City of Richmond

2012 Environmentally Sensitive Area Management Strategy (Background Technical Report for the 2041 OCP)

September 10, 2012 Draft

HB Lanarc-Golder + Raincoast Applied Ecology
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City of Richmond

2012 Environmentally Sensitive Area Management Strategy

(See 2012 Official Community Plan ESA Policies and Guidelines)

In the event of a conflict between this Strategy and the OCP ESA Policies and Guidelines the OCP shall take precedence

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HB Lanarc-Golder + Raincoast Applied Ecology
Acknowledgements

This Environmentally Sensitive Areas Management Strategy was realized through the leadership, ideas and dedication provided by Richmond City Council and its many contributors. The project team would like to acknowledge City of Richmond staff members for their significant contributions.

We would also like to offer recognition to community organizations, additional local and regional government staff, agencies and individual members of the public for their input and consideration of this plan. The consulting team of HB Lanarc Consultants - Golder Ltd. (Don Crockett, David Reid, and Aaron Licker) together with Raincoast Applied Ecology (Nick Page and Patrick Lilley) were retained to prepare the technical inventory and mapping, the Strategy report and supporting documents.
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PART 1 – Introduction

Purpose of the ESA Management Strategy

The City of Richmond is currently updating its Official Community Plan (OCP) including the mapping and designation of Environmentally Sensitive Areas (ESAs). Incremental changes in land use since 1999, improved science about environmental values, and changing regulations have necessitated an update of ESA mapping and designation. The purpose of this Management Strategy is to update the City’s ESA policies to better protect and strengthen Richmond’s ecological network by:

1. establishing Ecological Network policies and its beneficial services,
2. establishing ESAs as part of a new City-wide Ecological Network system,
3. updating the City’s ESA mapping and inventory using a science-based approach, and,
4. establishing innovative ESA management policies and guidelines.

What are Environmentally Sensitive Areas (ESAs) Legally?

Under the BC Local Government Act, Section 878 (d), City Council in an Official Community Plan may include policies relating to the preservation, protection, restoration and enhancement of the natural environment, its ecosystems and biological diversity (e.g., ESAs). In Section 919.1, the City may designate a development permit area (DPA) for the protection of the natural environment, its ecosystems and biological diversity. Under the DPA requirements, the City can require that lands, with justification, must not be altered. It may also list exemptions, or qualifications to the requirements. ESAs apply to the Farm Practices Protection (Right to Farm) Act and is subordinate to the authority granted to the City by the BC Local Government Act in matters related to farm operations and land use regulations.

Richmond’s first ESA Bylaw No. 5746 was adopted on December 9, 1991. Generally, the City has designated all ESAs as Development Permit Areas (DPAs) where development is regulated through a review and permitting process intended to ensure appropriate conservation of these ESA resources. The current ESAs are in the 1999 OCP (see maps). Currently, the City exempts, and the Strategy proposes to exempt, farming cultivation from

1 Part 2 Right to Farm: Section 2.2.c . . . the farm operation must not be conducted in contravention of the Public Health Act, Integrated Pest Management Act, Environmental Management Act, the regulations under those Acts or any land use regulation.
requiring an ESA Development Permit. Please refer to the section called “The Importance of Agriculture Lands for ESA Management”, later in Part 1.

Other initiatives by federal, provincial, and regional governments and agencies contribute to ESA management, such as fish habitat protection in intertidal areas of the Fraser River by DFO and FREMP, and the protection of Sturgeon Bank as a provincial Wildlife Management Area since 1998.

**Structure of the Report**

The report is divided into four parts, plus appendices:

- **Part 1** provides a brief introduction to the purpose of the study, defines ESAs, the Ecological Network (EN) and describes the roles, jurisdictions, and responsibilities of different participants in EN and ESA management.
- **Part 2** summarizes the methods and results of the new Ecological Network and ESA inventory, mapping, and data analysis components of the project.
- **Part 3** provides the Management Framework for the Ecological Network, including: a framework, including vision, goals, and strategies for protecting the Ecological Network, and highlighting new ideas for improving City ecological management.
- **Part 4** describes the Implementation Framework to protect and manage the Ecological Network including ESA policies and Development Permit Guidelines.

**The Appendices** provide more detailed information related to the study technical methods, vegetation, mapping, etc.

**Richmond’s Ecological Network**

The ESA Management Strategy is based on the concept of an Ecological Network (EN). The EN is a connected system of natural and semi-natural areas critical to the City’s long-term ecological health. It contributes to the health, vitality and liveability of the City.
Richmond’s Ecological Network includes natural aquatic (freshwater and marine) and terrestrial ecosystems on public and private lands, in both natural and semi-natural states including:

- Gulf of Georgia and Fraser River estuary, tidal marshes, tidal sloughs and mud flats,
- Freshwater marshes, bogs and stream edges,
- Forests, and treed areas and corridors,
- Semi-natural areas such as old fields with a history of cultivation, hedgerows, created ponds and wetlands in urban parks,
- Farmland and farmed edges,
- Wildlife management areas, parks, open space, trails, and greenways, and
- Utility corridors and industrial lands.

**Ecological Services**

To better support Richmond’s anticipated 2041 population of 280,000, its flora and fauna including migrating shorebirds, waterfowl, salmon, other fish, bees and range of animals, Richmond’s Ecological Network provides a range of ecosystem services. These include:

- Storing, filtering and storing water, particularly during flooding,
- Filtering particulates from air,
- Protecting biodiversity,
- Sequestering and storing carbon from the atmosphere, and
- Enriching the health and livability of the City by providing access to nature and green space within Richmond’s increasingly urban neighbourhoods.

**Effective Management of the Ecological Network**

Richmond’s Ecological Network (EN) spans a broad range of land use and tenure, which requires a number of management tools. Some components of the Ecological Network,

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2 The terms “Ecosystem services” and “Green Infrastructure” are often used interchangeably (e.g., Metro Vancouver’s Ecological Health Action Plan uses “green infrastructure”.)
such as fish habitat protection of marine areas, are adequately managed by existing agencies and their regulations. Other EN components require additional policies and regulations ensure that ecological services and other values are preserved. Therefore, the EN will be managed using a mix of tools and strategies depending on ownership, land use and zoning. Some of these regulations will be the responsibility of the City, while others will be managed by other organizations. As described later in the report, the City strives to effectively manage the Ecological Network by reducing administrative redundancy, clearly defining the roles and responsibilities of different participants, and applying fair and consistent policy decisions. Some Ecological Network policies will best be accomplished through education, stewardship programs, incentives, and community involvement.

**Roles and Responsibilities**

The Ecological Network is managed by many jurisdictions including:

**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 partially the foreshore of the Fraser River and watercourses that are connected to fish habitat, under the authority of the Fisheries Act. Species at risk are federally-listed species that are protected through the Species at Risk Act (SARA). However, most of the provisions under SARA are directed at species occurring on federal lands. In the City of Richmond, the Department of National Defence (DND) lands, Port Metro Vancouver, and Vancouver International Airport lands are affected by the regulatory requirements of SARA. At the same time, several federal departments are involved in improving the protection of species at risk.

**Provincial Government** is responsible for the management of water, most wildlife, contaminated sites, and other issues related to maintaining a healthy environment. However, its direct role in the management of environmental values has been reduced by the devolution of responsibility to municipal governments, or standardized through municipal permitting processes. The BC Ministry of Environment is responsible for the regulation of watercourses and riparian areas through the Water Act and Fish Protection Act (Riparian Areas Regulation). It plays a key role through the BC Conservation Date Centre for managing an inventory of rare species and ecological communities, although there is no provincial regulation to conserve most provincially-listed species or ecological communities at risk. It also manages the Sturgeon Banks and South Arm Islands Wildlife Management Areas.
Fraser River Foreshore Jurisdiction. The Fraser River foreshore areas are jurisdictionally complex.

- 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).
- Riparian landowners (of upland properties bordering the foreshore) have riparian rights which include access to navigable waters, erosion protection, and have to apply for ownership of accretion) once it takes on upland characteristics.
- The public is able to use the foreshore; however, the only rights that exist are the right to land boats and to embark from the foreshore in cases of emergency, and the rights of navigation, anchoring, mooring, and fishing over those lands covered by water.
- 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 Fraser River Estuary Management Program (FREMP) coordinates the complex governance system existing within the estuary. The partners are: Environment Canada, Fisheries and Oceans Canada, The Ministry of Environment, Port Metro Vancouver, and Metro Vancouver and involved municipalities.

Port Metro Vancouver and Vancouver International Airport. Two federal government agencies have an important role in the management of Richmond’s environment:

(1) Port Metro Vancouver, a corporation established by the Government of Canada in January 2008, owns and manages land and water-based transportation and industrial lands throughout the region, including areas south of No. 8 Road in south Richmond. Port Metro Vancouver works to reduce environmental impacts associated with its operations including fish habitat management along the Fraser River.

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As defined in section 1 of the Land Act, natural boundary means the visible high water mark of any lake, river, stream or other body of water where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the body of water a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself.
(2) The Vancouver International Airport (YVR) is owned by Transport Canada and is managed by the Vancouver International Airport Authority. While it encompasses most of Sea Island, most of this area is developed and consequently has lower ecological values. YVR has environmental management initiatives and policies to manage lands with ecological values.

**Metro Vancouver Regional District** has a more collaborative and less regulatory role in the management of ESAs and the EN. Metro Vancouver developed a broad biodiversity management strategy⁴ as a guide to better manage ecological assets for the entire region including maps identifying large natural areas and potential connections between them. Their recent publication “Ecological Health Action Plan” (2011) describes a green infrastructure approach to managing lands in the region. In addition, the region’s legislatively required Liquid Waste Management Plan developed by the Metro Vancouver Regional District and its member municipalities guides the management of surface water including stormwater. Metro Vancouver Parks is also responsible for the management of areas such as Iona Beach Regional Park and Don and Lion islands.

**The City of Richmond** is responsible for the planning and regulation of land use within the municipal boundary. This includes enacting an Official Community Plan (OCP), zoning, regulating the use of land, buildings and other structures, and designating parks and other public amenities. Under the BC Local Government Act, municipalities may designate Development Permit Areas to protect the natural environment, ecosystems, and biological diversity (e.g., ESAs). This is the primary legal tool by which the City of Richmond can protect ESAs. While it is permissible for the City to designate ESAs on urban and agricultural lands, it is not permissible for the City to vary land use or density without rezoning. The Local Government Act also provides local government powers to protect and restore the natural environment, its ecosystems and biological diversity through development permits.

Richmond also uses a Tree Protection Bylaw, and a Riparian Management Areas Strategy, to protect trees and riparian management areas respectively.

**Private Owners.** Most lands in Richmond are privately owned and include residential areas, commercial and industrial lands, and agricultural lands. Private landowners have

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⁴ See summary of previous and current work under the Metro Vancouver Regional Biodiversity Strategy see: [www.metrovancouver.org/planning/development/biodiversity/Pages/default.aspx](http://www.metrovancouver.org/planning/development/biodiversity/Pages/default.aspx)
a critical role in avoiding development on ESAs and maintaining ESAs (e.g., trees and other vegetation, and minimizing stormwater runoff.) These private lands include many ESAs, as well as smaller features such as gardens, backyard trees, boulevards plantings, ditches, and ponds that contribute to Richmond’s environment.

**The Importance of Agriculture Lands for Ecological Network (EN) Management**

Richmond’s privately owned agricultural lands play a critical role in maintaining environmental values and ecosystem services. Not only are they essential for food production and provide most of the City’s green space, but almost 52% (763 ha) of ESAs identified by this study are found within the Agricultural Land Reserve. These areas include uncultivated wetlands and 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 and has stated in the past that where farming and ESAs are in conflict, farm cultivation is to take precedence. Farmers need to cultivate their lands to be successful, face many obstacles to be economically viable, and often have few options to avoid farming on ESA lands. Examples of farming operations that protect and respect ecological areas and their beneficial services include non-cultivation of headlands and hedgerows to protect habitat, apiculture (bee hives for honey and pollination purposes), the preservation of riparian setbacks on agricultural water courses and following ecological conservation practices. Farmers often understand the ecological benefits of sound farming practices as they too benefit from clean water, unpolluted soils, and clean air.

The BC Farm Practices Protection Act (FPPA: also known as the Right to Farm Act) provides farmers with the right to farm provided that they use normal farm practices and adhere to applicable land use regulations as defined in the FPPA.
PART 2 – Richmond’s Ecological Network (EN)

What is an Ecological Network?

An Ecological Network is a science based approach to conservation planning that recognizes the importance of an interconnected network of natural (“green”) elements as a means of protecting ecological features and functions across landscapes. An Ecological Network assessment uses Geographic Information Systems (GIS) and the principles of landscape ecology, conservation biology and ecological services to identify a connected network of natural and semi-natural lands most critical to an area’s long-term ecological health. The Ecological Network approach has been used successfully to identify priorities for environmental management in other jurisdictions at both large (e.g., State of Maryland, State of Florida) and small (e.g., City of Edmonton, City of Surrey) scales.

Richmond’s Ecological Network (EN) is composed of both larger natural areas such as Richmond Nature Park, the Sturgeon Banks Wildlife Management Area, South Arm Islands WMA, as well as some of the urban parks, shoreline areas of the Fraser River, greenways, watercourses, and utility corridors. It also includes old fields, bog forest, and wetlands found in agricultural areas and other private lands.

Everyone benefits from the Ecological Network. It functions much like the network of roads or water pipes in sustaining the city; these natural areas store water to reduce flooding, help reduce greenhouse gases by storing carbon in soil and vegetation, and support important fish and wildlife communities. They ensure the health, vitality, and livability of the city.

However, unlike traditional ESA mapping, the Ecological Network approach also emphasizes the spatial relationships between natural and semi-natural areas and their important functional role in beneficial ecological processes, such as sustaining natural flows of water, nutrients, and energy. Key to this approach is the identification of the components of the Ecological Network, described below.
Components of the Ecological Network (EN)

Hubs are the largest intact patches of natural-functioning ecosystems (generally >10 ha). They are capable of supporting entire and diverse populations of animals and plants and associated ecological functions.

Sites are smaller (e.g., 0.25 – 10 ha) 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 between hubs.

Corridors are linear connections which provide linkages between hubs that facilitate movement of species, water, nutrients, and energy. Some corridors may be natural and functioning. Others represent potential connections that are currently impaired or not functioning well but which could, through restoration and enhancement, make an important contribution to the Ecological Network. These potential corridors require further study.

Foreshore and Riparian Areas, although rarely fully natural, provide important buffers to sensitive watercourses and foreshore areas with high environmental value. These ecosystems are often included as part of the network in recognition of their role in protecting the function of adjacent aquatic ecosystems. Many foreshore areas and riparian areas are linear in form and function as corridors.

Parks and Greenways often range widely in their naturalness and ecological function. However, as they 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 (some greenways also function as ecological corridors). Though most parks may have low biodiversity and eco-servicing potential (e.g., sports fields), large expanses of grass do provide filtration (and some carbon sequestering) as well as provide cooling effects. The City can strengthen the ecological network by strategically integrating environmental enhancements into some key parks and greenways. However, parks perform many functions and serve multiple objectives so the potential for environmental enhancements will vary by park making a single target difficult to establish. Environmental enhancements should be a part of a strategic program for some parks with the goal to advance opportunities for environmental enhancements that will net the greatest benefit to the Ecological Network.

The Matrix is the remainder of the land between the hubs, corridors, and other components of the Ecological Network. The Matrix is important because it encompasses most of the land base in the City (e.g., homes, backyards, commercial and industrial areas). In agricultural areas, the matrix is usually made up of actively cultivated fields and farm buildings. The matrix includes significant amounts of green and open space, is permeable, allows species to move to varying degrees between different parts of the network and enables ecological functions to varying degrees. Roads, railways, and other features can represent barriers to the permeability of the matrix.

Enabling Ecosystem Services in the Ecological Network. Ecosystem Network (EN) services are the services provided by ecosystems that benefit humans and are necessary for a healthy planet. In the City of Richmond, natural ecosystems provide a wide range of important services to sustain a strong environment, reduce the need for costly infrastructure, and promote healthy human communities. Examples of these multiple benefits include:

- water and air purification;
- flood protection;
Part 2 – Richmond’s Ecological Network

- waste decomposition;
- crop pollination; and
- Carbon storage and sequestration

Different components of an Ecological Network will vary in how they are currently providing these services and where there may be opportunities to restore or enhance them.

