

Ecological Inventory for New Westminster

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Submitted to:

City of New Westminster
511 Royal Avenue
New Westminster, BC
V3X 3A2

Submitted by:



DIAMOND HEAD
CONSULTING LTD.

342 West 8th Avenue
Vancouver, BC
V5Y 3X2

and



#102 1661 west 2nd Ave
Vancouver, BC
V6J 1H3





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1 History and Context

The City of New Westminster is a dynamic, vibrant urban center that grew up on the banks of the Fraser River. Much of the City's early prosperity was due to its position on this waterway, and the surrounding forests that supplied the local timber mills. Over time, continued industrial activity, development and population growth significantly altered the natural landscape. Today, the original old growth forests that once characterized this region are gone. Although the City still retains some natural areas and features, they generally exist in a fragmented, altered state. Despite their altered condition, they are of enormous value to the City and provide a number of benefits for both people and wildlife. In the face of continuing development pressure and the emergence of new threats, such as climate change and invasive species, the City is developing policies and strategies to protect, maintain and enhance its important natural heritage.

1.1 An ecological inventory of the City

This inventory of the City's natural assets supports ongoing planning initiatives across municipal departments. A primary objective is to identify natural areas and features that are significant functional components of the City's ecological network. The inventory provides a fundamental understanding of the occurrence, condition, and value of these assets, which is an essential first step to better inform future management decisions. Information in this report is complemented by New Westminster's Urban Forest Management Strategy, which provides a thorough analysis of the City's tree assets, policy and planning initiatives.

2 Regulatory Overview

The regulatory environment as it pertains to protection of natural areas is separated into federal, provincial and municipal levels. Each level of government has different powers and responsibilities, which influence land use and development. The City works with government agencies and other municipalities to achieve local and regional goals, including those related to biodiversity conservation.

2.1 Federal

Federal involvement in municipal affairs is limited due to constitutional provisions that give provinces jurisdiction over most matters. Some relevant exceptions include regulation of fisheries, species at risk, and migratory birds:

- **Migratory Birds Convention Act, 1994** (MBCA). Enacted to implement the *Migratory Birds Convention*, a treaty signed with the United States to protect *listed* bird species. The federal government has jurisdiction wherever listed birds occur.
- **Fisheries Act, 1985**. Currently, the federal government has jurisdiction wherever fish and fish habitat occurs. Recent amendments to the *Fisheries Act* focus fish protection on aboriginal, commercial and recreational fisheries specifically, rather than all fish habitat.
- **Species at Risk Act, 2002** (SARA). Includes provisions to help protect and manage threatened and endangered species and their critical habitat. The federal government's jurisdiction is limited to federally owned lands; however, provisions in the Act require that provinces protect listed species to the standards of SARA.

- **Canadian Biodiversity Strategy (1995).** Canada’s response to the Convention on Biological Diversity. Canada was an original signatory at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro.

2.2 Provincial

The Province grants municipalities the authority to govern its own affairs and pass by-laws relating to its environmental, social and economic well-being. However, the province does maintain jurisdiction in some areas:

- **Fish Protection Act, 1997** and attendant **Riparian Areas Regulation, 2004 (RAR)**. RAR was enacted to protect riparian habitat and maintain stream health and productivity. It requires municipalities to enact streamside protection provisions during development, using a meet-or-beat approach.
- **Water Sustainability Act, 2014.** This Act replaces the *Water Act, 1996*. The purpose of the Act is to manage the uses of water (including both surface and groundwater) in the province, except where private rights have been established as per the regulation. Provisions for protection of aquatic environments and stream health are included. The Act renames the *Fish Protection Act*, to be known as the *Riparian Areas Protection Act*, and will clarify the government’s authority to make regulations concerning development in riparian areas. This change may include amendments to the *Riparian Areas Regulation which is the policy adopted in New Westminister to determine streamside setbacks*.
- **Wildlife Act, 1996.** This Act provides for the protection and management of wildlife in British Columbia, including endangered and threatened species.
- **Local Government Act, 1996.** This Act outlines the powers and responsibilities of local governments. This includes implementation of land use regulations, development requirements, provisions for park land acquisition and designation of environmentally sensitive areas.
- **British Columbia Biodiversity Strategy.** A framework is currently being developed to prepare a Biodiversity Strategy for the province. This framework includes a report on the Status of Biodiversity (2008), a Biodiversity Atlas (2009) and other supporting material. Component reports address impacts to biodiversity, climate change, key and special elements, genetic diversity and First Nations.

2.3 Municipal/Regional

- **Metro Vancouver Regional Growth Strategy (RGS) – Metro Vancouver 2040: Shaping our Future (2011).** The RGS is supported by member municipalities, including the City of New Westminister. It contains goals, such as protecting the environment and responding to climate change impacts, which support the region’s collective vision for the future. The City works in partnership with Metro Vancouver to achieve regional objectives, such as establishment of a Green Zone and the Brunette Fraser Greenway, which is considered integral to the future regional park system and trail network.

- **Official Community Plan (2011).** The Official Community Plan (OCP)¹ provides the community's long-term vision for the City, in addition to the goals and objectives that support its path forward to achieving it. One of its primary goals is to protect the environment and respond to climate change impacts. Several strategies are provided, including protecting conservation and recreation lands and protecting and enhancing natural features and their connectivity.
- **Envision 2032 – Sustainability Framework (2013).** This document, developed by council, city staff, and community partners, is the lens through which the city's actions will be measured as it moves forward to meet its sustainability objectives. It provides a sustainability framework to guide and evaluate city plans, policies, projects and practices with regard to economic, social, cultural and environmental implications.
- **Urban Forest Management Strategy (2015).** The Urban Forest Management Strategy (UFMS) recognizes the urban forest as a valued public resource that provides a variety of ecological, economic, and social benefits. It recommends the protection of existing trees and measures to increase tree canopy cover across the City. This plan provides a community-supported vision for managing its urban forest.
- **Riparian Areas Protection Bylaw No. 7033, 2005.** The City's formal response to the Provincial Riparian Areas Regulation, enacted to preserve, protect, restore and enhance the natural environment near streams that support fish habitat from harmful conditions associated with commercial, industrial and residential development. Significant fish-bearing watercourses in the City that are subject to RAR include the Fraser River and Brunette River. Queensborough ditches have also been classified based on fish presence and habitat.
- **Tree Cutting Bylaw No. 5745, 1988.** The tree cutting bylaw requires approval of the City before cutting of trees. A valid tree permit is required prior to cutting on land within 30 metres of the Brunette River and other designated areas as specified in the bylaw.

