like Horseshoe Slough, adjacent areas become less important for maintaining connectivity.
- The residential areas of west and central Richmond have very little in the way of functioning ecological connections which emphasizes the value of the Railway Avenue Greenway and other constructed corridors.



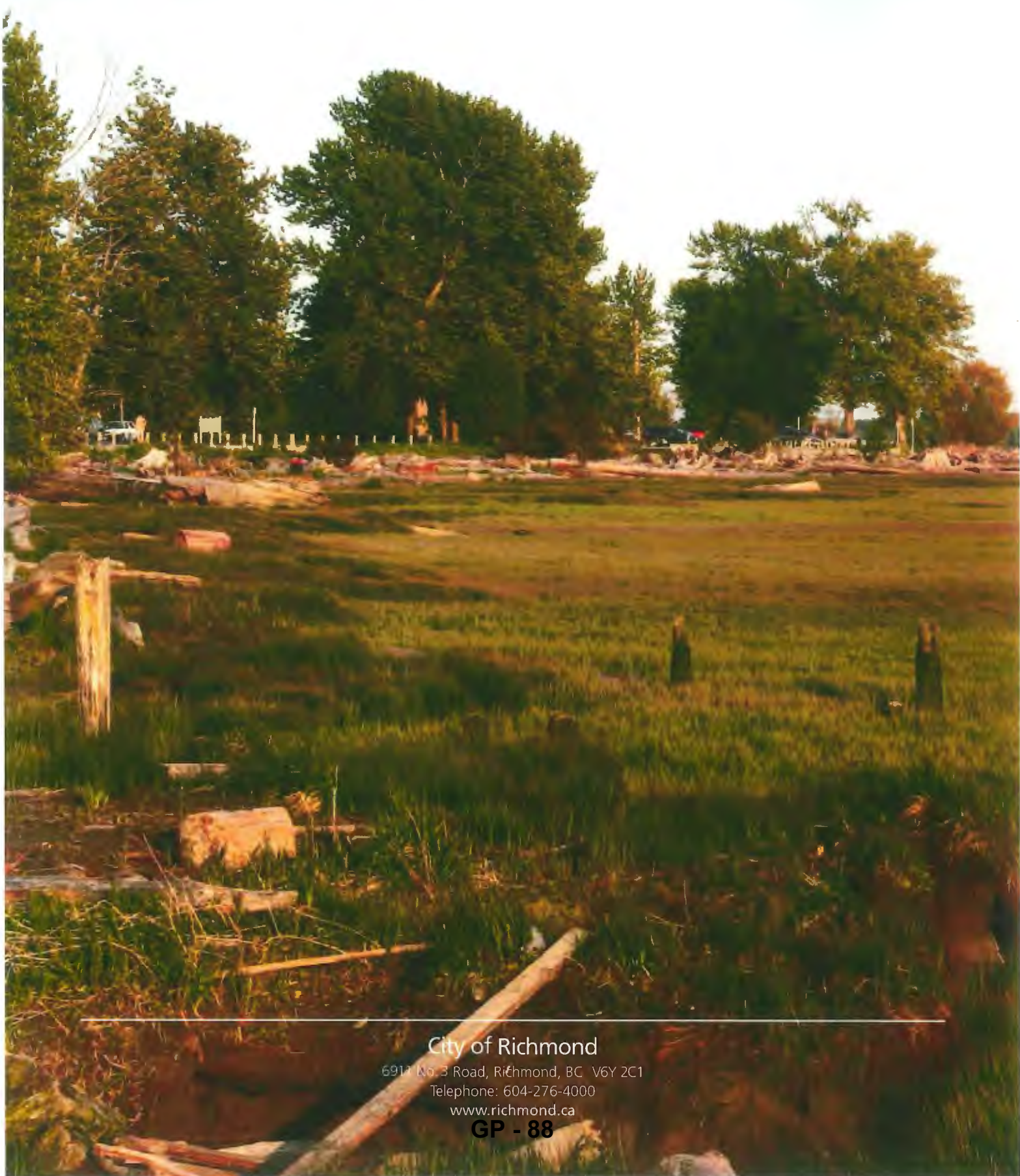
Summary of Richmond's Ecological Network Components						
Component	Hubs	Sites	Connections ¹	Fraser River Shoreline and Riparian Management Areas	Parks and Greenways	Matrix
Definition	Large areas of natural and semi-natural vegetation	Small areas of natural, semi-natural, and semi-modified vegetation	Linear connections or zones of connectivity between hubs, variable width when finally established	Linear strips along dike areas and watercourses to protect aquatic habitats and other values	City-owned and managed recreation lands, as well as non-City owned schools sites; opportunities for restoration and enhancement	Areas surrounding hubs, sites, and corridors including urban and other modified areas and open water
Size	Larger than 10 hectares	0.25 to 10 hectares	30m wide corridor	30m buffer inside dyke; 30m outside dyke; 15m and 5m Riparian Management Area buffer	various	n/a
Total Land Area ²	1,597 hectares	178 hectares	181 hectares	755 hectares	667 hectares	9,353 hectares
% of Land Area ²	13%	1%	1%	6%	5%	74%
Total Intertidal and Marine Area ³	2,421 hectares	31 hectares	6 hectares	470 hectares	47 hectares	11,158 hectares
% of Intertidal and Marine Area ³	17%	0.2%	0.0%	3%	0.3%	79%
Total Area of City ⁴	4,017 hectares	209 hectares	187 hectares	1,224 hectares	636 hectares	20,510 hectares
% of Area of City ⁴	15%	0.8%	0.7%	5%	2%	77%
Number	37 hubs	102 sites	84 corridors	-	-	-

1 Includes functioning, impaired, and non-functioning corridors, and zones of connectivity.

2 Includes all areas above the high water mark.

3 Includes all areas below the high water mark.

4 Includes all areas within the City boundary, including intertidal and marine areas.



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