Richmond’s Ecological Network management will be based on three major ecosystem service categories:

<table>
<thead>
<tr>
<th>Biodiversity and Wildlife Habitat</th>
<th>Animal and plant species depend on natural ecosystems for their habitat and biological needs, including economically- and culturally-important species (e.g., salmon, Great Blue Heron) and regionally-rare species and ecological communities. This ecosystem service is the dominant focus of traditional environmental mapping approaches.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Storage and Filtration</td>
<td>Sloughs, watercourses and wetlands provide important functions and capacity for managing water. This is particularly important in a flat, coastal city like Richmond. Ecosystem services in this category include stormwater retention, storage of water for irrigation, infiltration, and purification; flood and drought mitigation; and protection from stream and coastal erosion. Factors that influence water functions include vegetation, soils, location, and imperviousness in the surrounding landscape.</td>
</tr>
<tr>
<td>Recreation and The Enjoyment of Nature</td>
<td>Increasingly, natural ecosystems in Richmond are being valued for their recreation benefits, such as bird watching or nature study, and simply as places to experience and connect with nature. Citizens experience both physical and psychological wellness benefits (e.g., cognitive development in children) through nature. Recreational value is influenced by an area’s uniqueness, habitat diversity, as well as accessibility and proximity to residents. Greenways also provide</td>
</tr>
</tbody>
</table>
an opportunity to protect and use natural corridors
to provide cycling, walking and rolling corridors
between neighbourhoods in the city.
Mapping Richmond’s Ecological Network

Vegetation and Ecological Features Inventory

Because vegetation is one of the best indicators of ecological value and function, all natural and semi-natural vegetation in the City of Richmond was mapped using GIS and recent (spring 2009) air photos. The broad classes of vegetation mapped included forest, shrublands, grass, and mudflats. Wetlands, agricultural fields, and developed vegetation types (lawns, street trees, and gardens) were also mapped when they formed areas of significant size. Vegetation naturalness was also assessed on a scale from 1 (least natural) to 5 (most natural). A field review was conducted to verify the vegetation mapping for accuracy and completeness. Appendix A –Technical Methods provides further details on the vegetation mapping.

Key Results:

A total of 6,841 ha of the City of Richmond’s land area (inside the high water mark) and another 13,861 ha of its marine and intertidal areas (outside the high water mark) were analyzed as part of the vegetation inventory.

Forested plant communities in Richmond include bog forests composed primarily of shore pine and silver 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 forested are made up of planted ornamental trees.

- 9.0% of Richmond’s land area is forested
- 0.7% is evergreen or coniferous forest
- 1.1% is deciduous forest
- 7.2% is mixed forest

Herbaceous cover is the dominant vegetation cover type in Richmond, covering 28.0% of Richmond’s land area. Much of the herbaceous cover is comprised of agricultural fields, rough grass areas, playing fields and lawn areas in parks.

Shrub cover accounts for another 12.4% of Richmond’s vegetation. This includes shrub communities in bogs (composed of Labrador tea, bog blueberry, bog-laurel, bog cranberry, bog rosemary, salal, and heathers), 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. In contrast, 90% of intertidal and marine areas are either sparsely vegetated (e.g., mudflats) or unvegetated, and most of this is open water. More natural sparsely vegetated sites include beaches and mudflats while less natural sites include dyke faces and recently cleared development sites.

**Figure 1 - Vegetation classes (as a percentage of total land area) within the City of Richmond.**
Naturalness

Of the 20,702 ha of area mapped in Richmond’s boundary (land and water), 57.6% is classified as having some natural Ecological Network beneficial characteristics (classes 3, 4, and 5; Map 2). Only 12.4% of Richmond’s land area has natural characteristics.

Within Richmond’s land area, approximately:

1. 560 ha (5.9%) is classified as semi-natural (Class 3);
2. 558 ha (4.3%) of vegetation is classified as mainly natural (Class 4), and
3. 283 ha (2.2%) was classified as natural (Class 5).

Areas analyzed as mainly natural (Class 4) were predominantly remnant bog forest. Because of its natural and cultural history (was originally part of the Fraser River delta; most land was dyked to allow for settlement), the only vegetation classified as natural (Class 5) was the foreshore marshes and mudflats on Sturgeon Banks and the western perimeter of Sea Island. Figure 3 shows the naturalness values as a proportion of Richmond’s land area (including areas not mapped).

Figure 2 – Naturalness of Vegetation Areas (as a percentage of total land area)

The overwhelming majority of Richmond’s land area is urban or culturally altered. The above graph shows that there are very few natural areas remaining in Richmond, making protection of these areas even more important. To assist in Ecological Network delineation, existing data was analyzed on other ecological features in Richmond. Examples of data used included data on the watercourses, riparian areas, foreshore
areas (including the dyke crest and high water mark), existing parks, greenways, and trails.
**Figure 3 - Vegetation inventory summary results.**

*Note: Summary includes all mapping completed within the City of Richmond boundary and does not include any regional mapping outside of the City boundary.*

<table>
<thead>
<tr>
<th>Class</th>
<th>Area (ha)</th>
<th>Percent</th>
<th>Area (ha)</th>
<th>Percent</th>
<th>Area (ha)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land</strong></td>
<td></td>
<td></td>
<td><strong>Intertidal and Marine</strong></td>
<td></td>
<td><strong>Total</strong></td>
<td></td>
</tr>
<tr>
<td>Forest (FO)</td>
<td>1159.0</td>
<td>9.0</td>
<td>46.8</td>
<td>0.3</td>
<td>1205.8</td>
<td>4.5</td>
</tr>
<tr>
<td>Evergreen Forest (FO-EV)</td>
<td>89.6</td>
<td>0.7</td>
<td>0.5</td>
<td>0.0</td>
<td>90.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Deciduous Forest (FO-DE)</td>
<td>146.9</td>
<td>1.1</td>
<td>4.1</td>
<td>0.0</td>
<td>151.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Mixed Evergreen-Deciduous Forest (FO-MX)</td>
<td>922.6</td>
<td>7.2</td>
<td>42.2</td>
<td>0.3</td>
<td>964.7</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Shrubland (SH)</strong></td>
<td>1595.8</td>
<td>12.4</td>
<td>37.0</td>
<td>0.3</td>
<td>1632.8</td>
<td>6.1</td>
</tr>
<tr>
<td>Evergreen Shrubland (SH-EV)</td>
<td>4.8</td>
<td>0.0</td>
<td>0.0</td>
<td>-</td>
<td>4.8</td>
<td>-</td>
</tr>
<tr>
<td>Deciduous Shrubland (SH-DE)</td>
<td>1590.8</td>
<td>12.4</td>
<td>37.0</td>
<td>0.3</td>
<td>1627.8</td>
<td>6.1</td>
</tr>
<tr>
<td>Mixed Evergreen-Deciduous Shrubland (SH-MX)</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Herbaceous (HB)</strong></td>
<td>3602.8</td>
<td>28.0</td>
<td>1238.5</td>
<td>8.9</td>
<td>4841.3</td>
<td>18.1</td>
</tr>
<tr>
<td>Perennial Graminoid Vegetation (HB-GR)</td>
<td>2580.7</td>
<td>20.1</td>
<td>8.4</td>
<td>0.1</td>
<td>2589.1</td>
<td>9.7</td>
</tr>
<tr>
<td>Annual Graminoid or Forb Vegetation (HB-AN)</td>
<td>777.2</td>
<td>6.0</td>
<td>0.0</td>
<td>-</td>
<td>777.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Hydromorphic Rooted Vegetation (HB-HY)</td>
<td>244.9</td>
<td>1.9</td>
<td>1230.1</td>
<td>8.8</td>
<td>1475.0</td>
<td>5.5</td>
</tr>
<tr>
<td><strong>Sparse Vegetation (SV)</strong></td>
<td>293.9</td>
<td>2.3</td>
<td>247.3</td>
<td>1.8</td>
<td>541.3</td>
<td>2.0</td>
</tr>
<tr>
<td>Boulder or Cobble Sparse Vegetation (SV-BO)</td>
<td>43.6</td>
<td>0.3</td>
<td>18.0</td>
<td>0.1</td>
<td>61.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Unconsolidated Material Sparse Vegetation (SV-UC)</td>
<td>250.4</td>
<td>1.9</td>
<td>229.4</td>
<td>1.6</td>
<td>479.8</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Unvegetated (UV)</strong></td>
<td>189.3</td>
<td>1.5</td>
<td>1229.1</td>
<td>88.3</td>
<td>12480.8</td>
<td>46.6</td>
</tr>
<tr>
<td>Unvegetated Unconsolidated Material (UV-UC)</td>
<td>42.9</td>
<td>0.3</td>
<td>591.0</td>
<td>4.2</td>
<td>633.9</td>
<td>2.4</td>
</tr>
<tr>
<td>Unvegetated Water (UV-WA)</td>
<td>146.4</td>
<td>1.1</td>
<td>11700.5</td>
<td>84.0</td>
<td>11846.9</td>
<td>44.2</td>
</tr>
</tbody>
</table>

Total: 6840.9  53.2  13861.2  99.6  20702.0  77.3

1Includes all areas above the high water mark
2Includes all areas below the high water mark
### Figure 3 - Vegetation inventory summary results. (cont’d).

*Note: Summary includes all mapping completed within the City of Richmond boundary and does not include any regional mapping outside of the City boundary.*

<table>
<thead>
<tr>
<th>Naturalness Value</th>
<th>Land(^1)</th>
<th>Intertidal and Marine(^2)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ha)</td>
<td>Percent</td>
<td>Area (ha)</td>
</tr>
<tr>
<td>1 (Cultural)</td>
<td>3914.3</td>
<td>30.4</td>
<td>13.9</td>
</tr>
<tr>
<td>2 (Altered)</td>
<td>1324.8</td>
<td>10.3</td>
<td>27.2</td>
</tr>
<tr>
<td>3 (Semi-natural)</td>
<td>760.4</td>
<td>5.9</td>
<td>44.1</td>
</tr>
<tr>
<td>4 (Mainly natural)</td>
<td>558.4</td>
<td>4.3</td>
<td>1932.4</td>
</tr>
<tr>
<td>5 (Natural)</td>
<td>283.1</td>
<td>2.2</td>
<td>11843.5</td>
</tr>
<tr>
<td>Not classified</td>
<td>6020.1</td>
<td>46.8</td>
<td>61.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Forest Age</th>
<th>Area (ha)</th>
<th>Percent</th>
<th>Area (ha)</th>
<th>Percent</th>
<th>Area (ha)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Forest (O)</td>
<td>0.0</td>
<td>-</td>
<td>0.0</td>
<td>-</td>
<td>0.0</td>
<td>-</td>
</tr>
<tr>
<td>Mature Forest (M)</td>
<td>1064.7</td>
<td>8.3</td>
<td>82.9</td>
<td>0.6</td>
<td>1147.6</td>
<td>4.3</td>
</tr>
<tr>
<td>Young Forest (Y)</td>
<td>86.2</td>
<td>0.7</td>
<td>0.9</td>
<td>0.0</td>
<td>87.1</td>
<td>0.3</td>
</tr>
</tbody>
</table>

\(^1\)includes all areas above the high water mark  
\(^2\)includes all areas below the high water mark

### Summary Data

| Total Area of City of Richmond | 26784.0 ha |
| Total Land Area                | 12861.0 ha |
| Intertidal and Marine          | 13923.0 ha |

Number of Mapped Polygons 7663

Total Area Mapped (ha) 20702.0 ha

Total Area Mapped (%) 77.3%

Polygon Area Range 0–7274 ha

Mean Polygon Area 3.02 ha
Defining Ecological Network Components

Specific size and naturalness criteria were used to extract the largest areas of semi-natural to natural vegetation and form the basis of Richmond’s Ecological Network (see Appendix A for technical methods).

1. Ecological Network Hubs

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

Key Results:

1. In total, 37 hubs and 103 sites are delineated for inclusion in Richmond’s Ecological Network.
2. Hubs range from well-known natural areas such as Richmond Nature Park, Sturgeon Banks and South Arm Islands WMA, Terra Nova Rural Park, and the Sea Island Conservation Area (SICA), north of the Vancouver International Airport to lesser known areas such as Horseshoe Slough, the Northeast Bog Forest, mature cottonwood forests along River Road, and bog forest areas on either side of Shell Road south of Westminster Highway.
3. The five largest hubs within the City of Richmond are Sturgeon Banks (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); Sea Island Conservation Area and surrounding areas north of the airport).
4. Most of Richmond’s hubs are either outside of the dyke (70.0%) or within Richmond’s Agricultural Land Reserve (29.5%). Only 0.5% of Richmond’s hubs are inside the dyke and not on ALR lands.
5. The largest hubs on Lulu Island are along River Road (82 ha; River Road between Kartner Rd and Nelson Rd), 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 Richmond’s Agricultural Land Reserve.
2. **Ecological Network Corridors**

An analysis incorporating the permeability (or, conversely, impedance) of the landscape in Richmond for the movement of biodiversity was used to identify an initial network of existing and potential ecological corridors between hubs (see Map 5). Vegetation mapping was combined with existing land use, roads, and other data layers to map the impedance of the landscape to species movement. The analysis sought to delineate paths offering the least resistance (e.g., preferred land cover types for wildlife species, lowest number of barriers) to wildlife movement between hubs. This initial corridor network was then modified and supplemented by removing long corridors with low restoration potential, adjusting corridors to follow existing greenways and riparian corridors where they were in close proximity, and adding new corridors where greenways or riparian corridors have been designated. The final corridors were also classified according to their type (e.g., dyke/foreshore, riparian, agricultural) and current function (functioning, impaired, and non-functioning).

**Key Results:**

1. In total, 74.3 km of corridors were delineated within Richmond’s Ecological Network. 28.8 km (38.8%) of these corridors are located along foreshore areas within the Agricultural Land Reserve. 16.7 km (22.5%) of these corridors are located along foreshore areas. Although Richmond has 50 km of foreshore, only 16.7 km of the foreshore is within the Ecological Network.

2. 12.4 km of corridors (16.7%) mapped in Richmond were identified as functioning and currently provide connectivity between adjacent hubs within the network. 44.6 km of corridors (60.1%) were classified as impaired and, while providing some connectivity currently, could be improved with minor restoration and enhancement. 17.3 km of corridors (23.2%) were identified as non-functioning. Non-functioning corridors currently do not provide connectivity but represent possibilities to improve connectivity during large-scale City planning.

3. **Ecological Network Shoreline Zones:**

Shoreline areas (lands within 30 m (landward) of the high water mark) were added to the Ecological Network regardless of their land use, vegetation, or naturalness. These areas contribute to the health of the adjacent intertidal zone and provide important habitat for wildlife. They are also important sites to manage during development and redevelopment when ecological features such as riparian vegetation can be protected or restored.
4. Ecological Network Watercourses and Riparian Management Areas

Watercourses and their associated Riparian Management Areas (RMAs; 15 m and 5 m setbacks from selected watercourses in Richmond) also form important components of Richmond’s Ecological Network.

5. Ecological Network Sites

Sites are areas of vegetation semi-natural to natural vegetation (naturalness ≥ 3) between 0.25 ha and 10 ha in size (see Appendix A for further details).

Key Results:

1. 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 Cambie West 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).