2.4 Municipal Policy Recommendations

The City has specific powers to plan and manage land use within municipal boundaries. The OCP and *Envision 2032* Sustainability Framework encourage the protection and enhancement of natural areas and environmental functions in the City. Specific recommendations are made within this report to achieve these goals; the broader City-wide policies listed below should be considered for adoption:

- Establish an Environmental Development Permit Area and new design guidelines for land within 50 metres of Fraser River and Brunette rivers to encourage retention, restoration and enhancement of riparian habitat and urban forests;
- Identify a Green Infrastructure Network (GIN) for the City that is also consistent with the Regional Green Infrastructure Network (RGIN) proposed by Metro Vancouver as well as the initiatives proposed in Experience the Fraser (ETF);
- Develop an invasive species management plan for the City to address risks associated with introduced plant and animal species;

¹ **The Official Community Plan for the City of New Westminster.** The Corporation of the City of New Westminster Schedule A to Bylaw 7435, 2011

- Develop Park Master plans for Moody, Tipperary, Glenbrook Ravine and Hume Park. These should include concrete recommendations to enhance the parks wildlife habitat and ecological integrity;
- Enforce responsible development timing windows for fish and wildlife. This includes tree and shrub removal during the bird nesting season (March 1 to August 30), and regional timing windows established by the BC Ministry of Environment for work in and around a watercourse for the Lower Mainland Region;
- Consider implementing a City-wide Green Tax to acquire and restore high priority natural areas;
- Support stewardship activities on private land including tree planting, pollinator gardens, and backyard wildlife habitat;
- Encourage community adoption of public space, including boulevards and traffic circles and the inclusion of environmental components into these areas.

3 Completing the Ecological Inventory: Methods

This ecological inventory identifies areas of relative naturalness on City-owned (public) and privately owned lands. Due to the number and diversity of natural areas and ecological features that are present, specific criteria and limitations have been applied for this inventory:

- Natural areas and other cover types within the City and surrounding borderlands were classified using air photo interpretation;
- Four broad cover classes were applied as part of the classification: forest, aquatic, shrub/herb and developed (e.g. buildings, roads, etc.). Cover classes are described further according to sub-classes (e.g. deciduous, coniferous) and modifiers (e.g. mature, immature);
- Only natural areas larger than 500 m² were inventoried; small landscape features such as residential gardens and individual trees were not included;
- Borderlands in neighbouring jurisdictions were included to ensure that regional connectivity was considered;
- All streams were classified according to the Queensborough 2012 Watercourse Classification:
 - A (Red) – Rearing habitat that is accessible to fish;
 - B (Yellow) – Inaccessible to fish but providing important food and nutrients;
 - C (Green) – Not fish habitat.
- Residential boulevards were not stratified for this inventory;
- Cover classes follow property lines in areas where they closely overlap.

Ground truthing was completed to confirm the natural areas' class, subclass and modifiers (see Appendix C). Representative plots were established in natural areas (geo-positioned to permit future monitoring) as part of the ground survey (see Appendix B). Information collected included:

- Ecosystem Classification (BC Biogeoclimatic Ecosystem Classification System);
- Physiography, including topographic and soil information;
- Vegetation, including species, age, size, composition, and condition (i.e. health); and Invasive plant species.

4 A Summary of the Ecological Inventory

A substantial amount of information was collected as part of the ecological inventory. Full details are contained in the Appendices of this report. This section provides a brief snapshot of New Westminster's natural areas and their ecological conditions, as they exist in 2014.

4.1 Terrestrial ecology

Mapped terrestrial areas include natural and semi-natural cover classes (forest, shrub-herb, and areas influenced by urban developed). Developed areas include landscaped and maintained areas that provide natural features (gardens, parks, cemeteries, boulevards, etc).

- 232 hectares (ha) of terrestrial area was mapped across the City, this constitutes 14.8% of the City's landbase;
- Large, intact forest communities occupy 62 hectares (4%) of the City. The majority of these forests are found on public land including Hume Park, Glenbrook Ravine, and a lot between Boyne and Wood Street in the Queensborough neighbourhood. The largest tract of forest is on Poplar Island.
- All forests are second growth stands, the majority of which are dominated by deciduous species;
- Shrub herb communities cover 26 ha (1.6%) of the City. Invasive plants predominate in these areas, which generally occur as narrow linear strips along roads, railways and rights-of-way;
- Developed landscapes cover 144 ha (9.2%) of the City. Of this, approximately 48 hectares are categorized as urban trees. 96% of these are found in City parks where the understory associated with these trees are generally landscaped or maintained as turf.

Table 1: Terrestrial ecological cover types area summary

Class	Subclass	Modifier	Area (ha)	% of City Land Area (1538 ha)
Forest			61.9	4.0%
	Deciduous		48.2	3.1%
		Mature (60 yrs)	19.1	1.2%
		Young (10-60 yrs)	29.1	1.9%
	Evergreen		2.7	0.2%
		Mature (60 yrs)	2.7	0.2%
	Mixed Evergreen Deciduous		11.1	0.7%
		Mature (60 yrs)	3.8	0.2%
		Young (10-60 yrs)	7.3	0.5%
Developed			143.7	9.3%
	Garden		3.9	0.3%
		Private	0.5	0.0%
		Public	3.4	0.2%
	Managed Grass		92.1	6.0%
		Boulevard/Right-of-way	17.0	1.1%
		Cemetery	12.3	0.8%
		Lawn	3.6	0.2%
		Other	23.9	1.6%
		Park	20.3	1.3%
		Playing Field	15.0	1.0%
	Urban Trees		47.7	3.1%
		Hedgerow	1.1	0.1%
		Park Trees Deciduous	7.4	0.5%
		Park Trees Evergreen	4.8	0.3%
		Park Trees Mixed	30.8	2.0%
		Private Trees Deciduous	0.7	0.0%
		Private Trees Mixed	0.6	0.0%
		Street Trees	2.2	0.1%
Shrub/Herb			25.8	1.6%
	Herbaceous and Grass		2.3	0.1%
	Shrub		23.5	1.5%
Terrestrial Total			231.5	15.1%
Total Land Area			1538.0	

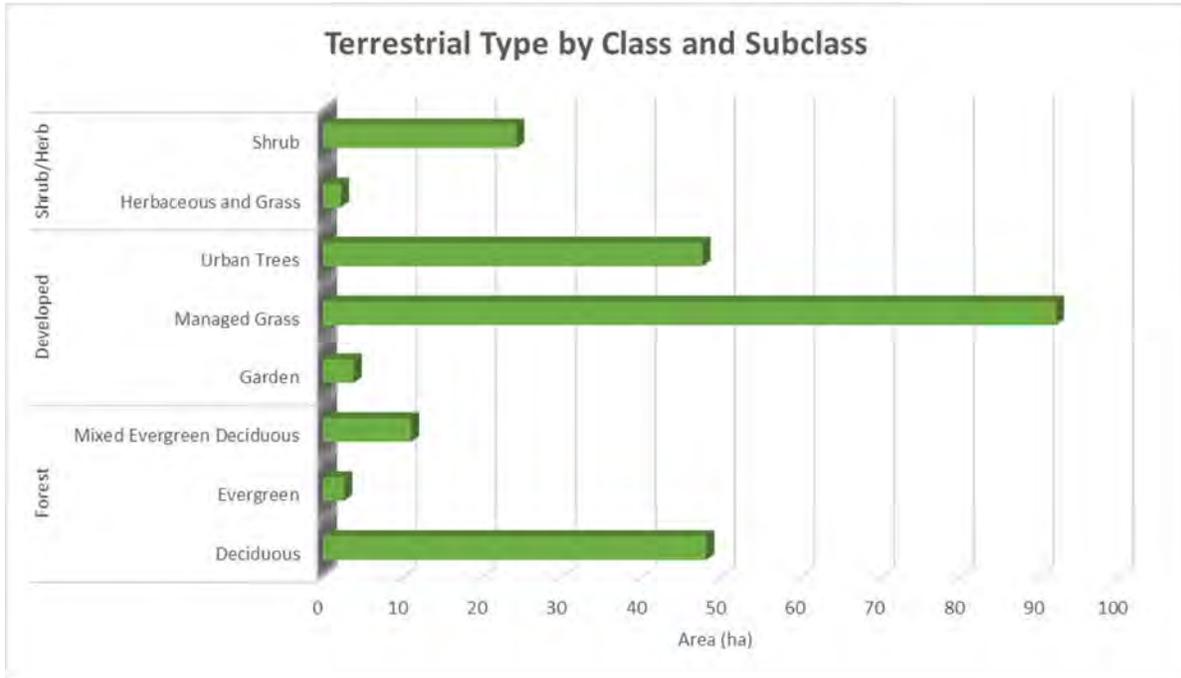
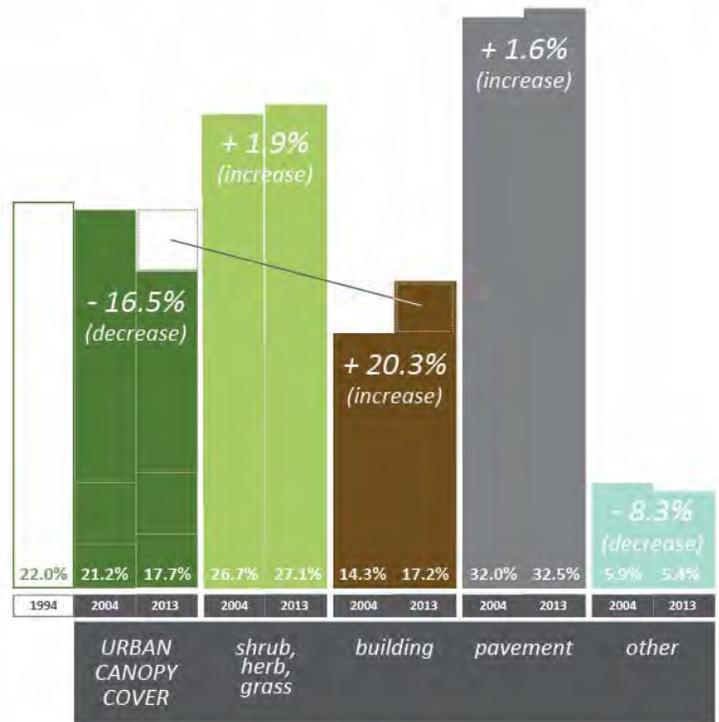


Figure 1. Terrestrial type summarized by class and subclass

The state of New Westminister’s urban forests:

The City of New Westminister conducted a detailed inventory of its urban forest in 2014 to inform its Urban Forest Management Strategy. An analysis of land cover for the entire City (public and private property) indicated that total tree canopy was 17.7% (SE +/- 3.38%). By comparison, forest cover in 2004 was 21.2%, indicating a decrease in forest canopy cover of 16.5% over 10 years. Shrub/herb/grass cover (including private lawns, etc) in 2013 was 27.1%. Impervious surfaces (buildings, pavement) accounted for half of the City’s land area (49.7%).



4.2 Aquatic ecology

Mapped aquatic habitat includes rivers, creeks, ditches, wetlands and intertidal (foreshore) areas. The Fraser River and Brunette River are the most prominent watercourses in New Westminister. They, along with open ditches on Queensborough, have been classified according to their current ability to support fish and/or fish habitat. Some of this work is based on the Queensborough Ecological Inventory (2010) and Queensborough Community Plan (2014).

- 748 ha of aquatic habitat was mapped; the Fraser River constitutes the majority (730 ha or 98%);
- The Fraser River foreshore is one of the City’s most ecologically significant features. The most significant in terms of size, value, and productivity is located on Queensborough’s southwest shoreline (Annacis Channel);
- The Brunette River flows south along the east side of New Westminister and covers approximately 7 ha;
- Open ditches in the Queensborough neighbourhood occupy 4 hectares in area. Only 6% of these are considered fish habitat, 24% providing important food and nutrients to downstream fish habitat. The majority (70%) of these ditches are not considered fish habitat.
- Glenbrook ravine contains a small wetland and creek;
- There are other landscaped ponds and creeks found in City parks including Tipperary and lower Glenbrook parks.

Table 1: Aquatic cover types area summary

Watercourse	Stream Class	Area (ha)
Brunette River	A	7.0
Fraser River	A	729.7
Ditch		4.3
	A	0.3
	B	1.2
	B2	0.1
	C	2.7
Lake/Pond	C	0.1
Stream	C	0.1
Wetland	C	6.4
Aquatic Total (ha)		747.6

4.3 Riparian habitat

Riparian habitat associated with the Fraser River and Brunette River is in poor condition. All areas within 30 metres of the Fraser River and Brunette River were assessed to determine their condition. Total riparian area is 94 hectares. 60ha (63%) of this area is considered developed and provides no natural habitat. Only 20ha (22%) of this riparian area is forested. 11ha (11%) is covered in shrub communities of which the majority is invasive species (Himalayan blackberry). Restoration of these riparian vegetation communities will protect water quality, enhance habitat for a variety of species, and provide an important movement corridor for wildlife within the City and region.