2. Concentrations of sites exist within the Bridgeport, West Cambie, Broadmoor, and Hamilton neighbourhoods of Richmond.

6. Public Parks and Greenways

Public parks and greenways offer opportunities for some strategic City-led restoration and enhancement opportunities focusing on ecological values. Although many public parks and greenways have only small amounts of natural ecosystems, the City can play a leadership role in Ecological Network protection and improvement by better managing some of them for ecological enhancement. Public parks and greenways (including schools) cover 586.5 ha or 4.6% of the land area of Richmond.
### Figure 4 - Summary of Richmond’s Ecological Network components

*Note: Due to overlap in the boundaries between some Ecological Network components, numbers in this table do not add up to total areas.*

<table>
<thead>
<tr>
<th>Definition</th>
<th>Hubs</th>
<th>Sites</th>
<th>Ecological Corridors&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Shoreline / Intertidal and Riparian Buffer Zones</th>
<th>Public Parks and Greenways</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large areas of natural and semi-natural vegetation</td>
<td>&gt; 10 ha</td>
<td>0.25–10 ha</td>
<td>30 m wide corridor</td>
<td>Linear strips along dyke areas and watercourses to protect aquatic habitats and other values</td>
<td>Various</td>
<td>Various</td>
</tr>
<tr>
<td>Small areas of natural, semi-natural, and semi-modified vegetation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>City-owned and managed recreation lands, including schools; opportunities for restoration and enhancement</td>
<td></td>
</tr>
<tr>
<td>Linear connections between hubs, variable width when finally established</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Areas surrounding hubs, sites, and corridors including urban and other modified areas and open water</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size</th>
<th>Total Land Area&lt;sup&gt;2&lt;/sup&gt;</th>
<th>% of Land Area&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Total Intertidal and Marine Area&lt;sup&gt;3&lt;/sup&gt;</th>
<th>% of Intertidal and Marine Area&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Total Area of City&lt;sup&gt;4&lt;/sup&gt;</th>
<th>% of Area of City&lt;sup&gt;4&lt;/sup&gt;</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,596.5 ha</td>
<td>12.6%</td>
<td>2,420.8 ha</td>
<td>17.1%</td>
<td>4,017.4 ha</td>
<td>15.0%</td>
<td>37 hubs</td>
</tr>
<tr>
<td></td>
<td>178.1 ha</td>
<td>1.4%</td>
<td>30.9 ha</td>
<td>0.2%</td>
<td>209.0 ha</td>
<td>0.8%</td>
<td>102 sites</td>
</tr>
<tr>
<td></td>
<td>180.5 ha</td>
<td>1.4%</td>
<td>6.1 ha</td>
<td>0.0%</td>
<td>186.6 ha</td>
<td>0.7%</td>
<td>84 corridor segments</td>
</tr>
<tr>
<td></td>
<td>304.7 ha</td>
<td>6.0%</td>
<td>469.6 ha</td>
<td>3.3%</td>
<td>1224.2 ha</td>
<td>4.6%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>589.0 ha</td>
<td>4.7%</td>
<td>47.4 ha</td>
<td>0.3%</td>
<td>636.4 ha</td>
<td>2.4%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>9,352.9 ha</td>
<td>73.9%</td>
<td>11,157.5 ha</td>
<td>79.0%</td>
<td>20,510.3 ha</td>
<td>76.6%</td>
<td>-</td>
</tr>
</tbody>
</table>

<sup>1</sup>Includes functioning, impaired, and non-functioning corridors

<sup>2</sup>Includes all areas above the high water mark

<sup>3</sup>Includes all areas below the high water mark

<sup>4</sup>Includes all areas within the City boundary, including intertidal and marine areas
### Figure 5 - Number and amount of hubs, sites, and corridors by island and land use type

<table>
<thead>
<tr>
<th>Island/Land use</th>
<th>Hubs</th>
<th>Sites</th>
<th>Corridors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ha)</td>
<td>% of area</td>
<td>Area (ha)</td>
</tr>
<tr>
<td>Lulu Island</td>
<td>987.9</td>
<td>9.3%</td>
<td>170.8</td>
</tr>
<tr>
<td>Port</td>
<td>0.0</td>
<td>0.0%</td>
<td>0.0</td>
</tr>
<tr>
<td>Urban</td>
<td>85.2</td>
<td>1.9%</td>
<td>31.0</td>
</tr>
<tr>
<td>Industrial</td>
<td>39.1</td>
<td>3.7%</td>
<td>26.3</td>
</tr>
<tr>
<td>Agricultural</td>
<td>863.7</td>
<td>17.8%</td>
<td>73.2</td>
</tr>
<tr>
<td>Sea Island and Iona Island</td>
<td>385.5</td>
<td>23.2%</td>
<td>2.4</td>
</tr>
<tr>
<td>Airport</td>
<td>100.0</td>
<td>7.9%</td>
<td>0.7</td>
</tr>
<tr>
<td>Agricultural</td>
<td>103.9</td>
<td>99.2%</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>181.6</td>
<td>61.3%</td>
<td>1.8</td>
</tr>
<tr>
<td>Mitchell Island</td>
<td>-</td>
<td>0.0%</td>
<td>2.8</td>
</tr>
<tr>
<td>Smaller Islands</td>
<td>223.1</td>
<td>98.2%</td>
<td>2.2</td>
</tr>
<tr>
<td>Intertidal and Marine Areas</td>
<td>2,420.8</td>
<td>17.1%</td>
<td>30.9</td>
</tr>
<tr>
<td>City of Richmond</td>
<td>4,017.4</td>
<td>15.0%</td>
<td>209.0</td>
</tr>
</tbody>
</table>

1 For hubs, sites, or corridors that lie across community boundaries, only the area of the hub within that planning area was included in the total hub area calculation.
Evaluating the Relative Value of the Ecological Network

The relative importance of different components of Richmond’s Ecological Network was evaluated using a series of criteria that measure each component’s existing ecological conditions and functions. Criteria were developed based on well-established landscape ecology, stormwater management, and planning principles and assess network components in each of the three major Ecosystem Network service categories highlighted previously:

Biodiversity and Wildlife (7 criteria):
1. Hub size (ha)
2. Area-to-perimeter ratio (roundness)
3. Area-weighted average naturalness
4. # of vegetation classes with naturalness ≥ 3
5. % interior forest (≥ 50 m from edge)
6. % habitat with naturalness ≤ 2
7. Road density (m/ha)

Sloughs, Watercourses, and Wetlands (5 criteria):
1. % total impervious area (TIA) within hub
2. Hub’s % contribution to overall catchment TIA
3. Amount and % of riparian buffer within hub (within 30 m of watercourse)
4. % Riparian Forest Integrity within hub
5. Amount and % wetlands within hub

Recreation
1. Number of dwellings within a 10 minute walk of hub or site
2. Number of hubs or sites within a 10 minute walk of hub or site
3. Number of distinct landscapes within the hub or site
4. Number of connections to existing recreation infrastructure

To evaluate the relative value of network components, each hub and site was numerically ranked from highest (1) to lowest (=total number of hubs or sites) using values calculated for each of the 16 criteria listed above. Overall ecological significance rankings (or "scores") within each broader category were then calculated by summing the numerical ranks derived for each the criteria within each category.
PART 3 – Managing the Ecological Network

Richmond’s 2041 Ecological Network Vision (Map 2)

The City of Richmond supports an Ecological Network of natural areas that provide critical ecological services, including protecting biodiversity, storing and filtering water, sequestering and storing carbon from the atmosphere, and enriching the lives of the city’s residents. The Network encompasses both terrestrial and aquatic (freshwater and marine) areas, include public and private lands, and encompass a range of land uses such as wildlife management areas, municipal parks, agricultural areas, utility corridors, and industrial lands.

The City of Richmond provides a critical role in managing a portion of the Ecological Network through the use of OCP ESA development permits, riparian management areas, plans, policies and municipal parks. Other components of the EN are managed as regional parks, fish habitat, or wildlife management areas.

Goals for Managing the Ecological Network

Goal 1
Preserve a connected network of natural and semi-natural areas. Richmond’s Ecological Network (EN) will protect a system of public and private lands through policy, guidelines, regulations, covenants, land donation, innovative development planning, conservation leases, voluntary stewardship, and acquisition. The City of Richmond will manage part of the Ecological Network through the use of ESA Development Permit Areas (DPAs), Riparian Management Areas (RMAs), municipal parks, and other approaches. Other organizations are fully expected to manage other components of the EN such as regional parks, Wildlife Management Areas, fish habitat, and conservation areas.

The network consists of six components:

i) large hubs (natural areas >10 ha);
ii) smaller sites (natural areas from 0.25–10 ha);
iii) ecological corridors;
iv) watercourses and riparian areas;
v) shoreline areas;
vi) parks and greenways.
Goal 2
Reconnect people with nature. Richmond’s neighbourhoods are increasingly urban, which reduces opportunities for residents to experience biodiversity and ecological processes. This disconnection from the natural world can reduce the health and liveability of urban communities. There are a range of opportunities for reconnecting people to nature - from creating small wetlands, to planting trees and native vegetation in backyards.

Goal 3
Maintain and enhance the value of ecosystems and ecosystem services. Ecosystem services encompass the range of resources and processes that are supplied by natural ecosystems. They include the storage and filtration of water by plants and soil, the development of soil through decomposition, air quality improvements through filtration by trees and plants, the capture and storage of carbon by trees and vegetation, and the pollination of food crops by bees and other insects. Richmond’s ESA Strategy expands the emphasis of environmental management to focus on three ecosystem services:

1. biodiversity and wildlife habitat;
2. water storage and filtration; and
3. recreation and the enjoyment of nature.

There are additional ecosystem services that are supplied by natural ecosystems. The three components listed above were chosen as representative samples that are quantifiable and directly linked to EN and ESA preservation and management.

Goal 4
Strategically connect and restore the ecological value of key parks and public lands. Many municipal parks, schools and other publically owned lands provide opportunities for enhancing ecosystem services, reconnecting people to nature, and enriching Richmond’s neighbourhoods through green space. Ecosystem restoration on public lands demonstrates the leadership of the City of Richmond in meeting the ecological goals of the ESA Management Strategy. It should be noted that ecosystem restoration does not necessarily entail the re-creation of original landscapes, but rather the creation of a modified landscape with enhanced ecological value such as biofiltration wetlands, raingardens, community gardens and urban forests. Landscape design should integrate ecological function wherever possible. Design opportunities should be explored that serve multiple uses, such as providing tree/shrub beds that provide a
buffer between adjacent land uses while offering habitat and a high value food source for wildlife.

Although city parks and other public lands have multiple and sometimes competing program requirements, restoring ecological value to some of these lands should remain high on the agenda of public land stewardship. This will require a renewed effort by Richmond Parks, in conjunction with other departments, to evaluate the parks system to determine high value candidate sites and priority projects that support the strengthening of the EN, and also to identify opportunities for multiple benefit projects, such as greenway/rainwater management corridors. Such an initiative would require the preparation of park resource management plans that would outline the capital costs and operations budgets required to sustain management prescriptions.

**Goal 5**

Integrate the management of the Ecological Network with other City responsibilities (e.g., park operations, flood protection) and with other jurisdiction’s responsibilities (e.g., DFO, FREMP). The City of Richmond is responsible for a range of activities that are directly or indirectly linked to the management of the Ecological Network. This includes managing rainwater, drainage, flood prevention, watercourses, transportation planning, park management, and energy sustainability. Continued coordination among departments, and heightened staff awareness and capacity will be needed to implement the ESA Management Strategy.
Principles for Managing the Ecological Network

The ESA Management Strategy (including management of the Ecological Network) is based on the following principles:

1. **Research** – The establishment of a functioning Ecological Network for the City of Richmond to be facilitated by rigorous and transparent science by the City, consultants, developers and other jurisdictions.

2. **Protect and Strengthen** – At its core, the Strategy will promote vibrant, natural spaces exist for coming generations.

3. **Reduce Administrative Redundancy** – Generally when others (e.g., Federal, Provincial, Regional governments) manage Ecological areas, the City will not also regulate them.

4. **Effective Communication** – Effective communication between both City departments and Richmond's citizens will promote effective implementation of the EN policies and actions.

5. **Cost Effectiveness** – The creation of the Ecological Network should not create an undue financial burden for the City.

6. **Cost Sharing** – Maintaining, expanding and protecting the Ecological Network should be shared by all appropriate parties (e.g., federal, provincial, regional, city, NGOs, property owners).

7. **Partnerships** – The management of the Ecological Network requires many agencies including senior governments, the region, the City, citizens, farmers, businesses, community and environmental organizations to continue to work together to ensure a sound ecological future for the City. Partnerships formed to support the EN must be holistic and communicative.

Effective Management of the Ecological Network

Richmond’s Ecological Network (EN) includes a broad range of land uses, ownership, and management activities. Some components of the EN are adequately managed by existing regulations or ownership such as fish habitat protection of intertidal marine areas, while others need additional regulations to ensure that ecological services and other values are preserved. Therefore, the EN will be managed with a mix of regulations, tools, and strategies depending on ownership and authority. Some of these regulations will be the responsibility of the City, while others will be managed by other organizations. As described in the principles section, the City’s approach to managing the EN strives to reduce regulation redundancy by relying on existing
measures. Figure 5, below, summarizes the range of regulations, laws, and policies for managing the Ecological Network.

**Table 5**: Components of the Ecological Network and Key Management Approaches.

<table>
<thead>
<tr>
<th>Components</th>
<th>Management Jurisdictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intertidal Zone</td>
<td>• Due to its importance, the Intertidal Zone within 30m of the high water mark is managed as ESA DPAs by the City of Richmond.</td>
</tr>
<tr>
<td></td>
<td>• This zone is also managed as fish habitat by Fisheries and Oceans Canada (DFO) through FREMP and Port Metro Vancouver.</td>
</tr>
<tr>
<td></td>
<td>• Intertidal zones are also managed under the Navigable Waters Protection Act, the Dike Maintenance Act, and other legislation.</td>
</tr>
<tr>
<td>Shoreline Zone</td>
<td>• Portions of the shoreline zone (e.g., forest areas) are also managed as fish habitat by Fisheries and Oceans Canada (through FREMP and Port Metro Vancouver).</td>
</tr>
<tr>
<td></td>
<td>• Shoreline areas within 30 m (landward) of the high water mark are managed as ESA DPAs by the City of Richmond.</td>
</tr>
<tr>
<td></td>
<td>• Trees within the shoreline zone are also protected through the City of Richmond’s Tree Protection Bylaw.</td>
</tr>
<tr>
<td>Hubs (&gt;10 ha) and Sites (&lt;10 ha)</td>
<td>• The portion of Hubs and Sites outside of municipal parks, regional parks, WMAs, and RMAs are managed as ESA DPAs by the City of Richmond. They include both public and private lands.</td>
</tr>
<tr>
<td>Functioning Ecological Corridors</td>
<td>• Functioning corridors outside of municipal parks, regional parks, WMAs, and RMAs are managed as ESA DPAs by the City of Richmond.</td>
</tr>
<tr>
<td></td>
<td>• Trees within functioning corridors are also protected through the City of Richmond’s Tree Protection Bylaw.</td>
</tr>
</tbody>
</table>
### Impaired and Non-functioning Corridors
- Although not ESAs, impaired and non-functioning corridors represent opportunities to provide connecting corridors between hubs and sites. Managed through City neighbourhood and Parks planning processes, they will be used as guidance for establishing new greenways and trails during future re-development.

### Additional Intertidal and Subtidal Areas
- Although not ESAs, intertidal areas >30 m seaward of the high water mark, and subtidal areas including portions of the Fraser River and Strait of Georgia are protected as fish habitat by Fisheries and Oceans Canada. Other laws and regulations also apply to these areas. Some are part of WMAs.

### Municipal Parks
- Although not ESAs, municipal parks mapped as Hubs, Sites, or other components of the Ecological Network are managed by the City of Richmond’s Parks Department and are not designated as ESA Development Permit Areas. The Strategy encourages the Parks Department to assess its parks inventory for candidate sites for enhanced ecological restoration and to set a priority action list that can be shared with other departments to benefit from cost sharing dual initiatives. The Richmond School District would be consulted during the process.

### Greenways
- Although not ESAs, the ecological value of greenways is managed by the City of Richmond’s Parks Department using the 2010 Richmond Trail Strategy. Greenway design should incorporate enhanced ecological functions wherever possible, integrating planting design with rainwater management, adjacency buffers, shade trees, etc.

### Riparian Management Areas (RMAs)
- Although not ESAs, RMAs encompass 5 m or 15 m zones surrounding ecological important watercourses. RMAs fulfill Richmond’s requirements under the Provincial Fish Protection
### Part 3 – Managing the Ecological Network

**Richmond ESA Management Strategy** *(September 10, 2012 draft)*

- Development activities that impact fish habitat (including riparian habitat) in RMAs may require approval under the Fisheries Act.

| **Regional Parks and Park Reserves** | Although not ESAs, Iona Beach Regional Park and park reserves are managed by Metro Vancouver Parks. Metro Vancouver’s “Experience the Fraser” is a unique vision to connect communities, parks, natural features, historic and cultural sites and experiences along the Lower Fraser River. Metro Vancouver’s Regional Parks and Greenways Plan update is available at [www.metrovancouver.org](http://www.metrovancouver.org/about/publications/Publications/ParksGreenwaysPlan.pdf) |
| **Wildlife Management Areas (WMA)** | Although not ESAs, the Sturgeon Banks WMA and South Arm Marshes WMA are managed by the BC Ministry of Environment through the Wildlife Act. |
| **Sea Island Conservation Reserve (SICA)** | Although not an ESA, Sea Island Conservation Area (SICA) is owned by the Government of Canada and managed by the Canadian Wildlife Service to maintain bird habitat. |
| **Department of National Defense Lands** | Managed by DND according federal laws including Species at Risk Act (SARA) and Canadian Environmental Assessment Act (CEAA), an OCP ESA is proposed to signal city ecological management expectations. |
| **Garden City Lands** | The Garden City Lands are not included in the Strategy and are subject to separate study. |
Big Ideas

“Big Ideas” are possible strategies new to Richmond that can be explored to preserve and manage Richmond’s Ecological Network. Although the Big Ideas will require an effort by the City to incorporate these initiatives into daily practice, the benefits to the Ecological Network may be considerable.

Idea 1

**Incorporate more Ecosystem Services into the ESA Development Permit Process and Other City Processes (e.g., City Park’s Planning, Tree Bylaw Implementation)**

Currently, the City’s ESA DP Guidelines are used to protect designated ESAs. Under Idea 1, the development permit review process could emphasize the protection of a broader range of values and ecosystem services in the Ecological Network areas including biodiversity, hydrologic function, carbon sequestration and storage, and eco-recreation. Development Permit guidelines and application requirements are found in Part 4 - Implementation.

Idea 2

**Strategically Restore Ecological Values in Urban Parks**

The Parks department supports the Ecological Network Concept, as it promotes strategic park land acquisition, restoration and enhancement. Currently, Parks has mechanisms in place that promote ecological health. Under Idea 2, Parks would consider designating a portion of key city parks for habitat creation such as wetlands, meadows, forest, and butterfly gardens, to promote the experiential qualities of nature such as frog habitat and cattail marshes, with priority given to initiatives that will provide the greatest benefit to the EN. In addition, these projects will demonstrate strategies and techniques that can be used in adjacent private lands.

Idea 3

**Develop Ecological Network Enhancement Priorities**

Currently, the City has several funding mechanisms in place that are intended to enhance ecological functions, and should utilize the ESA Management Strategy and inventory to continue to identify opportunities for parkland acquisition and restoration and enhancement. The City could identify key sites for acquisition, restoration and
enhancement for inclusion in the annual Capital planning process. As part of an Ecological Network Enhancement Plan, the City could formalize this process by identifying and prioritizing Ecological Network acquisition, restoration and enhancements city-wide. This option is used in part to avoid acquiring scattered and isolated sites, and to change limited resources into parks and amenities of higher priority. Public access is the decisive factor in determining whether municipalities consider an environmentally sensitive area to represent a passive park amenity. If public use and appreciation are encouraged through the placement of trails, boardwalks and viewpoints, the area effectively represents a passive park. A cost estimate could be developed for each project, in order of priority.

Additional funding for these priorities may include:

**Amenity Contributions**: Often developers are required to contribute to an amenity within the community, such as a park, recreational facility, community centre, etc. Although the City currently uses this program, “Amenities” may be expanded to include priority projects identified as part of the Ecological Network.

**Habitat Compensation**: Possible compensation by a developer for on-site habitat loss where such loss cannot be avoided or satisfactorily mitigated on site. The value of the loss can be estimated by one or a combination of methods, at the City’s discretion, and the funds would be collected by the City to be directed to the Ecological Network Fund. Examples of how to determine the amounts to be paid as compensation include:

- the cost of replacing the same habitat as that being lost on a minimum 2:1 (area) basis, as specified by a Qualified Environmental Professional (QEP). The compensation monies collected could then be used to cover design, materials and maintenance costs on city-owned land identified for enhancement.
- land value of the habitat being lost on a minimum 2:1 (area) basis. This would be appropriate for a priority project where land would need to be purchased, such as a parcel to reinforce an important corridor.
Idea 4
Create an Ecological Network Compensation Bank

Large developments may involve unavoidable loss of ecological values (e.g., habitat stormwater management, carbon retention, etc.) that cannot be effectively protected, replaced or mitigated within the project. Under Idea 4, the municipality could set up an ecological compensation bank funded by senior governments, developers, partners and possibly the City as a tool for anticipating and compensating for future unavoidable ecological loss associated with development. The aim would be to proactively restore non/low functioning ecological areas to create high functioning areas.5

The advantages of establishing a compensation banking approach include:
- enables a systematic approach to off-site compensation;
- provides a constructive and efficient option for the development community to address cases when on-site losses are unavoidable;
- provides opportunity to collate resources, reduce ecological fragmentation and achieve higher ecological gain for monies invested; and
- supports the City and community plan for a complete community.

Sites eligible for funding from the EN bank would be identified proactively to ensure compatibility with existing and planned community uses. Potential sites could include both private and public lands. Criteria would be established to ensure that priority remained for on-site protection6 and the only “unavoidable” impacts would be eligible for off-site compensation. A considered approach would also need to be developed to ensure that projects met important environmental principles of equivalency (e.g., off-site locations would be near impact sites, off-site locations would achieve equivalent or higher quality, etc.).

5 Precedent example: the North Fraser Harbour Habitat Compensation Bank. The North Fraser Port Authority created a habitat compensation banking system – operated since 1993 by the North Fraser Harbour Commission in partnership with the DFO – to facilitate compensation for industrial, port, commercial, or recreational developments where on-site mitigation or compensation would be impractical or inadequate, and where off-site compensation would be considered acceptable. http://www.speciesbanking.com/bank/north_frraser_harbour_habitat_bank

6 Studies of habitat compensation projects have indicated that re-created areas have rarely reached the predicted productivity levels comparable to the areas they were replacing.
Examples of high value ecological projects include initiatives such as wetland construction, edge vegetation programs for hubs, sites, and corridors, or land purchase and vegetation programs for non-functional or impaired corridors. A key emphasis could also be placed on intertidal area enhancement initiatives. In Richmond, given the need to improve the flood management system in the face of climate change induced sea level rise, an opportunity exists to develop projects proactively that compensate for likely future dike improvements that would generate losses in coastal wetlands. Dike upgrades could impact coastal wetland and mudflat ecosystems, depending on whether they are extended into the intertidal zone or the developed side of the dike. Ironically, the loss of these ecosystems increase flood risk and reduce Richmond’s ability to adapt to change. As such, the City could look for candidate areas where this type of environmental asset could be recreated with relatively low impact on existing developed areas.

**Idea 5**

**Assist Farmers in Protecting Ecological Network Values on Agricultural Lands**

There are generally three approaches to solutions geared to help farmers in protecting ESAs on agricultural lands:

**Voluntary** initiatives geared towards ecological best practices and ESA protection that the farmer may or may not choose to participate in. Many farmers, understanding the requirements for healthy plant or livestock growth, are often in tune with good environmental practices. Ecological and other Habitat Reserves, “Natural” parks and recreation reserves are permitted uses in the ALR. It is possible that these uses could be undertaken voluntarily by a farmer as a conservation covenant used to protect ecological values on farm land, but the legality of placing a covenant on agricultural land would need to be investigated.

**Stewardship programs** are voluntary and combine educational programs with a sense of “doing the right thing.” Stewardship programs are effective means to protecting

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7 City of Richmond publication

8 In 2004, the Growing Green Project, a two-year law and policy reform project on sustainable food in British Columbia, had raised the issue that “a covenant that prohibits the use of agricultural land for farm purposes has no effect until approved by the Commission.”

[www.ffcf.bc.ca/GrowingGreen.html](http://www.ffcf.bc.ca/GrowingGreen.html)
ecological value in a spirit of education, trust, and respect. However, the key drawback of a voluntary approach to protecting, ecological values is the issue of non-compliance.

**Incentives** may be provided for farmers that achieve high environmental standards. Incentives can be a way to entice or compensate a farmer for protection of key ecological values, recognizing that the farmer has incurred a cost for the public benefit. Incentives are good instruments to achieve desired outcomes and signal a real attempt by the City (and provincial/federal governments) to reconcile environmental objectives with economic realities. For example, the City could set up a program and solicit funding from the higher levels of governments to identify key ecological values on farm lands and “lease” the land for a defined period of time. Additional incentives could be added to compensate the farmer for increased environmental contributions, such as enhanced vegetation programs, or enlarged buffers near watercourses.

Some combination of the approaches may be appropriate to assist farmers in the protection of ecological values on farm land. Some precedent programs for further investigation are:

- Environmental Farm Plan Program,
- Delta Farmland and Wildlife Trust, and
- The Land Trust Alliance and The Land Conservancy to investigate the concept of investing in working farms for conservation purposes.

In addition, develop a program where the City leases agricultural lands that have important environmental values (i.e., are part of the Ecological Network) from farmers to manage these lands for both agricultural and environmental goals. Precedent programs have been used successfully in other provinces to compensate farmers for loss of cultivation to maintain key ecological objectives.

**Idea 6**

**Develop Performance-Based Standards for Managing the Environmental Impacts of Urban Development**

Currently, the City uses a prescriptive approach where the applicant must meet DP guidelines. Under Idea 6, the City could develop performance-based standards as an option for developers to reduce the environmental impact of urban development. Performance-based standards are a regulatory approach that prescribes the ecological outcome expected, but not the means by which the result is achieved which encourages flexible approaches. Some examples include using on-site wetlands, rain gardens, forest patches, green roofs, and other habitat features in residential, commercial and industrial developments. The standards should address issues such as
Part 3 – Managing the Ecological Network

rainwater volume, surface water quality and air quality at site-scales from single family lots, to multi-family sites, to large-scale commercial or industrial developments.

As an illustration, SFU UniverCity had required a standard that required new development to capture and store the first 35mm of rainfall, which then are released at pre-development rates to enhance base flows and reduce storm surges. Developers responded in various ways to achieve this requirement, depending on building program, site restrictions, costs, and maintenance. Performance-based standards could be applied to the Ecological Network by specifying a requirement for vegetative cover by class, survival rates, soil depths, runoff restrictions, vegetation management prescriptions, irrigation methods, etc. for a hierarchy of priority compensation projects or for new comprehensive development sites.

Idea 7
Promote the Ecological Network and its Health

Under Idea 7, the City would continue to promote partnerships with other organizations involved in preserving and enhancing Richmond’s Ecological Network. Expand on outreach activities such as Ecological Network "walks and talks" that could be undertaken in partnership with the School District and community groups. Promote and support community stewardship groups and activities.

Idea 8
Monitor the health of the Ecological Network

Review the Ecological Network mapping periodically and report on its status. In addition, develop a report card for ESAs based on indicators of environmental health:

- watercourse habitat quality,
- water quality and temperature,
- extent of intertidal wetlands,
- fish presence,
- amphibian presence,
- extent of freshwater wetlands,
- forest cover, and
- public access and recreation (e.g., population within 10 minute walk of an Ecological Network area).
Idea 9

**Fund Raising and Ecological Investment Strategy**

Implementation of the Ecological Network Strategy serves many objectives – including biodiversity, water management, carbon management, and eco-recreation. Funding of the Ecological Network should come from a variety of sources, including from partnership organizations outside Richmond.

A key to success is to arrange an Investment Strategy for the Ecological Network Strategy and to organize funding so that multiple objectives can be accomplished with each dollar invested. To implement, a subsequent more detailed budgeting and administrative study will be required.

**Ecological Enhancement and Acquisition Program**

The purpose of this program is to fund ecological improvements and compensation initiatives. Possible partnerships with Federal, Provincial agencies programs, Port Metro Vancouver and YVR and others should be explored.

A possible source of funds could be from grants, donations and proposals where required on-site ecological protection or compensation is not provided.

**Possible uses for Funds:**

1. Land acquisition or leasing of land in the Ecological Network for high value or threatened ecological network areas.
2. Ecological improvements to City-owned lands,
PART 4 – Implementation

Implementation of the Ecological Network should include six interrelated programs:

1. City Management Refinements
2. Environmentally Sensitive Area (ESA) Policies and Guidelines
3. Communications
4. Monitoring

1. City Management Refinements

Effective City management is an essential tool in both building awareness of ecological values in Richmond, and in ensuring that ecological values are achieved in concert with land and economic development.

The City of Richmond manages and coordinates a variety of policies and bylaws to protect and enhance the natural environment, as well as to protect and improve conditions for agriculture.

Appendix B lists the related bylaws, summarizes their existing environmental role, and introduces key refinements that should be considered in upcoming bylaw reviews.

A proposed Rainwater Management Strategy is upcoming for the City of Richmond, and is a good vehicle to manage hydrology in the City. Water related issues must be considered at a variety of scales, including City-wide, drainage basin, and site scales. Hydrology issues therefore often involve much area that is outside the Ecological Network boundaries as shown on the attached maps.

The City of Richmond adopted the Richmond-specific Riparian Management Area approach as its response to the Riparian Areas Regulation. The adopted approach proactively identifies those watercourses within Richmond where the RAR applies and establishes two categories of riparian management areas: 15m and 5m Riparian Management Areas. Development activities, as identified in the RAR, are not permitted to occur within an identified Riparian Management Area.

The City has the ability to restrict development in RMAs through the Development permit process but does not currently have a Development Permit Area or Bylaw that
requires enhancement or compensation for loss. The process for developing these additional tools is underway. The Ecological Network framework provides an opportunity for strengthening and diversifying the habitats of the RMA buffers by identifying where RMA corridors can form part of the Network. Richmond’s RMA is a good opportunity to connect a contiguous system of habitat throughout the City.

2. Environmentally Sensitive Area (ESA) Policies and Guidelines (Map 3)

Introduction

The general ESA policies relate to ‘the protection of the natural environment, its ecosystems and biological diversity’. The policies are written and administered with recognition of the twin goals to:

- protect the natural environment, ecosystems and biodiversity; and
- to support active agriculture in Richmond.

This policy section provides the justification, objectives, general areas and exemptions, and allows for Environmentally Sensitive Areas (ESA) Development Permits and guidelines in the City of Richmond.

The ESA policies are organized in six sections:
- General ESA Development Permit Guidelines
- Intertidal DP Area
- Shoreline DP Area
- Upland Forest DP Area
- Old Fields and Shrublands DP Area
- Freshwater Wetland DP Area

Read each section in conjunction with the others to understand the ecological relationships and Development Permit Guidelines for the Richmond Ecological Network.

Justification: Environmentally Sensitive Areas (ESAs) are critical components in maintaining Richmond’s natural attributes and liveability. Ecosystem functions also provide free goods and services on which we depend. The City will protect significant ESAs, and ensure that development proposals meet ESA policies and guidelines. The
Guidelines also recognize that the conservation of nature and its ecosystems enable Richmond to mitigate and adapt to climate change.

**Objectives:** The objective of ESA management is to preserve the spatial extent, condition, and function of ESAs as development occurs resulting in no-net-loss or the improvement of ESAs. Recognizing that development is a significant part of urban life, the goal of the City is to create developments that successfully protect and integrate ESA’s and their services into the broader community and promote methods that reinforce and strengthen a connected ecological network.

**ESA Designation:** The extent of ESA Development Permit Areas is shown on Map 1, and clarified by the Area Designation description in each of the Intertidal, Shoreline, Upland Forest, Old Fields and Shrublands, and Freshwater Wetland Areas.

**Activities Affected:** Development permits are required for two activities in designated ESA Development Permit Areas:

1. Activities including site clearing, the construction of new structures, or the modification of existing structures that may alter vegetation, soils, or water movement in an ESA Development Permit Area; and
2. the subdivision of land in an ESA Development Permit Area.

The ESA DP review will trigger a process specifically targeted to scrutinize and minimize the impacts of the proposed development on the ESA.

**ESA Exemptions**

The following activities are exempt from the development permit process for ESAs:

1. Renovations to interiors.
2. Exterior renovations and construction activities which do not impact upon, or extend into, the designated ESA (e.g., within the existing footprint of buildings or paved areas).
3. Maintenance activities on existing structures which can be reasonably shown to not result in damage to trees, shrubs, or fish habitat. (Note that the City may specify a qualified professional review of such proposed works).
4. Regular and emergency City maintenance activities for drainage control and diking (environmental best practices will be followed).
5. Construction and maintenance activities carried out by, or on behalf of the City, and designed to enhance the coexistence of natural habitat and public trails.

6. Where an environmentally sensitive area covenant satisfactory to and in favour of the City of Richmond has already been registered for the protection of the ESA.

7. Streamside enhancement and fish and wildlife habitat restoration works (e.g., planting riparian species, removing invasive species) that have obtained the required senior government approvals.

8. The removal of trees deemed hazardous by a qualified arborist that threaten the immediate safety of life and buildings.

9. Subdivision and development operations (which include but are not limited to demolition/clearing, fill placement, crossing replacement upgrade and building) on City owned lands which are within 30 m (98.4 ft.) landward of the high water mark and within 5 m (16.4 ft.) and 15 m (49.2 ft.) of the Riparian Management Area (e.g., West Dike). Such operations will be subject to the Riparian Management Area (RMA) protection requirements (see Bulletin Info-23).

10. Activities (e.g., construction of fences) on privately owned lands along the West Dike which are within 30 m (98.4 ft.) landward of the high water mark and within 5 m (16.4 ft.) and 15 m (49.2 ft.) of the Riparian Management Area. Such operations will be subject to the Riparian Management Area (RMA) protection requirements (see Bulletin Info-23).

11. City parks which are below the high water mark and extend seaward 30m (98.4 ft).

Note: There is a continuous 30 metre ESA buffer (GIS mapping) below the high water mark. This exemption is intended to exclude those areas of park that fall into this buffer (e.g., Garry Point Park).