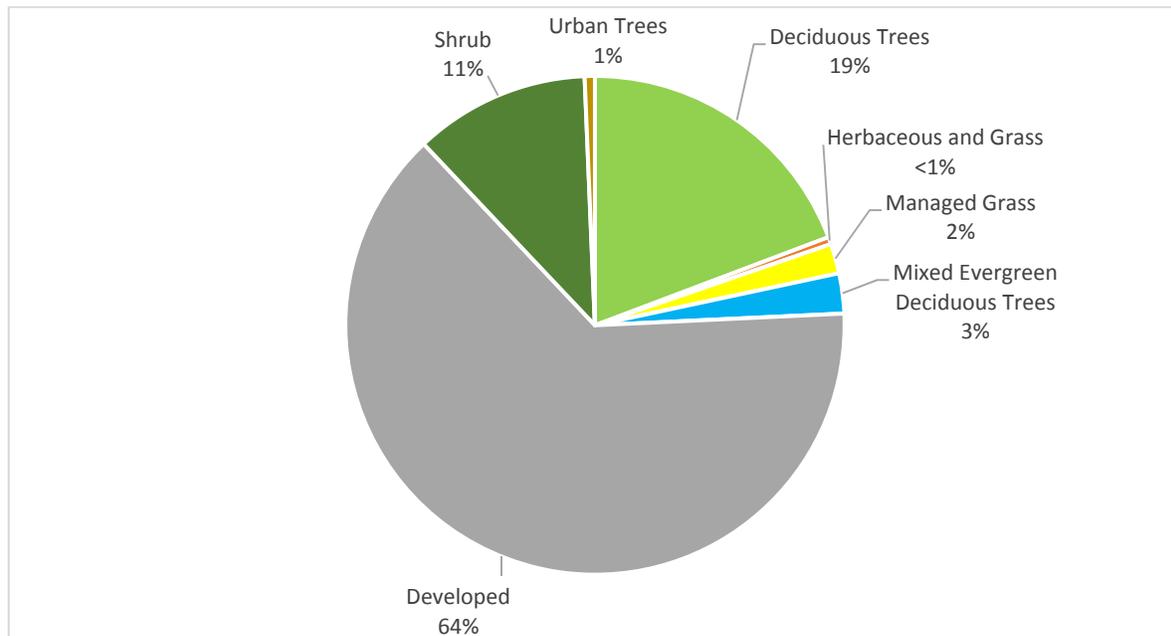


Figure 2. Riparian subclass summarized by percent of area (total area = 94ha)

Restoration work in the Brunette River corridor:

Enhancement of the Brunette River is supported by Metro Vancouver's Ecological Health Action Plan (EHAP), in partnership with the City of New Westminster. This initiative also supports development of the Brunette Fraser Greenway as part of a regional transportation corridor. Other restoration partners include the Sapperton Fish and Game Club and Evergreen. Conceptual habitat enhancement designs² have been prepared and implemented for the Lower Brunette River, which is the portion of the Brunette downstream of North Road to its confluence with the Fraser River. Restoration work in the Brunette River has been conducted by stakeholders, including the Sapperton Fish & Game club, since 1969 to protect environmental values, including endangered species and salmonids.

² LGL Ltd Environmental Research Associates. Fish and Riparian habitat opportunities in lower Brunette River. Prepared for Metro Vancouver. September, 2012

5 Important Natural Areas

New Westminister supports a diversity of natural areas within its borders. These vary from rivers and large intact forested areas to small fragmented pockets of vegetation. The ecological function of these areas is dependent on their specific features, condition, size, connectivity, and location within the urban context. Four distinct natural areas were identified in the City:

- Fraser River foreshore and islands;
- Brunette River corridor;
- Glenbrook ravine; and
- Large treed parks.

These natural areas are large in size and are considered the most important in terms of their ecological significance. Each unit has unique attributes that contribute to overall biodiversity and ecological function in New Westminister, and in some cases, regionally. The Fraser, Brunette, and Glenbrook units are significant linear ‘corridors’, while the large treed parks (e.g. Queen’s Park) represent the City’s most prominent green ‘patches’. Taken as a whole, these units form a substantial component of the City’s green infrastructure: the network of natural areas and open space that conserves natural ecosystem values and processes, while providing benefits to both people and wildlife³.

Work by Metro Vancouver has also contributed to our understanding of the regional network of natural areas. The regional Biodiversity Strategy (2001-2006)⁴ and the regional Sensitive Ecosystem Inventory (SEI) (2010-2012)⁵ used similar methods to map and identify regionally important natural areas and potential connections between them. As expected, both Biodiversity Strategy and SEI mapping showed that biodiversity values in New Westminister were highest in the Fraser River channel and foreshore (including Poplar Island), Brunette River corridor, and Glenbrook ravine (see Appendix A). Urban parks including Queens Park were also identified as having higher ecological values than the surrounding landscape by the regional Biodiversity Strategy but were not mapped as sensitive ecosystems. Most of the sensitive ecosystems in New Westminister were mapped as riparian areas including Poplar Island and Glenbrook ravine.

Focusing management effort on these units (particularly those contributing to green infrastructure) will improve overall ecological integrity, optimize resources and provide substantially more benefits for both wildlife and the community over the long-term.

³ Benedict, M. and McMahon E. Green Infrastructure: linking landscapes and communities. 2006. The Conservation Fund. Island Press.

⁴ Axys Environmental Consulting. 2006. Assessment of Regional Biodiversity and Development of a Spatial Framework for Biodiversity Conservation in the Greater Vancouver Region. Biodiversity Conservation Strategy Partnership, Burnaby, BC.

⁵ Meidinger, D., J. Clark, and D. Adamoski. 2014. Sensitive Ecosystem Inventory Technical Report for Metro Vancouver & Abbotsford 2010-2012. Prepared for Metro Vancouver. 162 pp.

Remaining land in the City is generally highly developed with limited ecological function. Collectively, this area is called the Urban Matrix. These areas are typically under private ownership, on which the City has limited jurisdiction. The City should build public awareness of the accumulative values of the smaller natural features found in these areas.