12. First Nation owned lands (e.g., currently on Sea Island) near the Metro Vancouver Iona Sewage Treatment Plant and if more occur, they too are to be exempt.

13. Agricultural activities.

To take advantage of an ESA DP exemption for the agricultural activities identified below, property owners must provide, to the satisfaction of Council or its designated staff, information to demonstrate that they are legitimately farming:

- **For existing farmers:** For example, that they have generated on the affected site, legitimate agricultural income (e.g., from government tax records), and this information is to be supplemented by other sources (e.g., a government Farm Number, BC Assessment information, City tax or assessment information);
• **For new farmers:** For example, written information from a government source that they have been granted a period of time (e.g., two years) to demonstrate that they will and can generate legitimate agricultural income and this information is to be supplemented by other sources (e.g., a government Farm Number, BC Assessment information, City tax or assessment information). Where this permission has been granted and not achieved, the City may require the owner to restore and rehabilitate the modified environmental asset and services;

For clarity:

• Property owners who are proven farmers are entitled to the agricultural exemption without applying for an ESA DP;

• Property owners who are proven farmers and lease their land to legitimate farmers are entitled to the agricultural exemption without applying for an ESA DP;

• Property owners who are not proven farmers and lease their land to legitimate farmers are not entitled to the agricultural exemption and the property owner is required to apply for an ESA DP;

• Property owners who are not proven farmers and lease their land to not proven farmers are not entitled to the agricultural exemption and the property owner is required to apply for an ESA DP.

Exempt agricultural activities:
Where the above criteria are met, the following agricultural activities are exempt from obtaining an ESA DP:

• Accessory farm buildings (e.g., agricultural barns, sheds, accessory accommodation for seasonal farm workers, greenhouses), excluding the principal accessory farm residence;

• Agricultural farm cultivation including land clearing, field drainage, irrigation, Agricultural Land Commission (ALC) and City approved farm soil filling, growing crops, fencing, raising animals and bee keeping;

Non-exempt agricultural activities:

• For clarity, all owners of proposed residences in the ALR and City designated and zoned agricultural areas are to apply for and receive an ESA DP. Accessory residential buildings and structures (e.g., detached garages; swimming pools; tennis courts) and subdivisions will also require an ESA DP.

Other Federal and Provincial Agriculturally Related Policies:

• Agricultural activities in Riparian Management Areas are subject to the Fisheries Act;

• Non-agricultural buildings and infrastructure on ALR lands are subject to the conditions of the Provincial Riparian Area Regulations.
ESA General Development Permit Area Guidelines

The ESA General Guidelines apply to all ESA DP Areas in the City of Richmond, including Intertidal, Shoreline, Upland Forest, Old Fields and Shrublands, and Freshwater Wetland Areas.

1. Prior to any land disturbance and before issuing an ESA Development Permit, the City will require the applicant to provide, at his/her expense, an Environmental Report certified by a Qualified Environmental Professional (QEP) conducted in appropriate environmental survey season(s), to identify:
   a) All ‘Environmentally Valuable Resources’, including features such as sensitive ecosystems, wildlife, plants and plant communities, wildlife habitat and corridors, riparian areas, aquatic species and other high value habitat, and recommendations for: development patterns and servicing to minimize impacts on the identified ecological features;
   b) non-disturbance areas in which no development activity may occur and which may not be impacted by development;
   c) buffers from the outside edge of the identified features or non disturbance areas.

The City, through its ESA Development Permit Application process, is open to preliminary discussion with development proponents to discuss the feasibility, process, timelines, variances and any other requirements that may be involved. It is the developer’s responsibility to accurately confirm the location, condition, and type of ecological features on the site including the boundaries of the ESA. The developer will commission a Qualified Environmental Professional to prepare an accurate inventory to locate and identify all the ecological features on the site. Features on adjacent sites must also be noted, if present. The survey will, at a minimum, include all existing trees, vegetation, and known wildlife habitat, including active bird nests, wetlands, and watercourses. An assessment of drainage features and local hydrology will be required for ESAs encompassing freshwater wetlands. The features will be listed and drawn to scale on a site plan. Existing information including, but not limited to, the current and previous mapping including 2011 ESA maps, Metro Vancouver’s 2011 Sensitive Ecosystem mapping, FREMP habitat mapping and coding, and Canadian Wetland Service wetland mapping must be reviewed where available.
2. The Environmental Report shall be provided in general conformance with the BC government publication ‘Develop With Care’. The Environmental Report may be provided at two levels, in accordance with ‘Develop With Care’: 

   a) A preliminary bio-inventory (site survey) that identifies environmentally valuable resources on or within 100m of the proposed development site. This inventory should identify three areas:

      i) Areas suitable for development, subject to meeting other guidelines and best management practices;

      ii) Areas where conservation of ecological features and functions is required, and buffers thereto;

      iii) Study Areas requiring further biological study, for example where uncertainty exists related to species at risk presence or use, or areas where inventory or analysis is required at a different season of the year.

   b) A detailed inventory and conservation evaluation shall be completed for Study Areas. This detailed inventory may determine proposed boundaries within the study area between conservation/buffer areas and areas of potential development.

   c) Both the preliminary and detailed ecological inventories should be consolidated into the Environmental Report, which should also provide recommendations for environmental management, protection of environmentally sensitive areas during and after construction, and for ecological restoration of disturbed areas. The Environmental Report shall be co-ordinated with the development proposal.

   d) An environmental monitoring program prepared by the Qualified Environmental Professional if applicable, will form part of the development permit to ensure protection of retained ecological features and non-disturbance areas as well as compliance with other applicable conditions of the permit.

3. The applicant must submit a plan that:

   a) Identifies DPA elements and the proposed development.

   b) Delineates the top of bank and riparian area (for creeks, streams and rivers) or natural boundary (for wetlands, ponds, lakes, and terrestrial sensitive ecosystems);

   c) Locates the applicable buffer or setback recommended by the Qualified Environmental Professional to separate the proposed development from the ecological feature; and
d) Identifies where soil or vegetation will be disturbed for construction of buildings, yards, driveways, patios, and walkways;

**Carefully Plan and Design Development Activities.** This step will identify buildable and protected areas, and evaluate what effect the construction and completed project will have on the ecological areas. Through the design process, the proponent will submit site planning and design concept documents noting the location of protected ESA’s with proposed development showing such things as location of building(s) and structures, roads and parking areas, utilities, open space landscape and stormwater management areas. In some cases, sun shadow assessments may be required. Drawings showing site grading and drainage showing spot elevations and directional flow, catch basins, lawn basins, etc. will be required. The purpose of these documents is to demonstrate that the intended development can be constructed and maintained within acceptable impacts to the ESA as determined by the City.

**Maintain Connections between ESAs and Other Components of the Ecological Network.** Wherever they exist, large tracts of habitat or long continuous corridors should be preserved in order to facilitate movement of wildlife between different parts of the Ecological Network. Development in ESAs should strive to avoid fragmenting natural ecological areas or creating small patches which have lower value than a single large patch. Achieving this guideline will require knowledge of the landscape surrounding the ESA and property, including adjacent ESAs, other parts of the Ecological Network, parks, trails, shorelines, sloughs or canals. In areas along the urban/rural boundary, the corridor acts to increase the amount and diversity of wildlife habitat while protecting crops from vehicular pollution. The corridor also screens views, and filters out wind-blown dust, agricultural chemicals, odours and noise.

4. While the Environmental Report will provide site-specific recommendations, the following general guidelines shall be used by the City in reviewing applications:
   a) Avoid fragmenting ESAs and disrupting the interior habitat areas of ESA hubs and ESA sites. Development, including agricultural development, should be sited to the outer fringes of these ESAs to maximize the amount of interior habitat remaining within the ESA.
   b) ESA upland habitat corridors shall be 30m width as a target. Narrowest point of wooded corridors shall be 15m. Where existing corridors are hedgerows, minimum width of hedgerow corridors shall be 5m.
c) Minimize crossings of ESA hubs, ESA sites and ESA corridors or hedgerows with roads, trails or utility lines. Where crossings are required with permanent surface disturbance (e.g. roads and trails) provide ecological passage across the corridor, e.g. by overhead tree canopy that bridges the corridor for birds, and underground culvert passage for fish, reptiles, amphibians and small mammals.

d) Provide advice by the Qualified Environmental Professional on location, alignment, extent, and mitigation of any proposed infringements on the valuable habitat areas. Where infringement is required, give preference to the conservation of ESAs in the following order (higher priority to lower priority):

   i. Intertidal
   ii. Shoreline
   iii. Freshwater Wetland
   iv. Upland Forest
   v. Old Fields and Shrublands

c) Where required ESA conservation exceeds 80% of the property area, the City may consider other options, such as lease, purchase, or reducing the ESA area.

f) In considering e) above, the City will require that covenants or other legal protection measures be provided so that the 80% rule does not apply to subsequent applications.

Mitigate Impacts during Implementation. Many impacts of land development occur during the construction phase such as when excessive vegetation is cleared, retained trees and root zones are damaged, soils excavated or compacted, and sediment is discharged to watercourses. Best management practices such as sediment and erosion control, tree protection fencing, relocation of plant or animals, and timing windows to protect nesting birds must be employed where applicable. On complex or large sites, impact mitigation should be guided by a site-specific Environmental Protection Plan (EPP) prepared by qualified professionals.

The following is a minimum drawing checklist that will be necessary for City ESA DPA review, as a part of the Environmental Report:
• Site Plan
• Existing Conditions and Protection Measures
• Vegetation survey requirements (see Appendix D)
• Raptor nest survey
• Excavation and Construction Access
• Grading and Drainage, including structures
• Sediment controls
• Planting Plan(s)
• Irrigation Plans, if applicable
• Utilities and Lighting
• Site Sections and Relevant Details
• Geotechnical review

1. The City may request a peer review of an Environmental Report at the expense of the applicant to confirm recommendations in the Environmental Report.

2. Where applicable, the applicant will provide a B.C. Land Surveyor certified site plan that:
   a) Locates the proposed development relative to the ESA DPA boundaries and property lines;
   b) Locates the ecological features of the DPA as identified by the Qualified Environmental Professional.

3. Development should be in accordance with the mitigation and restoration strategies recommended in the Environmental Report provided to the City of Richmond.

4. The City may refer applications for ESA DPs to the Provincial Agricultural Land Commission when located within the Agricultural Land Reserve. In this regard, applications to reduce the ESA setback may require submission of a Farm Plan acceptable to the Agricultural Land Commission, prior to exemption under the Farm Practice Protection (Right to Farm) Act. Where an acceptable Farm Plan has not been submitted and approved, all other specific guidelines shall be addressed.
ESA Intertidal Development Permit Area Guidelines

Read this section in conjunction with the General ESA Policies, which provide general justification, objectives, general area designation and exemptions, definitions, and general development guidelines which also apply in this Development Permit Area.

Area Designation: Coastal areas within 30 m (seaward) of the high water mark\(^9\) which are influenced by waves, tides, and other processes along the Fraser River or Strait of Georgia. Also includes the shallow subtidal zone in some sites.

Typical Conditions: Mudflats, and a range of vegetated estuarine or salt marsh communities; tidal channels or shallow ponds are often present; developed shorelines with riprap, docks, and pilings are also included.

Justification: The intertidal zone is important for:

1. fish and wildlife habitat - the intertidal zone around Richmond’s Islands is recognized for its importance for fish such as juvenile salmon from throughout the Fraser River watershed, but also for spawning eulachon, and smaller fish such as starry flounder which are an important part of the foodweb;
2. protection of Richmond’s dikes and other infrastructure from wave and current erosion by dissipating energy;
3. aesthetic and cultural values that make intertidal zones an important part of Richmond’s parks and greenways.

Management Objectives: Prevent infilling or direct disturbance to vegetation and soil in the intertidal zone; maintain ecosystem processes such as drainage or sediment that sustain intertidal zones.

Related Regulations: All intertidal zones in the City of Richmond area are considered fish habitat under the federal Fisheries Act. DFO regulates activities affecting fish habitat through their participation in the Fraser River Estuary Management Program (FREMP)\(^10\). Port Metro Vancouver, as a federal agency, is also responsible for fish habitat management. Many intertidal zones also have important values for migratory

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\(^9\) The High Water Mark is the highest extent of tidal inundation under normal tides (e.g., no storm surges or abnormal water temperatures). It is usually defined in the field by vegetation and debris indicators. Note that the high water mark used for the ESA mapping was defined by visual interpretation of 2009 orthophoto imagery supplemented with field assessment in a few areas.

\(^10\) Fraser River Estuary Management Program. See [here](#).
wildlife such as shorebirds and waterfowl; migratory birds and their nests are protected under the Migratory Birds Convention Act and intertidal zones designated as part of provincial Wildlife Management Areas (including Sturgeon Bank WMA) are also managed for conservation values. Other relevant legislation and regulations that affect the intertidal zone include the provincial Dike Maintenance Act, the provincial Wildlife Act (for listed wildlife as well as Wildlife Management Areas), the federal Species at Risk Act, and the federal Navigable Waters Protection Act.

**Environmental Report Assessment Requirements:** For all ESA areas classified as intertidal zone:

1. Confirm the ESA boundary including location of high water mark based on field assessment by a qualified professional.
2. Assess and confirm ecological characteristics including general vegetation types using existing information such as FREMP mapping and field assessment by a qualified professional.
3. Review FREMP habitat coding (red, yellow, green) and relevant policies.
4. Identify any previous habitat compensation or enhancement activities such as a marsh restoration and fill removal.
5. Review site history to determine the potential for contaminants or buried structures based on previous use.
6. Identify any nearby (within 100 m) wildlife use such as raptor or heron nests using existing information and field surveys by a qualified professional.\(^{11}\)

**Guidelines:**

1. Preserve all intertidal zones, except in accordance with the conditions of the development permit and other necessary permits or approvals (e.g., FREMP, Port Metro Vancouver, Navigable Waters).
2. Maintain ecological processes important to the long-term health of the intertidal zone including drainage and hydrology and natural sediment or detritus movement (accretion and erosion).
3. Development must not increase shade or disrupt the movement of detritus or other materials. Where water access is necessary for transportation or recreation facilities, filling of the intertidal zone shall be avoided. The preferred

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\(^{11}\) Inventory Method for Raptors (BC Environment 2001). See [here](http://www.ilmb.gov.bc.ca/risc/pubs/tebiodiv/raptors/version2/rapt_ml_v2.pdf)
method of development over the intertidal zone is on pilings or floating structures.

4. Consider contiguous or nearby ESA areas such as shoreline zone which have the potential to influence the intertidal zone.

5. No alterations should be made to the intertidal area without an appropriate environmental assessment and implementation of mitigation measures. The City may require preparation of an Environmental Protection Plan (EPP) prepared by a qualified professional to guide environmental management on sensitive, complex, or large sites.

6. No recreational trails or other facilities shall be constructed in the intertidal zone.

7. Permitted works shall use careful site design to avoid the most sensitive portions of the intertidal zone (see FREMP habitat coding);

8. All works within or adjacent to the intertidal zone shall be constructed, where required, to preserve and enhance the shoreline by:
   i. Providing safe, durable access such that people are afforded an unobstructed view of the waterfront wherever possible;
   ii. Retaining mature vegetation, including existing large trees, shrubs, and aquatic vegetation;
   iii. Replanting disturbed areas with native vegetation.

9. Where possible, restore degraded intertidal zones by removing historical fill, structures, or contaminated sediment, and recreating natural habitats such as mudflat and marsh.

10. Conformance with these guidelines does not exempt applicants from meeting requirements of other agencies, such as those participating in the Fraser River Estuary Management Program (FREMP), and Port Metro Vancouver. It the responsibility of proponents to ensure they meet all external requirements.

**ESA Shoreline Development Permit Area Guidelines**

Read this section in conjunction with the ESA General Guidelines, which provide general justification, objectives, general area designation and exemptions, definitions, and general development guidelines which also apply in this Development Permit Area.

**Area Designation:** Coastal areas within 30 m (landward) of the high water mark with environmental values related to their association to the Fraser River and Strait of Georgia.
Typical Conditions: The marine riparian zone in Richmond typically includes the crest and back slope of the perimeter dike and its associated trails or roads, as well as developed or natural areas landward of the dike. Land uses are variable and typically include such things as developed lands such as roads, parking areas, landscaped areas, boat facilities and buildings;

Justification: The shoreline zone is important for:
1. fish and wildlife habitat, both within the forests and other ecosystems found within the shoreline, and the adjacent intertidal zone;
2. protection of Richmond’s dikes and other infrastructure from wave and current erosion by dissipating energy;
3. filtering contaminants and sediment before it reaches the intertidal zone; and
4. aesthetic and cultural values that forms an important part of Richmond’s parks and greenways.