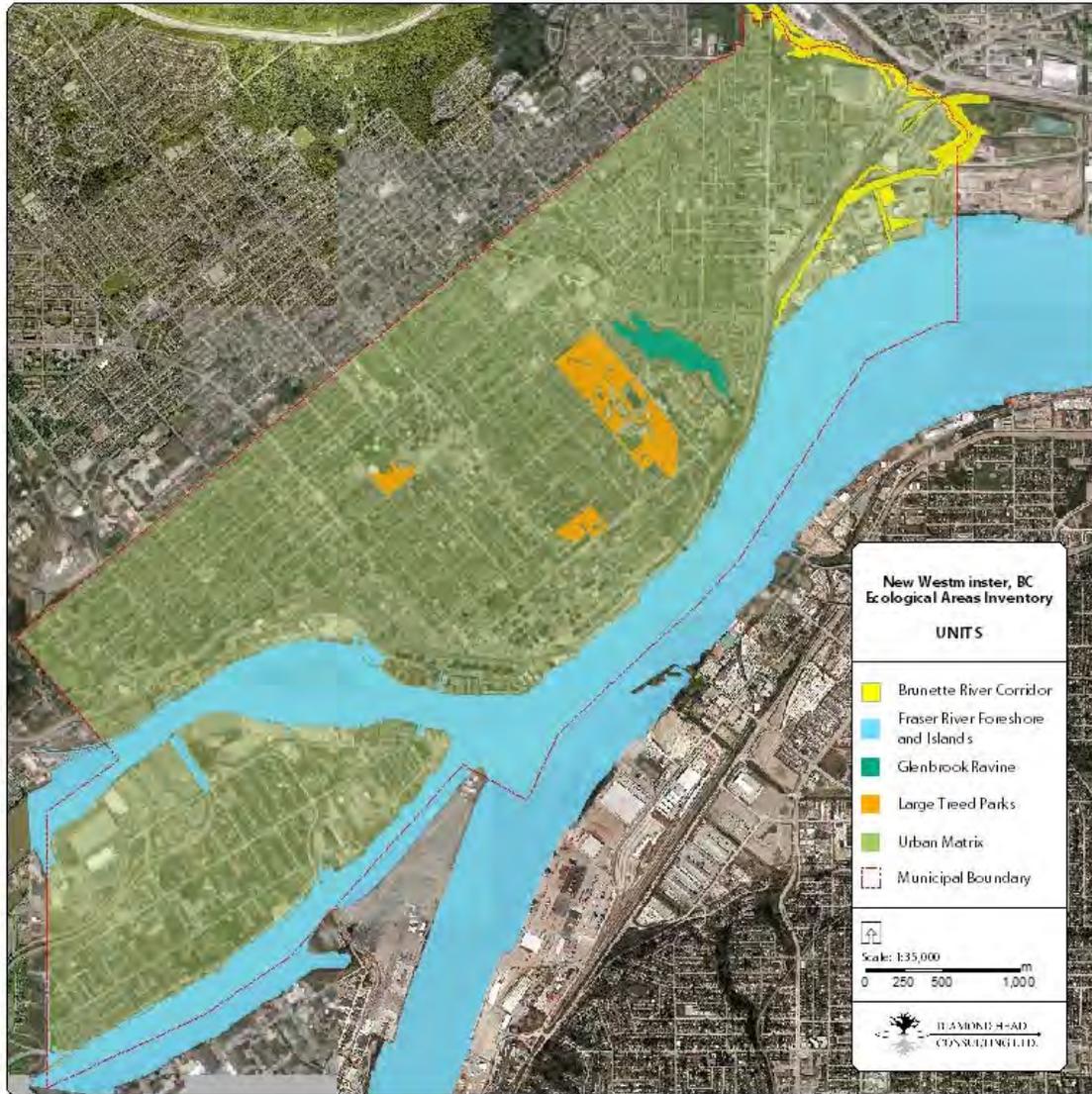


Figure 3. Natural Area Units

5.1 Fraser River foreshore and islands

The Fraser River is one of the region's most significant natural ecosystems. The river and its delta is considered globally important for fish and migratory birds. It provides habitat for an abundance of fish and wildlife, including the world's largest sockeye salmon run. The river is also a linear corridor, which provides ecological connectivity through the regional landscape. New Westminster's entire south edge borders the Fraser River shoreline. The river also encompasses the Queensborough Neighbourhood on Lulu Island and several smaller islands including Poplar Island, which is an isolated natural area located in the middle of the Fraser.

The foreshore of the Fraser River has been significantly altered from its historic state for industrial use and to control flooding. The shoreline is armoured with fragmented and narrow riparian plant communities. These vegetated areas support a high cover of invasive species and few mature trees or wildlife trees. With the exception of Queensborough, there are few natural wetland/intertidal ecosystems that remain. In a natural state, the riparian plant community that would have existed next to the Fraser would support a wetland transition area as well as an active floodplain. These would support a very high level of biodiversity.

Fish and Wildlife: The Fraser River is recognized internationally for its importance for migratory salmon populations; the water, marshes, mudflats, and shorelines of New Westminster support all five salmon species at some time during the year. Vegetated marshes are the most important habitat for juvenile fish because they provide protection from predators while at the same time providing rich food resources for migrating salmon. Other freshwater fish include trout species and members of the sucker, minnow, catfish, stickleback, smelt, Starry Flounder, Threespine Stickleback and lamprey families. White Sturgeon is perhaps (see Species at Risk section) one of the rarest species found in the Fraser River.

Mammal use reflects the mix of aquatic and riparian areas and includes American Beaver, American Mink, Raccoon, River Otter, Harbour Seal, and Steller's Sea Lion. Bird use is also varied and includes species which use the shoreline and adjacent riparian areas like Bald Eagle and Great Blue Heron, as well as Common Merganser, Common Cormorant, Bufflehead, grebes, and ducks. No detailed bird or mammal surveys have been undertaken on the Fraser River in the City of New Westminster.



Photos 1 and 2: The Fraser River foreshore is heavily armoured



Photos 3 and 4: There is extensive recreation area developed for public access along the Fraser.

Table 1. Fraser River foreshore and islands ecological features condition and recommendations

Important Natural Features	Ecological Communities/ Species at Risk	Threats/Issues
<ul style="list-style-type: none"> • South edge of Queensborough has the only significant intertidal wetland areas in the City; • Poplar Island is a relatively isolated and intact habitat with forests, intertidal wetlands, and mudflats. It provides an important refuge for birds; • The river provides critical habitat for a wide range of fish, birds and mammals and connects them across the region. 	<ul style="list-style-type: none"> • Lyngbye's sedge (Herbaceous Vegetation) • Tufted hairgrass–Douglas' aster (Herbaceous Vegetation) • Black cottonwood–red alder/salmonberry (Forest) • Western redcedar /three-leaved foamflower (Forest) • Henderson's checkermallow • Vancouver Island beggarticks • Great Blue Heron • Green Heron • White Sturgeon 	<ul style="list-style-type: none"> • Riparian habitat is highly disturbed from industrial activity and urban development; • Potential for spills of deleterious substances from industrial activity; • Intact natural riparian and intertidal habitat is fragmented and discontinuous; • Shoreline is heavily armoured for flood protection. Few natural wetland/intertidal ecosystems exist; • High cover of invasive species (Himalayan blackberry, knotweed); • There are few high value wildlife trees.

Table 2 cont. Fraser River foreshore and islands ecological features condition and recommendations

<p>Recommendations</p>

- Identify and pursue opportunities along the Fraser River for the creation of intertidal wetlands;
- Work with local industry to establish wider riparian setbacks (30 metre target where possible) and reclaim degraded habitat as an interim voluntary measure to protect water quality and biodiversity along Fraser River corridor;
- Identify opportunities during upcoming development and redevelopment to acquire land or use other planning tools (implementation of a bylaw) and incentives (densification), to establish a 30 metre (target) riparian buffer along the Fraser River;
- Explore establishment of a Development Permit Area and associated development guidelines to protect and enhance habitat on developable lands next to the Fraser River;
- Integrate habitat improvement and enhancement as part of ongoing flood protection works;
- Install interpretive signage to raise awareness of environmental significance of Fraser River;
- Maintain designation of Poplar Island as Natural/Habitat in Official Community Plan;
- Work with regional partners, stakeholders, and developers to remove all knotweed and other invasive plant species growing within 30 metres of the river; and
- Install artificial perches and nesting sites along the river for raptors.