Management Objectives: Preserve existing shoreline vegetation and soils, and increase natural vegetation in developed areas during redevelopment or retrofitting.

Related Regulations: Some shorelines in Richmond are considered fish habitat under the federal Fisheries Act because of their role in maintaining the health of the adjacent intertidal zone (e.g., shading, detritus additions, etc). Fisheries and Oceans Canada (DFO) regulates activities affecting fish habitat through their participation in the Fraser River Estuary Management Program (FREMP)\(^\text{12}\). Port Metro Vancouver, as a federal agency, is also responsible for fish habitat management. Other relevant legislation and regulations that affect the shoreline zone include the provincial Dike Maintenance Act, the provincial Wildlife Act (for listed wildlife as well as Wildlife Management Areas), the federal Species at Risk Act, and the federal Navigable Waters Protection Act.

Environmental Report Assessment Requirements: For all ESA areas classified as shoreline zone:
1. Confirm the ESA boundary including location of high water mark based on field assessment by a qualified professional.

\(^{12}\) Fraser River Estuary Management Program. See [here](http://www.bieapfremp.org/main_fremf.html) or http://www.bieapfremp.org/main_fremf.html
2. Assess and confirm ecological characteristics including general vegetation types using existing information such as FREMP mapping and field assessment by a qualified professional.

3. Review FREMP habitat coding (red, yellow, green) and relevant policies for the adjacent intertidal zone.

4. Identify any previous habitat compensation or enhancement activities.

5. Review site history to determine the potential for archaeological significance, contaminants or buried structures based on previous use. Refer to Provincial database on known archaeological sites.

6. Identify any nearby (within 100 m) wildlife use such as raptor or heron nests using existing information and field surveys by a qualified professional\(^\text{13}\).

Guidelines:

1. Preserve all natural vegetation and all trees in the shoreline zone, except in accordance with the conditions of the development permit and other necessary permits or approvals (e.g., FREMP, Port Metro Vancouver, Navigable Waters).

2. Maintain ecological processes important to the long-term health of the shoreline zone including drainage and hydrology.

3. Consider contiguous or nearby ESA areas such as the intertidal zone which have the potential to influence the shoreline zone.

4. No alterations should be made to the shoreline zone without an appropriate environmental assessment and implementation of mitigation measures. The City may require preparation of an Environmental Protection Plan (EPP) prepared by a qualified professional to guide environmental management on sensitive, complex, or large sites.

5. No recreational trails or other facilities shall be constructed in the shoreline zone without written approvals from FREMP or other regulatory bodies.

6. Permitted works shall use careful site design to avoid the most sensitive portions of the shoreline zone.

7. Water quality and natural systems shall be protected by leaving stream banks intact and by not altering natural slopes and existing vegetation.

8. All works within or adjacent to the shoreline zone shall be constructed, where required, to preserve and enhance shoreline values by:

\(^{13}\) Inventory Method for Raptors (BC Environment 2001). See here or http://www.ilmb.gov.bc.ca/risc/pubs/tebiodiv/raptors/version2/rapt_ml_v2.pdf
i. Providing safe, durable access such that people are afforded an unobstructed view of the waterfront wherever possible;

ii. Retaining mature vegetation, including existing large trees, shrubs, and aquatic vegetation;

iii. Replanting disturbed areas with native vegetation.

9. Development proposals that include measures to restore degraded shoreline zones by removing historical fill, structures, or contaminated sediment, and recreating natural habitats such as riparian forest may increase the level of support by the agencies provided that the works comply with DFO and FREMP guidelines. In many areas, the shoreline zone has been developed or landscaped and improvements including tree planting will enhance its ecological value over the long term.

10. Conformance with these guidelines does not exempt applicants from meeting requirements of other agencies, such as those participating in the Fraser River Estuary Management Program (FREMP), and Port Metro Vancouver. It is the responsibility of proponents to ensure they meet all external requirements.

**ESA Upland Forest Development Permit Area Guidelines**

Read this section in conjunction with the ESA General Guidelines, which provide general justification, objectives, general area designation and exemptions, definitions, and general development guidelines which also apply in this Development Permit Area.

**Area Designation:** Treed areas (woody vegetation >5 m tall) not including forested wetlands (swamps and bog forests) or forested riparian zones adjacent streams, rivers, and other watercourses.

**Typical Conditions:** Richmond’s upland forests are typically forested with paper birch, red alder, and black cottonwood with lesser amounts of western hemlock and western red cedar. Non-native trees (e.g., European birch, Sycamore maple) are also common. Upland forests range in size from large hubs (e.g., >10 ha) to small groups or even rows of single trees. Developed forest areas such as maintained trees in urban parks with an understorey of mowed grass are not included as ESAs. Future ecological restorative works in public parks would add to the ESA inventory. Understorey vegetation is variable and ranges from partially landscaped areas, to dense thickets of native shrubs mixed with ferns, forbs, and mosses.

**Justification:** Upland forests are a critical part of Richmond’s ecological network. Its environmental values include:
1. habitat for wildlife and plants;
2. carbon storage in above- and below-ground plant material;
3. hydrologic cycle importance through rainfall interception and evapotranspiration;
4. improvements to air quality by capture or modification of particulates and gases such as ozone; and
5. aesthetic values in urban parks and greenways.

Management Objectives: Maintain stands or patches of healthy upland forests designated as ESAs by preventing or limiting tree removal or damage, and maintaining ecological processes that sustain forests over the long term.

Related Regulations: The City of Richmond’s Tree Protection Bylaw (No. 8057)\(^{14}\) regulates tree removal or damage on private and public lands and applies in ESAs. Its goal is to sustain a healthy, viable urban forest. Upland forests are not explicitly protected or managed through provincial or federal legislation. Relevant regulations which influence forest protection in urban areas include the BC Wildlife Act if there are any listed wildlife (herons and eagles), the Migratory Bird Convention Act which protects the nests of most birds during the nesting season, and potentially the federal Species at Risk Act.

Environmental Report Assessment Requirements: For all ESA areas classified as upland forest:

1. Confirm the ESA boundaries based on field assessment by a qualified professional.
2. Assess and confirm general ecological characteristics including general vegetation types using existing information such as recent orthophoto imagery and field assessment by a qualified professional.
4. In areas proposed encroaching or adjacent (within 20m) to an upland forest ESA, conduct a tree survey that locates each tree, records species, size (diameter), and health based on the requirements of Richmond’s Tree

\(^{14}\) City of Richmond Tree Protection Bylaw (summary). See here or http://www.richmond.ca/services/Sustainable/environment/treeremoval.htm
Protection Bylaw. The City will review the QEP’s impact assessment and may approve encroachment if there is a net ecological benefit.

5. Identify any nearby (within 100 m) wildlife use such as raptor or heron nests using existing information and field surveys by a qualified professional\(^\text{15}\).

Guidelines:

1. Preserve all upland forest, except in accordance with the conditions of the development permit and other necessary permits or approvals (e.g., Wildlife Act).

2. Permitted works shall use careful site design to avoid the most sensitive portions of the upland forest (e.g., largest or oldest trees, wildlife habitat features, natural understory).

3. Where tree removal in ESA areas cannot be avoided, preserve the largest and healthiest trees and minimize the creation of narrow forest patches with edge habitat (maintain the mass and volume of internal forest). The City of Richmond requires tree replacement on or near the development site. This may include nearby parks or other public lands. Some trees may be retained on site as artificial snags or downed logs under the direction of City staff.

4. The City of Richmond’s tree replacement requirements are specified in the Tree Protection Bylaw except in cases where an area-for-area replacement is permitted, in which case:
   i. The compensation ratio is replacement of one tree (6 cm calliper as defined by BC Nursery Trades Association for deciduous trees, 2 m height for coniferous) for every tree that is removed in an ESA area; or
   ii. 1.5 sq. meters for every 1.0 sq. meters of upland forest removed. Replacement trees are to be planted in other areas of the ESA unless permission is granted to plant trees on other parts of the property or on City property.

5. Preserve snags and downed logs where they are not a risk to safety.

6. Maintain ecological processes important to the long-term health of the upland forest including hydrologic processes and soil quality.

7. Avoid excavation, filling, or soil compaction in a zone around trees measuring 30 cm for every 2.5 cm of trunk diameter (e.g., 25 cm diameter tree = 300 cm root protection zone). Use tree protection fencing and signs during construction.

Works that may affect the roots of retained trees should be designed to avoid direct damage or be raised above the soil level (e.g., decks or pilings).

8. Where possible, improve the condition of the forest by removing invasive plant species, including: English Ivy, Yellow Lamium, Himalayan Blackberry, Japanese Knotweed, Common Laurel, and Daphne Laurel.

9. Restore or enhance upland forest through active management such as tree planting and thinning.

10. Where trees are removed at the ESA edge, plant trees and understorey shrubs at the margins to increase habitat in the ecotone.

11. Vegetation is to be selected that is consistent with the existing plant communities, provide high food source and habitat values.

12. Use pruning, thinning, supplemental planting, or other methods to reduce the risk of windthrow on newly exposed forest edges.

13. Locate trails or other recreational facilities to avoid the most sensitive portions of upland forests, and constructed to minimize tree or shrub removal, soil excavation, or compaction. Avoid trails in the centre of large forest patches where recreation use including dog walking will reduce habitat value for wildlife.

14. The City may require the preparation of an Environmental Protection Plan (EPP) prepared by a qualified professional to guide environmental management on sensitive, complex, or large sites.

15. Conformance with these guidelines does not exempt applicants from meeting requirements of other agencies. It the responsibility of proponents to ensure they meet all external requirements.

**ESA Old Fields and Shrublands Development Permit Area Guidelines**

Read this section in conjunction with the ESA General Guidelines, which provide general justification, objectives, general area designation and exemptions, definitions, and general development guidelines which also apply in this Development Permit Area.

**Area Designation:** Old fields and shrublands are temporarily (>2 years) or permanently abandoned agricultural or cleared lands that support mixed grass, forb, and shrub vegetation. Grass and shrub vegetation is often intermixed with increasing shrub cover after 10 years without mowing. Old field and shrubland is a manmade habitat type associated with the changing pattern of farming in agricultural landscapes, particularly the abandonment of farms.
**Typical Conditions:** Old field and shrublands support dense grass or shrub growth. Reed canary grass or bentgrass are commonly abundant but mixed with velvetgrass, orchard grass, and red fescue and weedy perennials such as creeping buttercup, red clover, white clover, and purple-leaved willow herb depending on moisture levels. Hardhack, Himalayan blackberry, or cut-leaf blackberry are the most common shrub species (note hardhack is often an indicator of disturbed wetlands). Old field characteristics develop quickly, usually two to three years after cessation of annual mowing or tilling in agricultural fields. Hedgerows are an important part of old field and shrubland communities.

**Justification:** Old fields and shrublands are important for:

1. biodiversity including small mammals and the owls and hawks that hunt in them, and invertebrate pollinators (bees and flies);
2. carbon storage in wet soils (above-ground biomass is minor); and
3. hydrological benefit in areas with seasonal flooding.
4. old fields are also part of the cultural history of Richmond and are found in areas that were important farms.

**Management Objectives:** Maintain the extent and condition of old fields and shrublands, while recognizing the dynamic nature of these ecosystems. Preservation should recognize the balance between habitat loss and creation with the overall objective of preventing the permanent loss of old fields and shrublands.

**Related Regulations:** Old fields and shrublands are not explicitly protected or managed through provincial or federal legislation. The Migratory Bird Convention Act protects the nests of most birds during the nesting season, and the federal Species at Risk Act protects a small suite of listed species that may infrequently use old fields such as vesper sparrow and streaked horned lark.

**Environmental Report Assessment Requirements:** For all ESA areas classified as old field or shrubland:

1. Confirm the ESA boundaries based on field assessment by a qualified professional.

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16 Including the regionally rare Short-eared Owl, which have been observed on Sea Island
2. Assess and confirm general ecological characteristics including general vegetation types using existing information such as recent orthophoto imagery and field assessment by a qualified professional.


4. Review site history (age of old fields) based on historical air photo assessment and local knowledge.

Guidelines:

1. Preserve large patches of old field and shrubland except in accordance with the conditions of the development permit and other necessary permits or approvals (e.g., Wildlife Act).

2. Permitted works shall use careful site design to avoid the most sensitive portions of the old field and shrubland unit such as more diverse areas with a range of grasses, seasonally flooded areas, areas with perching sites for raptors.

3. Old fields slowly change to shrublands and finally to forest over 10 to 25 years. While this evolution will create positive ecological benefits, maintaining old fields provides unique habitat benefits and contributes to biodiversity. Management practices such as infrequent strip mowing as occurs in the Sea Island Conservation Reserve is needed to maintain them as old fields over time.

4. Work with farmers to retain old fields and shrublands (hedgerows) where they do not conflict with farm use. Leasing arrangements by the City may be investigated as a possible means of retaining old fields and shrublands on some sites.

5. Enhance the value of old fields and shrublands by providing perching or roosting sites, or planting hedgerows.

6. Conformance with these guidelines does not exempt applicants from meeting requirements of other agencies. It the responsibility of proponents to ensure they meet all external requirements.

ESA Freshwater Wetland Development Permit Area Guidelines

**Area Designation:** Areas with vegetation and soils influenced by the presence of freshwater in the rooting zone for plants\(^{17}\); includes open, forested, and shrub bogs,

\(^{17}\) A wetland is land where the water table is at, near, or above the surface or which is saturated for a long enough period to promote such features as wet-altered soils and water tolerant vegetation. Wetlands include organic wetlands or "peatlands", and mineral wetlands or mineral soil areas which are influenced by excess water but produce little or no peat (Environment Canada, 1996).
swamps, marshes, wet meadows, seasonally flooded fields, and shallow (<2 m depth) ponds and ditches.

**Typical Conditions:** Wetlands are widespread in Richmond and include bog forests with pine and birch trees, shrub swamps with Labrador tea and other bog plant species, cattail marshes, reed canary grass marshes, ditches and ponds. In some cases, wetland vegetation has been removed and only the soil remains from the previous wetland ecosystem. Bogs and related peatland wetlands are found within the previous boundaries of Lulu Island bog. Many large freshwater wetlands in Richmond such as Richmond Nature Park are within the ecological network but are not designated as development permit areas because they are protected as parks.

**Justification:** Freshwater wetlands are important for:
1. regulating water flow (hydrology) by storing water during rainfall and promoting groundwater infiltration;
2. influencing water quality through filtration, capture, and transformation of a variety of chemical constituents in plants and soil;
3. providing habitat for diverse and often unique community of plant and animal species including amphibians, waterfowl, dragonflies, sedges, and peat-mosses;
4. storing carbon in saturated organic soils, particularly peat soils that are common in Richmond.

**Environmental Report Assessment Requirements:** For all ESA areas classified as freshwater wetland:
1. Confirm the ESA boundary based on field assessment by a qualified professional.
2. Assess and confirm general ecological characteristics including general vegetation types using existing information such as recent orthophoto imagery and field assessment of soil and vegetation by a qualified professional. Wetland identification often requires specialized skills particularly in disturbed areas where soil and natural vegetation has been modified.
4. Review the site’s drainage system including watercourses, ditches, and stormwater pipes using City of Richmond’s online GIS Inquiry mapping tool supplemented by field assessment if necessary;
5. Assess impacts to site hydrology for development activities that have the potential to affect hydrology and seasonal water table fluctuations (e.g., land drainage, ditches, large areas of impervious surface coverage, stormwater discharge or water storage).

6. Identify any nearby (within 100 m) wildlife use such as raptor, crane, or heron nests using existing information and field surveys by a qualified professional\(^\text{18}\).

7. Assess freshwater wetland ESA areas for the presence of species or ecological communities at risk (see BC Conservation Data Centre\(^\text{19}\) for current ranking).

**Management Objectives:** Maintain the areal extent and condition of freshwater wetlands designated as ESAs by preserving vegetation and soils, and maintaining predevelopment hydrology, drainage patterns, and water quality.

**Related Regulations:** Freshwater wetlands are not explicitly protected or managed through provincial or federal legislation unless they are fish habitat or require a federal permit or approval (e.g., Navigable Waters Protection Act of Canadian Environmental Protection Act). Relevant regulations which influence wetland protection in urban areas include the BC Wildlife Act if there are any listed wildlife (herons and eagles), the Migratory Bird Convention Act which protects the nests of most birds during the nesting season, and potentially the federal Species at Risk Act for SARA-listed species. Commitments by Metro Vancouver's member municipalities under the regional Liquid Waste Management Plan may eventually provide some protection of freshwater wetlands for their role in urban watershed management.

**Guidelines:**

1. Preserve the extent and condition of all freshwater wetlands in ESAs, except in accordance with the conditions of the development permit and other necessary permits or approvals.

2. Maintain ecological processes important to the long-term health of freshwater wetlands including drainage patterns, hydrology, seasonal water table fluctuations, and water quality.

3. Consider contiguous or nearby ESA areas, or other areas of the Ecological Network, which have the potential to influence the freshwater wetland. Use


\(^\text{19}\) BC Species and Ecosystem Explorer. See here or http://a100.gov.bc.ca/pub/eswp/
vegetated buffers of at least 30 m around wetlands to prevent direct or indirect disturbance.

4. No alterations should be made to freshwater wetland without an appropriate environmental assessment and implementation of mitigation measures. The City may require preparation of an Environmental Protection Plan (EPP) prepared by a qualified professional to guide environmental management on sensitive, complex, or large sites.

5. No recreational trails or other facilities shall be constructed in freshwater wetlands.

6. Permitted works shall use careful site design to avoid the most sensitive portions of the freshwater wetland.

7. Development proposals that include measures to restore degraded freshwater wetlands by removing historical fill, structures, or contaminated sediment, and recreating natural habitats such as sedge marsh or shrub swamps will be viewed positively by the City.

Conformance with these guidelines does not exempt applicants from meeting requirements of other agencies. It is the responsibility of proponents to ensure they are meeting

### 3. Communications

Public awareness and concern about the natural environment, GHG and climate change is evident in the broad media as well as the public process surrounding the 2041 OCP Update. This awareness translates into voluntary stewardship of the environment by many non-government organizations, corporations and individuals. The cumulative good done by this civility should be recognized and encouraged, and the City of Richmond should continue to lead stewardship by example on its own properties and operations.

Regular public information on challenges, opportunities, and progress towards constant improvement in managing the natural environment is a key engine to voluntary stewardship. The measurement of improvement towards targets provides a barometer of progress and public accountability.

#### 3.1 Communication and Education

Communication and education are inter-connected strategies to enhance public awareness of the Ecological Network and ESAs and the services they provide, increase knowledge or expertise about how they should be managed or protected, and improve
the acceptance of the ESA Strategy by the public, landowners, professionals, and municipal staff.

1. Develop a strategy for “rolling out” the ESA Strategy. This could include a variety of methods such as neighbourhood information sessions, school activities, and “walks and talks”, that could be undertaken in collaboration with local ENGOs and the local School Board.
2. Develop a unique identity for Richmond’s Ecological Network (signs, logo, etc).
3. Promote achievement (see above).
4. Use momentum building demonstration projects such as the Olympic Oval development and West Cambie Greenway.
5. Education and social marketing.

3.2 City Leadership

The City of Richmond can lead the protection of the Ecological Network by implementing ecological restoration projects on key city-owned lands, increasing internal coordination of municipal initiatives, enhancing staff capacity, and supporting landowners and residents who contribute to environmental management.

Examples include:

1. Consider creating a corporate “Green the Network” program by focusing City-based (parks and/or public works department) vegetation planting in the Ecological Network and ESA areas on a priority hub/site/corridor basis. This will raise the profile of the Ecological Network and its benefits as well as the City’s leadership in implementing the ESA strategy.
2. Consider designating a portion of key city parks for habitat creation such as wetlands, meadows, forest, and butterfly gardens, to promote experiential qualities of nature, with priority given to initiatives that will provide the greatest benefit to the Ecological Network.
3. Developing a checklist for City project reviews to avoid development conflicts with Ecological Network and ESA management, and to identify opportunities for improving or restoring ecological value (eco-plus concept).
4. Explore opportunities for relocating dikes to restore foreshore and salt marshes, both as habitat and as flood mitigation measures.
3.3 Stewardship Activities

Stewardship is defined as voluntary activities that are encouraged through education, collaborative actions, the provision of resources or expertise, or financial resources or incentives.

1. Investigate opportunities to develop incentive programs that would encourage appropriate tree planting on private property to reinforce the “Ecological Network and ESAs particularly in and around sites and corridors. Incentive programs could include subsidies for the purchase of trees and provide training on appropriate planting and maintenance practices.

2. Consider partnering with local ENGOs to create a program and support system to promote naturescaping on properties.

3. Improve environmental management of agricultural lands by building on the Environmental Farm Plan Program, the Delta Farmland and Wildlife Trust, and informal stewardship projects. It would focus on:
   
   i. Supporting the work of ARDCorp (BC Agricultural Research and Development Corp.) in environmental farm planning by providing city staff resources and financial assistance.

   ii. Consider developing a program to lease agricultural lands that have important ecological values (i.e., are part of the Ecological Network) from farmers to provide the basis for managing these lands for both agricultural and environmental goals.

   iii. Demonstrate best management practices on leased agricultural lands (set-asides, riparian fencing, field margin stewardship, retention of forest patches, etc).

3.4 Improved Coordination

Achieving success with the Ecological Network Strategy and ESAs will be due to establishing a coordinated approach to improve environmental management in Richmond. Its success will depend on recognizing the roles and responsibilities of different levels of government (federal, provincial, regional, First Nations, and municipal) in managing the environment. An essential component of the ESA Strategy will be to:

1. Improve coordination and collaboration within the City of Richmond’s departments. Work with ARDCorp (BC Agricultural Research and Development Corp.) to actively promote environmental farming initiatives applicable to
Richmond and with the City’s Agricultural Advisory Committee and the Richmond farming community.

2. Collaborate with provincial, federal and regional institutions to continue to cooperatively manage Sturgeon Banks WMA, Sea Island Conservation Area, and Iona Beach Regional Park as an inter-connected conservation unit.

4 Monitoring

Monitoring will be important to measuring the success of the ESA Strategy in conserving environmentally sensitive areas. With the availability of high resolution ortho photography, the City should undertake a comparative review of the Ecological Network and ESA’s either through its GIS department or by contracting out to the private sector. Areas of uncertainty may require some ground investigation by qualified city staff or through a contracted QEP. The science-based approach to mapping and identifying environmentally sensitive areas and their component values has created a dataset which will be useful in measuring changes to land cover and land use over time. There are other measures of success including access to natural areas, restored habitat in urban parks and greenways, and measures to track environmental health such as forest cover, extent of wetlands, watercourse habitat quality.

1. Map environmentally sensitive periodically.

2. Develop a report card on environmental management based on indicators of (1) environmental health: watercourse habitat quality, water quality (temperature), extent of intertidal wetlands, fish presence, amphibian presence, extent of freshwater wetlands, and forest cover; and (2) indicators of public access and recreation; (e.g., population within 10 minute walk of ESA).

3. Improve management of environmental information (data, reports, etc).

4. Please refer to the Appendix B for Bylaws with Environmental Components for policies on enforcement. The bylaws outline various regulatory tools available to the City, and the Table in the appendix recommends various refinements to the policies.
APPENDICES

Appendix A
TECHNICAL METHODS
General Methodology

Preparing the ESA Management Strategy involved an incremental study approach, as follows:

1. An Initial Scientific Review:
   - **Why:** It is important to know what is environmentally there and how best to manage it (e.g., to identify a best practices environmental management model - the Ecological Network Model)
   - **The General Process:**
     - an extensive scientific based review and analysis of relevant City and other authorities’ recent and current environmental and ecological policies, studies, maps and orthophotos, including the existing 1999 OCP ESA areas and guidelines,
     - consultations with stakeholders (e.g., City divisions, DFO, FREMP, ALC)
     - selected field work to verify what’s there and preliminary findings (e.g., areas along the West Dike),
     - a review of relevant environmental management models
     - selecting a best practices model (i.e., the Ecological Network [EN] Model)
     - based on the Ecological Network Model, applying and evaluating the environmental and ecological assets
     - identifying possible EN and ESA areas (e.g., bog, marsh, trees, wildlife), their ecological values (e.g., biodiversity, habitat, recreation) and their suggested their relative importance (e.g., from High to Lower: Intertidal Areas, Shorelines, Upland Forests, Old Fields and Shrublands, Freshwater Wetlands) was done
     - Integrating the above to identify a preliminary Ecological Network Model (e.g., Hubs, Corridors, Sites)

2. Making the ESA Management Strategy Relevant and Current
   - As some of the past environmental studies reviewed are out of date with respect to more recent City approved planning policies which superseded them (e.g., the 2006 West Cambie Area Plan, 2006 City Riparian Management Area Approach, 2009 City Centre Area Plan, more recent City Centre approved and pending rezonings), it was necessary to adjust the draft Ecological Network to reflect these realities,
   - As well, the proposed ESA Strategy was adjusted to reflect the principle of minimizing regulatory redundancy which means that:
• in some circumstances, rather than use the City’s ESA approach, the agency with the more authority will be expected to implement the Ecological Network and,
• in other cases, the City would retain singular (e.g., ESA or Riparian) and in other cases, dual regulatory authority (e.g., City: ESA and with FREMP, certain Shoreline areas)

3. The Proposed ESA Management Strategy Result
   The result is the proposed ESA Management Strategy which includes Ecological Network policies and map, and ESA policies, guidelines and map.

Vegetation Mapping

An important gap in the existing dataset for the City of Richmond was the lack of consistent City-wide vegetation mapping. Vegetation provides the structure which supports biodiversity and is a key indicator of ecological function. Vegetation can also be mapped consistently using the interpretation of orthophotos (rectified air photos). To fill this gap in existing data, natural and semi-natural vegetation was mapped across the entire City using orthophotos taken in April 2009. Vegetation polygon mapping was conducted in ArcView 3.2 and ArcGIS 9 at a scale of 1:4,000 with a minimum polygon size of approximately 0.1 ha.

Analytical methods used a modified version of the U.S. National Vegetation Classification to classify all natural and semi-natural vegetation across the City. The USNVC was selected as the best standardized approach for mapping vegetation in Richmond for several reasons:

• There is no consistent, standardized approach currently being used for urban areas of the lower Fraser Valley;
• Terrestrial Ecosystem Mapping (TEM) is the most standard method in BC, but it is often too coarse for urban areas;
• The USNVC is a documented method that can be further refined to look at specific plant communities of conservation significance; and
• The USNVC is used by the BC Conservation Data Centre and NatureServe (the North American conservation data management system) and future data collected on ecological communities can be used for regional conservation planning.
The USNVC classifies vegetation into a series of physiognomic (structural) classes based on vegetation type. There are seven physiognomic classes: forest, woodland, shrubland, dwarf-shrubland, herbaceous, non-vascular, and sparse vegetation. Subclasses are used to further divide the classes based on vegetation composition and characteristics, such as leaf phenology.

The analysis also defined some natural areas that do not have vegetation but were important to the study, such as water bodies, mudflats, or recently cleared sites. To include these, the mapping added one additional class, unvegetated (UV), with two subclasses, unconsolidated material (UC) and water (WA).

Selected field review of vegetation communities was undertaken to better identify polygon boundaries and characterize dominant species in representative sites. As well, the boundaries and classification of many polygons were reviewed by a second project team member to ensure consistency.

**Vegetation Modifiers**

To further characterize vegetation, modifiers and submodifiers were added to denote more specific land cover types or uses (e.g., pasture, crops, golf courses, ponds) that affect vegetation management. For forested polygons, forest age was assessed as young, mature, or old-growth. Tables 1 and 2 summarize the range of vegetation modifiers used.

Small areas of vegetation were not mapped (e.g., one or few street trees, house lawns, and gardens) in urban or dense suburban areas where natural or semi-natural vegetation was not the dominant land cover type. While they are a part of green infrastructure in the City, mapping efforts focused on the larger areas of vegetation.

**Vegetation Naturalness**

As part of the vegetation mapping, the study assessed the naturalness of each vegetation polygon, taking into account the history and frequency of human disturbance. Naturalness is an important aspect of vegetation in urban areas because modification includes initial logging, changes to ecological disturbance processes such as reduced flooding, succession, and the establishment of non-native plants. A scale from 1 to 5 was used, where 1 was least natural and 5 was most natural. Table 3 provides the naturalness scale used with example habitat types and Table 4 describes forest age ratings.
### Table 1. Vegetation classes (5) and subclasses (13) in the City of Richmond

<table>
<thead>
<tr>
<th>Class</th>
<th>Subclass</th>
<th>Richmond Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest (FO)</td>
<td>Evergreen Forest (FO-EV)</td>
<td>Western hemlock forest</td>
</tr>
<tr>
<td></td>
<td>Deciduous Forest (FO-DE)</td>
<td>Black cottonwood forest; paper birch forest</td>
</tr>
<tr>
<td></td>
<td>Mixed Evergreen-Deciduous Forest (FO-MX)</td>
<td>Western red cedar forest; Big-leaf maple forest</td>
</tr>
<tr>
<td>Shrubland (SH)</td>
<td>Evergreen Shrubland (SH-EV)</td>
<td>Rhododendron gardens</td>
</tr>
<tr>
<td></td>
<td>Deciduous Shrubland (SH-DE)</td>
<td>Hardhack shrubland; Himalayan blackberry shrubland</td>
</tr>
<tr>
<td></td>
<td>Mixed Evergreen-Deciduous Shrubland (SH-MX)</td>
<td>Cultivated gardens</td>
</tr>
<tr>
<td>Herbaceous (HB)</td>
<td>Perennial Graminoid Vegetation (HB-GR)</td>
<td>Lawns; old fields; pastures</td>
</tr>
<tr>
<td></td>
<td>Hydromorphic Rooted Vegetation (HB-HY)</td>
<td>Cattail marshes; reed canary grass marshes</td>
</tr>
<tr>
<td></td>
<td>Annual Graminoid or Forb Vegetation (HB-AN)</td>
<td>Gardens; fields with corn</td>
</tr>
<tr>
<td>Sparse Vegetation (SV)</td>
<td>Boulder, Cobble, Gravel, or Talus Sparse Vegetation (SV-BO)</td>
<td>Gravel bars; riprap bank protection with sparse vegetation</td>
</tr>
<tr>
<td></td>
<td>Unconsolidated Material Sparse Vegetation (SV-UC)</td>
<td>Exposed soil and gravel with sparse vegetation</td>
</tr>
<tr>
<td>Unvegetated (UV)</td>
<td>Unvegetated Unconsolidated Material (UV-UC)</td>
<td>Gravel and soil with no vegetation</td>
</tr>
<tr>
<td></td>
<td>Unvegetated Water (UV-WA)</td>
<td>Water (ponds, river, channels with no emergent vegetation)</td>
</tr>
</tbody>
</table>
Table 2. Vegetation modifiers (3) and submodifiers (19) for City of Richmond

<table>
<thead>
<tr>
<th>Modifier</th>
<th>Submodifier</th>
<th>Modifies</th>
<th>Richmond Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural (AG)</td>
<td>Pasture (AG-PA)</td>
<td>HB-GR</td>
<td>Hay fields and pastures</td>
</tr>
<tr>
<td></td>
<td>Old field (AG-OF)</td>
<td>HB-GR</td>
<td>Unmaintained fields with previous agricultural activity</td>
</tr>
<tr>
<td></td>
<td>Seasonally flooded (AG-SF)</td>
<td>HB-GR</td>
<td>Agricultural fields with seasonal flooding</td>
</tr>
<tr>
<td></td>
<td>Row Crop (AG-RC)</td>
<td>HB-GR, SH</td>
<td>Vegetable fields, blueberry fields</td>
</tr>
<tr>
<td></td>
<td>Corrals (AG-CO)</td>
<td>SV-UC</td>
<td>Corrals, horse riding rings, feed lots</td>
</tr>
<tr>
<td></td>
<td>Bare Ground (AG-BG)</td>
<td>SV-UC</td>
<td>Recently plowed or cleared fields with no evidence of crop</td>
</tr>
<tr>
<td>Developed (DV)</td>
<td>Playing Field (DV-PF)</td>
<td>HB-GR</td>
<td>Turf soccer fields</td>
</tr>
<tr>
<td></td>
<td>Lawn (DV-LA)</td>
<td>HB-GR</td>
<td>Developed lawns in parks</td>
</tr>
<tr>
<td></td>
<td>Old fields (DV-OF)</td>
<td>HB-GR</td>
<td>Unmaintained fields without previous agricultural activity</td>
</tr>
<tr>
<td></td>
<td>Garden (DV-GA)</td>
<td>SH, HB</td>
<td>Large residential gardens, parks</td>
</tr>
<tr>
<td></td>
<td>Golf Course (DV-GC)</td>
<td>HB-GR</td>
<td>Grass areas in golf courses</td>
</tr>
<tr>
<td></td>
<td>Bare Ground (DV-BG)</td>
<td>SV-UC</td>
<td>Gravel road, dirt road, and similar clearings</td>
</tr>
<tr>
<td></td>
<td>Road Margin (DV-RM)</td>
<td>HB-GR</td>
<td>Road medians and edges, may be sporadically maintained</td>
</tr>
<tr>
<td></td>
<td>Urban Trees (DV-UT)</td>
<td>FO</td>
<td>Planted hedges, landscaping trees, forest with no natural understory</td>
</tr>
<tr>
<td>Aquatic (AQ)</td>
<td>Wetland (AQ-WN)</td>
<td>HB-HY</td>
<td>Freshwater wetlands: fens, marshes, swamps</td>
</tr>
<tr>
<td></td>
<td>Lake/Pond (AQ-LP)</td>
<td>HB-HY, UV-WA</td>
<td>Farm and golf course ponds, natural lakes</td>
</tr>
<tr>
<td></td>
<td>River/Fluvial (AQ-RF)</td>
<td>HB-HY, UV-WA</td>
<td>Larger river channels including the Fraser River</td>
</tr>
<tr>
<td></td>
<td>Marine/Intertidal (AQ-MI)</td>
<td>NV-AL, SV-UC</td>
<td>Mud flats, beaches, river flats with tidal activity</td>
</tr>
<tr>
<td></td>
<td>Ditches (AQ-DI)</td>
<td>UV-WA</td>
<td>Large ditches</td>
</tr>
</tbody>
</table>
Table 3. Vegetation naturalness ratings (5) for City of Richmond