5.2 Brunette River corridor

The Brunette River flows from Burnaby Lake (northwest of the City) into the Fraser River providing regional connectivity. The north end of the Brunette exists in more of a natural state. As it flows south towards the Fraser River it becomes more disturbed and impacted by industrial development. Hume Park is located adjacent to the Brunette River upstream at the Burnaby-New Westminster boundary. It is a 13 hectare park that provides a variety of amenities including sports fields, a swimming pool, trails, and natural areas. A native mixed-wood forest is protected within the park, and is associated primarily with the valley, high bench floodplains, and adjacent upland areas. Forests are second growth and are dominated by pioneer deciduous tree species including red alder, black cottonwood and bigleaf maple, which predominant throughout the riparian area. Scattered conifer trees including western redcedar, western hemlock and Douglas-fir also occur. Further downstream, the river (and associated riparian area) becomes more constricted as it flows through an industrial area before joining the Fraser River.

Fish and Wildlife: The Brunette River corridor supports a diverse fish and wildlife community, many of which are Species of Conservation Concern (SCC). Fish species in the Brunette River include the endangered Nooksack Dace (see Species at Risk section), Coho Salmon, Chum Salmon, Cutthroat Trout, Common Carp, Threespine Stickleback, and Brown Bullhead. Mammals found in the riparian corridor include Coyote, American Beaver, American Mink, Raccoon, Striped Skunk, and possibly Muskrat and Short-tailed Weasel. Black Bear have also been observed. Pacific Water Shrew, a red-listed species, could potentially occur. Reptile and amphibians potentially occurring include Western Toad, Northern Red-legged Frog and Painted Turtle, all of which are SCC. American Bullfrog and Green Frog, both of which are introduced, may also be present. Upwards of 60 bird species have been recorded annually in the Burnaby Lake area, as part of the Christmas Bird Count. The number of birds found in the river corridor is likely lower due to less open water habitat compared to the lake, but still high compared to adjacent developed areas.



Photos 5 and 6: The Brunette River has very productive aquatic habitat; however, much of its associated riparian habitat has been degraded by adjacent development



Photos 7 and 8: Hume Park provides intact riparian habitat; however, many invasive plant species including impatients (right) are present.

Table 3. Brunette River corridor ecological features condition and recommendations

Important Natural Features	Ecological Communities/ Species at Risk	Threats/Issues
<ul style="list-style-type: none"> The river provides critical habitat for a wide range of fish, birds and mammals and connects the Fraser River with Burnaby Lake; Scattered large conifer trees (Douglas-fir 110 cm diameter) in Hume Park; High bench floodplains in Hume Park. 	<ul style="list-style-type: none"> Nooksack Dace (Chehalis lineage) Painted Turtle (Pacific Coast population) Great Blue Heron Black cottonwood–red alder/salmonberry (Forest) Western redcedar /three-leaved foamflower (Forest) Western redcedar /swordfern Dry Maritime (Forest) 	<ul style="list-style-type: none"> Narrow riparian area provides limited buffer from adjacent land uses; Southern reaches are heavily impacted by industrial development; Potential for spills of deleterious substances from industrial activity; Much of the southern reaches area heavily armoured for flood protection; Numerous invasive species exist (English Ivy, impatiens, blackberry, knotweed); There are few high value wildlife trees near the River.

Recommendations

- Work with local streamkeeper organizations (e.g. Sapperton Fish and Game Club) and continue to support their efforts to restore instream habitat on lower reaches of Brunette River;
- Continue to collaborate with Metro Vancouver, DFO, and other partners to implement recommendations of *Brunette Basin Watershed Plan*, *MV Ecological Health Plan*;
- Work with Metro Vancouver, stakeholders, and municipal and industry partners to prioritize and implement recommendations from 2012 MV report “Fish and riparian habitat opportunities in lower Brunette River”;
- Increase the width of the forested riparian zone in Hume Park;
- Increase base flow water levels to improve in-stream rearing and spawning habitat for salmonids and the endangered Nooksack Dace. Base flows are often determined by groundwater, which in urban areas can be influenced by the amount of impervious surface and infiltration. Integrated Stormwater Management Plans should consider impacts of urbanization on hydrologic processes. Strategies to improve groundwater recharge and infiltration by reducing impervious surfaces should be examined, including implementation of stormwater fees;
- Explore establishment of a Development Permit Area and associated development guidelines to protect and enhance habitat on developable lands next to the Brunette River;
- Improve stormwater management in catchments which flow into the Brunette River;
- Work with local industry to establish wider riparian setbacks (30 metre target) and reclaim degraded habitat to protect water quality and biodiversity in Brunette River corridor;
- Identify opportunities during upcoming development and redevelopment to acquire land or use other planning tools/incentives to establish 30 metre riparian buffer along the Brunette River;
- Work with Port Metro Vancouver and Metro Vancouver to support Brunette River as a recreational blueway by working to raise baseflows in the river and removing unnecessary (i.e. human) obstructions (including pilings at mouth of Brunette);
- Update stormwater management plans to improve water quality in Brunette River;
- Install artificial perches and nesting sites next to the Brunette River to provide perching sites for raptors and other species;

- Work with Coquitlam, Burnaby, and Metro Vancouver to manage knotweed and other invasive plant species from riparian areas in Brunette River corridor;
- Deactivate all unauthorised trails within 30 m of the Brunette River;
- Continue to support appropriate recreational trail development as part of the regional Brunette Fraser Greenway initiative. Trails should be located beyond and above the top of bank, except at designated crossings, and far enough away from the watercourse to minimize impacts to watercourse and riparian vegetation. Existing informal trails may be upgraded if they can meet minimum design standards that prioritize fisheries, wildlife, and water quality values for this corridor;
- Install signage to raise awareness of Brunette River and the value of salmon habitat (restoration) and discourage illegal dumping and other activities that may harm ecological integrity; and
- Develop a strategy to manage beaver populations to maintain ecological integrity of Brunette River. Consult with regional municipalities (e.g. Coquitlam, Surrey) to determine latest best practices for beaver management in the Lower Mainland. Install tree protective measures (e.g. beaver protection fencing) in areas where beaver activity is identified

5.3 Glenbrook Ravine

Glenbrook Ravine is a forested natural area that runs through the heart of the City. The park is well used by residents; however, it is isolated and the closest natural area is Queens Park which is 100m to the east. A small forested wetland exists at the northern end of the park. A small, stormwater-fed ephemeral watercourse flows through the centre of the park. Most water flow is diverted into the stormwater system at its southern end. The natural forest stand is dominated by deciduous tree species, including big-leaf maple and red alder. Some black cottonwood and western hemlock also occur. There are large areas dominated by Himalayan blackberry along the eastern edge of the park. There is a public garden and pond at the south end of the ravine.

Fish and Wildlife: Wildlife present are typically smaller species with reduced range requirements and those that are adapted to urban areas. The forest habitat provides low structural diversity with no large conifer trees or wildlife trees of significant value. Mammals likely include Coyote, Raccoon, Striped Skunk, the introduced Eastern Grey Squirrel, and mice, voles, moles and shrew species. The park provides habitat types that are suitable for a wide variety of both resident and migratory bird species. The wetland at the north end of the forest could potentially provide breeding habitat for amphibians. No fish are supported by aquatic habitat in Glenbrook Ravine.



Photos 9 and 10: Forested area in Glenbrook ravine are dominated by young deciduous species.



Photos 11 and 12: Invasive species present include large areas of Himalayan blackberry and English ivy.

Table 4. Glenbrook Ravine ecological features condition and recommendations

Important Natural Features	Ecological Communities/ Species at Risk	Threats/Issues
<ul style="list-style-type: none"> • Small artificial wetland (north end); • Large intact forested natural area; • Artificial pond at south end of the ravine. 	<ul style="list-style-type: none"> • None identified 	<ul style="list-style-type: none"> • Large areas of invasive species (Himalayan blackberry, English ivy); • Even-aged stand with low structural diversity; • Presence of humans and pets.
Recommendations		
<ul style="list-style-type: none"> • Control invasive plants in various areas of the ravine including English ivy, clematis and blackberry and re-establish native plant species; • Under-plant western redcedar and grand fir in stands dominated by deciduous species; • Create wildlife trees and encourage naturally placed large woody debris as they become available; • Work with Metro Vancouver to discuss potential sewer/stormwater separation and potential for daylighting. 		

5.4 Large Treed Parks

The City has several large, landscaped parks that it maintains to provide a range of amenities for different user groups. The most prominent of these are Queen’s Park, Moody Park and Tipperary Park. These parks are large in size and have significant amounts of mature tree cover; however, understory vegetation is predominantly a mix of maintained grass and landscaped garden areas. There are also artificial ponds and watercourses that have been created in Tipperary Park. Hume Park is one of the City’s largest treed parks; however, the majority of the forest area is natural and only the outer edges have been landscape. Therefore, Hume Park has been included as part of the Brunette River Corridor (Section 5.2).

Fish and Wildlife: There is considerable human use in these parks and wildlife is typically limited to birds and small mammals that are adapted to developed residential areas. Mammals most likely inhabiting landscaped parks include Coyote, Raccoon, Striped Skunk, Douglas Squirrel, Eastern Grey Squirrel, mice, voles, and shrew species. Coast Mole, a native species which leaves behind distinctive small mounds of soil (mole hills), occurs in Queen’s Park and Hume Park.

New Westminster’s bird community will include a variety of resident and migratory species that can adapt to urban landscapes; many will seasonally use the urban forest for feeding or nesting. Queens Park is a site designated for the annual Christmas Bird Count but data on bird occurrence was unavailable. Likely urban adapted birds inhabiting these parks include introduced European Starling, Northwestern Crow, House Sparrow, Rock Dove, Black-capped Chickadee, Purple Finch, American Robin, Dark-eyed Junco, Spotted Towhee and Song Sparrow.



Photos 13 and 14: The understory of many urban parks is maintained with little native shrub cover.



Photos 15 and 16: Ponds have been created in Tipperary Park

Table 5. Landscape parks ecological features condition and recommendations

Important Natural Features	Ecological Communities/ Species at Risk	Threats/Issues
<ul style="list-style-type: none"> • Large trees; • Urban ponds and water features. 	<ul style="list-style-type: none"> • None identified 	<ul style="list-style-type: none"> • High cover of invasive plant species; • Low understory vegetation cover; • Habitat fragmentation; • Presence of humans and pets.
Recommendations		
<ul style="list-style-type: none"> • Naturalize small pockets of understory plant communities by planting shrubs and ferns; • Designate wildlife refuge areas in Queen’s Park where recreation use and vegetation maintenance is reduced; • Minimize human disturbance in intact forested areas by re-locating or de-commissioning trails; • Install artificial wildlife features (nest boxes, wildlife trees) in suitable areas; • Implement recommendations of Queen’s Park Master Plan (2013). • Promote nature appreciation and conservation through use of interpretive signage and other targeted education. 		

5.5 Enhancing the Urban Matrix

The Matrix is defined as the land outside of the larger framework of natural areas (corridors and patches). Smaller natural areas and features (gardens, street trees, pocket parks, green roofs, bioswales, etc.) are more typical in these areas due to land constraints posed by buildings, roads, and infrastructure (buildings, roads, infrastructure). However, they still provide tremendous value in terms of their ecological services and contribution to quality of life and biodiversity in the City. Conservation, restoration and infrastructure interventions in the Matrix can support ecosystem functions such as stormwater infiltration, pollinator mobility, and seed dispersal for plants. They can also act to buffer and/or complement adjacent ecosystems or features in a green infrastructure network.

Fish and Wildlife: Wildlife in the urban matrix is limited to species that are highly tolerant and adapted to urban development. Common species likely include Raccoon, Striped Skunk, the introduced Eastern Grey Squirrel, mice, voles and shrew species as well as Norway Rat and Black Rat. The Queensborough Ecological Inventory (2010) recorded 20 bird species including common resident and wintering species, the most widespread being the Black-capped Chickadee. Other species included resident Bushtit, American Robin, Northwestern Crow, Song Sparrow, Mallard and Canada Goose. Barn Owls have been recorded hunting in the open fields. No native fish populations occur in ponds or other water features in the developed part of New Westminister, except for Threespine Stickleback. It is unknown if any amphibians other than introduced American Bullfrogs are found in smaller ponds or ditches in Queensborough. Pacific Treefrog may be present in some areas.



Photos 17 and 18: Natural features in the Urban Matrix are generally maintained with extensive turf and gardens.



Photos 19 and 20: Many linear right of ways are degraded but provide corridors connecting higher value habitat areas



Table 6. Matrix ecological features condition and recommendations

Important Natural Features	Ecological Communities/ Species at Risk	Threats/Issues
<ul style="list-style-type: none"> Linear corridors that follow roads, hydro rights-of-way and railways; Numerous open ditches in the Queensborough neighbourhood. 	<ul style="list-style-type: none"> Barn Owl (Queensborough) 	<ul style="list-style-type: none"> Invasive plant species (shrub communities dominated by Himalayan blackberry); Industrial maintenance requirements degrade habitat and restrict restoration. Loss of trees, plants and open fields to infill development.
Recommendations		
<ul style="list-style-type: none"> Restore linear shrub and grass areas to help facilitate wildlife passage between larger natural areas. Priority areas include railways and industrial areas at the south end of the Brunette River; Promote and encourage naturescaping including native plant gardens, hedgerows, water features, and artificial nesting sites; Leave areas of grass areas to grow providing habitat for small mammals and prey for raptors including Barn Owl; Seed or plant flowering species to benefit bees and other pollinators; Encourage pervious surfaces and sustainable water use including rainwater harvesting. 		