<table>
<thead>
<tr>
<th>Name</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>Undisturbed by direct human activity</td>
<td>Old-growth Forest</td>
</tr>
<tr>
<td>Mainly Natural</td>
<td>Disturbed historically (logged) by sufficient time to restore native species and structure; eg forests greater than 120 years old</td>
<td>Older forest, saltmarshes; some older deciduous forests</td>
</tr>
<tr>
<td>Semi-natural</td>
<td>Disturbed vegetation; predominantly native species but lacking some species and structures associated with natural vegetation</td>
<td>Red alder forest;</td>
</tr>
<tr>
<td>Altered</td>
<td>Heavily disturbed vegetation that is often a mix of native and non-native species; may be recovering or rapidly changing</td>
<td>Old fields; hedgerows, shrub communities on cleared sites</td>
</tr>
<tr>
<td>Cultural</td>
<td>Vegetation that is regularly maintained</td>
<td>Crops, pasture, gardens, lawns</td>
</tr>
</tbody>
</table>

Table 4. Forest age ratings (3) for City of Richmond

<table>
<thead>
<tr>
<th>Forest Age</th>
<th>Name</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Young</td>
<td>Typically 5 to 35 years with canopy closure; often very even in appearance</td>
<td>Young red alder or cottonwood stands</td>
</tr>
<tr>
<td>M</td>
<td>Mature</td>
<td>35 to 120 years old; multilayered canopy; more structural diversity</td>
<td>Mature second-growth coniferous, deciduous, and mixed forests</td>
</tr>
<tr>
<td>O</td>
<td>Old</td>
<td>&gt;120 years old</td>
<td>Old growth forest</td>
</tr>
</tbody>
</table>

Delineation of the Ecological Network

The study used several GIS-based analysis methods to identify hubs and corridors. These GIS methods were supplemented with more qualitative assessments of hub boundaries and corridor integrity.

Hub Identification

Hubs were initially defined as contiguous areas of ecological importance at least 10 ha in size. Ten hectares was selected as the size threshold for hubs because it encompasses moderately large natural areas that can support populations of many native wildlife species, particularly if there are other natural areas nearby.
GIS analysis was first used to identify and delineate hubs of contiguous or near-contiguous vegetation of naturalness 3 or greater at least 10 ha in size. Polygons with naturalness 3 or greater include young red alder forests, structurally-diverse old fields with shrub development, natural wetlands, and more.

Second, to the hubs that met this first criterion, the study added any adjacent areas of naturalness 2 or greater. This acknowledged that hub boundaries will likely change over time as some areas are lost to development or other activities while others areas may become more natural through succession. For example, old fields classified as naturalness 2 were added to adjacent hub areas.

Third, the study conducted a manual review of GIS-generated hub boundaries and made minor modifications to eliminate small breaks or holes such as two-lane roads or utility rights-of-way and to remove linear “arms” on hubs which are subject to substantial edge effects.

Finally, the study identified any remaining existing natural park lands and added them either to existing hubs or as new hubs, whether or not they met the 10 ha or naturalness criteria. This was done in recognition of their important role in the Ecological Network.

**Sites**

Sites are smaller areas of natural or semi-natural vegetation between 0.25 and 10 ha in size. They are also important to the functioning of the EN but are too small to be considered hubs. Many neighbourhood parks have areas of forest or shrub vegetation in this size range with significant ecological value.

**Assessing Landscape (Hub) Linkage Potential**

A corridor suitability layer (Weber & Wolf 2000) was created in order to assess the linkage potential across the landscape between hubs and to identify conduits and barriers for wildlife migration and seed movement. This corridor suitability layer is a landscape assessment of relative impedance to wildlife travel. Several layers were combined in an overlay process to represent lower impedance values for natural features and higher impedance values for human made features such as roads.

The base layer of this raster scanned pattern layer is vegetation. To the vegetation layer, the study filled in areas not mapped during the vegetation mapping (unvegetated areas, urban areas,) using the Metro Vancouver land cover layer from 2006 to form a...
single layer covering the entire City. Then, the study overlaid the City of Richmonds’s watercourse and roads as these have the potential to be conduits and barriers respectively, to the movement of animals and plants. As the watercourses were linear (vector-based) features, they are shown at a 1 metre width.

Once all the layers (vegetation, development, watercourses, roads) were combined through overlay, the study assigned an impedance value which measures the degree to which each landscape type inhibits wildlife use and movement. Wildlife, in this context, should be considered a hypothetical species rather than a specific mammal, bird, or amphibian species. Selected impedance values used for each land cover type are summarized in Table 5, below. Although numerical, the values represent the qualitative judgment of the authors.

**TABLE 5: Impedance Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>Category</th>
<th>Feature</th>
<th>Impedance Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation</td>
<td>Forest</td>
<td>Coniferous/evergreen</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deciduous or Mixed</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Shrubland</td>
<td>Evergreen, Deciduous or mixed</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deciduous Shrubland</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mixed Shrubland</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Herbaceous</td>
<td>Graminoid or Forb</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hydromorphic Rooted</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Sparsely Vegetated or UnVegetated</td>
<td>Boulder, Cobble, Gravel, or Talus</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unconsolidated material</td>
<td>200</td>
</tr>
<tr>
<td>Modifiers</td>
<td>Agriculture</td>
<td>Pasture</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Old Field/Rough Grass</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forage</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Row Crop</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corral</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bare Ground</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Developed</td>
<td>Playing Field</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lawn</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Garden</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Golf Course</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gravel/dirt road</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road margin</td>
<td>150</td>
</tr>
</tbody>
</table>
### Appendix A: Technical Methods

<table>
<thead>
<tr>
<th>Aquatic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban trees</td>
<td>200</td>
</tr>
<tr>
<td>Wetland, Lake/Pond or River/Fluvial</td>
<td>50</td>
</tr>
<tr>
<td>Creeks and ditches (higher values for channels less supportive of fish life)</td>
<td>50 to 150</td>
</tr>
<tr>
<td>seasonal flood</td>
<td>0</td>
</tr>
<tr>
<td>marine intertidal</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other veg</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest age</td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td>add 25</td>
</tr>
<tr>
<td>Mature</td>
<td>add 0</td>
</tr>
<tr>
<td>Old</td>
<td>substract 25</td>
</tr>
<tr>
<td>Forest type</td>
<td></td>
</tr>
<tr>
<td>Riparian forest (adjacent to streams 30m)</td>
<td>substract 25</td>
</tr>
<tr>
<td>Interior forest (&gt;100 m from edge)</td>
<td>substract 13</td>
</tr>
<tr>
<td>Naturalness</td>
<td></td>
</tr>
<tr>
<td>Natural</td>
<td>substract 20</td>
</tr>
<tr>
<td>Mainly Natural</td>
<td>substract 10</td>
</tr>
<tr>
<td>Semi-natural</td>
<td>add 0</td>
</tr>
<tr>
<td>Altered</td>
<td>add 10</td>
</tr>
<tr>
<td>Cultural</td>
<td>add 20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Urban Areas</th>
<th>Generalized land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential - Rural</td>
<td>500</td>
</tr>
<tr>
<td>Residential - Single</td>
<td>1000</td>
</tr>
<tr>
<td>Detached/Duplex</td>
<td></td>
</tr>
<tr>
<td>Residential - Townhouse</td>
<td>2500</td>
</tr>
<tr>
<td>Residential - Low-rise</td>
<td>3500</td>
</tr>
<tr>
<td>Apartment</td>
<td></td>
</tr>
<tr>
<td>Residential - High-rise</td>
<td>4000</td>
</tr>
<tr>
<td>Apartment</td>
<td></td>
</tr>
<tr>
<td>Residential - Commercial/Mixed, Industrial and other Intensive Uses*</td>
<td>5000</td>
</tr>
</tbody>
</table>

*Note: there are added impedance values to buffers around these land uses (900 for 20m buffer, 500 for 20-50m buffer and 250 for 50-100m buffer)

<table>
<thead>
<tr>
<th>Traffic</th>
<th>Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td></td>
</tr>
<tr>
<td>Provincial Highway</td>
<td>5000</td>
</tr>
<tr>
<td>Arterial</td>
<td>1000</td>
</tr>
<tr>
<td>Major Collector</td>
<td>500</td>
</tr>
<tr>
<td>Local</td>
<td>300</td>
</tr>
<tr>
<td>Green</td>
<td>100</td>
</tr>
<tr>
<td>Lane</td>
<td>200</td>
</tr>
<tr>
<td>Margin/Lane</td>
<td>200</td>
</tr>
</tbody>
</table>

---

Richmond ESA Management Strategy (September 10, 2012 draft)  Appendix A: x
Appendix A: Technical Methods

<table>
<thead>
<tr>
<th>Terrain</th>
<th>Slopes</th>
<th>0-8% slope</th>
<th>add 0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9-15% slope</td>
<td>add 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16-25% slope</td>
<td>add 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;25% slope</td>
<td>add 10</td>
<td></td>
</tr>
</tbody>
</table>

**Corridor Identification**

A detailed process was undertaken to propose optimum connections between hubs. This process involved using GIS analysis followed by detailed review to find the shortest, most natural connectivity route between hubs.

Least-cost path analysis was used to determine the best ecological routes between hubs. Least-cost path analysis is a GIS method used to assess connectivity between habitat sites by examining the condition of the intervening landscape. The analysis identifies pathways between hubs that offer the lowest cumulative resistance to movement by plant and animal species. A manual review of the GIS identified least-cost paths was conducted, leading to minor adjustments to the network to remove errors and merge or remove redundant or closely parallel paths. Potential corridors were then created by buffering the least-cost paths by 50 m on each side for a total width of 100m.

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.

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.

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 least-cost path analysis and are shown where connectivity would significantly benefit the integrity of the Ecological Network but is currently lacking. Larger-scale restoration efforts would be required to restore connectivity in these areas.
Intertidal and Shoreline Areas

Shoreline areas are defined as lands within 30 m (landward) of the high water mark. The Intertidal Zone is defined as lands within 30 m of the high water mark. The high water mark was based on existing City of Richmond data supplemented with minor recent field assessment and visual checks.

Evaluating the Ecological Integrity and Functioning of the Network

The relative importance of different components of Richmond’s Ecological Network was evaluated using a series of criteria that measure each component’s existing ecological conditions and functions. Criteria were developed based on well-established landscape ecology, stormwater management, and planning principles and assess network components in each of the four major Ecosystem Network service categories highlighted previously:

1. Biodiversity and Wildlife (7 criteria):
   - Hub size (ha)
   - Area-to-perimeter ratio (roundness)
   - Area-weighted average naturalness
   - # of vegetation classes with naturalness ≥ 3
   - % interior forest (≥ 50 m from edge)
   - % habitat with naturalness ≤ 2
   - Road density (m/ha)

2. Watersheds, Watercourses, and Wetlands (5 criteria):
   - % total impervious area (TIA) within hub
   - Hub’s % contribution to overall catchment TIA
   - Amount and % of riparian buffer within hub (within 30 m of watercourse)
   - % Riparian Forest Integrity within hub
   - Amount and % wetlands within hub

3. Recreation
4. Number of dwellings within a 10 minute walk of hub or site
5. Number of hubs or sites within a 10 minute walk of hub or site
6. Number of unique landscapes within the hub or site
7. Number of connections to existing recreation infrastructure
For each criteria, each hub and site was initially ranked for their ecological value from highest to lowest. Each hub and site’s overall ecological significance in each of the four major ecosystem service categories was then assessed by simple addition of the ranks for all the indicators within each category.
# Appendix B

## Existing Richmond Bylaws with Environmental Components

<table>
<thead>
<tr>
<th>Existing Bylaw</th>
<th>Environmental Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Official Community Plan Bylaw 7100 (1999)</td>
<td>Goals, objectives, policies, development permit justification and guidelines</td>
</tr>
<tr>
<td>Zoning Bylaw 8500 (2009)</td>
<td>Establishes zones for land use, density, yards, height, parking, etc.</td>
</tr>
<tr>
<td>Tree Protection Bylaw 8057</td>
<td>Requires permits for tree removal and planting of replacement trees</td>
</tr>
<tr>
<td>Soil Removal and Fill Deposit Regulation Bylaw 6803</td>
<td>Regulates fill in the City. Separate from ALR’s regulation of soil removal/deposit.</td>
</tr>
<tr>
<td>Pollution Prevention and Cleanup Bylaw 8475</td>
<td>Prohibits release of a polluting substance to soil or watercourse / drainage system.</td>
</tr>
<tr>
<td>Watercourse Protection and Crossing Bylaw No. 8441</td>
<td>Prohibits pollution or obstruction of drainage components, regulates ditch crossings</td>
</tr>
<tr>
<td>Drainage, Dike and Sanitary Sewer System Bylaw 7551</td>
<td>Includes an annual fee per parcel for improvements and upgrades to the Dike System</td>
</tr>
<tr>
<td>Floodplain Designation and Protection Bylaw 8204</td>
<td>Sets flood construction levels</td>
</tr>
<tr>
<td>Subdivision Control Bylaw 6530</td>
<td>Sets design and constructions standards for subdivision, works and services</td>
</tr>
<tr>
<td>Municipal Ticket Information Authorization Bylaw 7321</td>
<td>Allows ticketing and fines for named offences</td>
</tr>
<tr>
<td>Development Application Fees Bylaw 7984</td>
<td>Includes fees for Development Permits</td>
</tr>
</tbody>
</table>

Note: refer to the original bylaws for details of their wording and intent
Also refer to Map 2: City of Richmond Ecological Network Management Map
Appendix C: Vegetation Survey Guidelines for ESAs

All applicants for development permits involving environmentally sensitive areas (ESA) should submit a vegetation survey with the application as part of the Environmental Report. The vegetation survey should include the following:

1. The location, diameter (dbh), crown elevation, base elevation, and species of all trees greater than 20 cm in diameter or greater at breast height in and adjacent to the designated ESA. Trees adjacent to designated ESAs includes trees within 10 m of the ESA boundary. Multi-stemmed or clumped trees should also be included.

   (DBH – Diameter Breast Height) means the diameter of the trunk of a tree measured at a point 1.4 metres above the natural grade, except where the diameter of a tree having multiple trunks 1.4 metres above the natural grade shall be the sum of 100% of the diameter of the largest trunk and 60% of the diameter of each additional trunk.

2. The extent of coverage and species of the dominant understorey shrubs within the areas described above;

3. A description of any ecological communities ranked as S3 (vulnerable at a provincial scale) or higher;

4. The location and type of all known utilities entering or immediately adjacent to the ESA;

5. Existing and proposed property lines and building footprints for the entire site;

6. The location of the high water mark (if adjacent to the foreshore or a waterway system) and the extent of the ESA on the site.

The application should also include:

1. One or more photographs showing as much of the ESA as possible. The photographs should be notated on the plan showing the viewpoint and direction of view;

2. A grading plan or cross section showing finished grade and appropriate drainage within 1.5 times the drip-line of the tree;

3. If necessary, a landscaping plan showing the location, size, and species of trees and shrubs to be planted as compensation for those anticipated for removal. At least 50% of the replacement species should be selected from the city’s list of recommended native plants and should be compatible with natural vegetation growing in the area. All planting is required to conform to BCSLA/BCNTA planting standards.
Appendix D: MAPS