6 Species and Ecological Communities of Conservation Significance

The BC Conservation Data Centre (CDC) tracks and ranks plants, animals, and ecological communities in the province that are of conservation concern attributed to rarity, threats, or declining populations⁶. The CDC lists 18 fish and wildlife species, and 42 ecological communities that potentially occur in the City of New Westminister; this includes 5 fish, 5 mammals, and 8 snails or slugs. However, most occur in natural ecosystems and the extent of urbanization in New Westminister greatly limits the likely occurrence of many of these species or communities in the City.

⁶ Subnational (provincial) ranks are defined as:

S1 (Critically Imperilled) - Critically imperilled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2 (Imperilled) - Imperilled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3 (Vulnerable) - Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 (Apparently Secure) - Uncommon but not rare; some cause for long-term concern due to declines or other factors.

Remnant ecosystems including the marshes of the Fraser River foreshore and larger forest patches such as Poplar Island and Glenbrook Ravine may support rare plants and birds. More rigorous field surveys are needed to determine the presence of rare species. Wildlife and plant communities have never been systematically sampled in the City of New Westminster and even student reports and stewardship surveys are lacking for most areas.

This section describes ecological communities and species at risk that have been confirmed or are likely to occur in the City of New Westminster. Data collected during as part of the Queensborough Ecological Inventory in 2010 was used to complement this inventory.

6.1 Rare Plants

Two rare plants occur or potentially occur in the foreshore marshes on the margin of the Fraser River. Further inventory of wetland areas during the summer is needed to better survey for rare plant species, particularly sedges, grasses, and rushes.

Vancouver Island beggarticks. This species was observed on the margin of an intertidal marsh located on Queensborough Island. It is ranked as Vulnerable (S3) in B.C. and was designated as Special Concern by COSEWIC in 2001. Small populations are relatively widespread in freshwater marshes in the lower Fraser River.



Photo 21: Vancouver Island beggarticks was observed on the south shore of Queensborough

Henderson’s checkermallow. This species is ranked as Vulnerable (S3) in B.C.; it has not been assessed by COSEWIC. It is a perennial vascular plant that occurs in intertidal marshes of the lower Fraser River. It has not been confirmed in New Westminster, but suitable habitat is present on Queensborough Island.

6.2 Rare Wildlife Species

There are a number of vertebrate species at risk that occur or potentially occur in the City:

Great Blue Heron. Breeding colonies of the *fannini* subspecies of Great Blue Heron are ranked as Imperilled/Vulnerable (S2S3B) in B.C., and were designated as Special Concern by COSEWIC in 2008 (BC CDC, 2014). Suitable nesting trees occur in the foreshore of the Fraser River, particularly the large black cottonwood and red alder trees growing along the river edge, but no nests have been observed. Herons likely forage in low numbers in the ditches throughout Queensborough, Brunette River, and the Fraser River foreshore. During low tide they also forage in intertidal areas.

Green Heron. Breeding Green Herons are ranked as Vulnerable/Apparently Secure (S3S4B) in B.C. and have not been assessed by COSEWIC (BC CDC, 2014). This shy bird is associated with deciduous shrubs and trees near water, and is occasionally observed in intertidal marshes or riparian forest in the Lower Fraser River.

Western Screech-owl. The *kennicottii* subspecies of Western Screech-owl, which occurs in this area, is ranked as Vulnerable (S3) in B.C. and was designated as Threatened by COSEWIC in 2012 (BC CDC 2014). This species has decreased in numbers in recent years, possibly because of predation by Barred Owls. Recent studies have suggested that it may survive best in small urban woodlots, where Barred Owls are much less common.

Barn Swallow. Breeding sites of the Barn Swallow are ranked as Vulnerable/Apparently Secure (S3S4B) in B.C. (BC CDC, 2014). This bird nests on human structures and forages over open fields, meadows, shrublands and wetlands. Suitable nesting sites occur in older buildings and bridges in New Westminster and foraging would occur over the open fields and older subdivision areas.

Barn Owl. Barn Owls have been observed hunting in open field of the Queensborough neighborhood and roost under the Queensborough Bridge. The loss of open fields and suitable nest sites in the last 20 years reduces the potential for Barn Owl to still forage in this area. Any birds still roosting beneath the Queensborough Bridge would most likely be foraging in habitats northwest of the bridge on the mainland. The Barn Owl is ranked as Vulnerable (S3) in B.C. and was designated as Special Concern by COSEWIC in 2001 (BC CDC, 2014).

White Sturgeon. White Sturgeon occurs in the lower Fraser River and may use subtidal or intertidal areas in the city for feeding or migration. Their occurrence in the study area is unconfirmed. It is ranked as Imperilled (S2) in B.C. and was designated as Endangered by COSEWIC in 2003 (BC CDC, 2014).

Painted Turtle – Pacific Coast Population. Painted turtles occur in Burnaby Lake and the upper reaches of the Brunette River in the City of Burnaby. They likely occur in the lower reaches as well and one identified turtle was observed near the Skytrain crossing in July 2014. The Pacific Coast population of Painted Turtle is ranked as S2 (red) provincially and are listed as Endangered in Canada.

Nooksack Dace (Chehalis lineage). Nooksack Dace are found in the Brunette River including the City of New Westminster (Hume Park area). They are a small, bottom-dwelling fish related to minnows that are found in two areas of the lower Fraser Valley. They are ranked as S1 (red) provincially and are listed as Endangered in Canada.

Pacific Water Shrew. Pacific water shrews are found along low elevation streams, marshes and wetlands. They feed on freshwater organisms but also require healthy riparian habitat to survive. Intact natural areas along the Brunette River provide suitable habitat for this species. They are ranked as S1 (red).

6.3 Rare Ecological Communities

Plant communities are defined as units of vegetation with a relatively uniform plant species composition and physical structure.

Western redcedar /three-leaved foamflower Dry Maritime. This plant community includes forested areas that are rich with moist moisture regime. Representative areas of this plant community are found in Hume Park as well as Glenbrook Ravine. It is ranked as Vulnerable/Imperiled (S2S3) in B.C. (BC CDC, 2014).

Western redcedar /swordfern Dry Maritime. This plant community includes forested areas that are rich with fresh moisture regime. Representative areas of this plant community are found in upper to mid slopes of Hume Park as well as Glenbrook Ravine. It is ranked as Vulnerable/Imperiled (S2S3) in B.C. (BC CDC, 2014).

Lyngby's sedge Herbaceous Vegetation. This ecological community is widespread and locally abundant in foreshore areas of the lower Fraser River, but it is also provincially rare and has declined since development of the region began. It is ranked as Vulnerable (S3) in B.C. (BC CDC, 2014). It is the dominant plant community in many estuarine marshes (Figure 5).



Photo 22: Intertidal marsh on south shore of Queensborough



Tufted hairgrass–Douglas' aster Herbaceous Vegetation. This ecological community is found in higher intertidal marshes and may occur in Queensborough and the larger floodplain islands. It is ranked as Vulnerable (S3) in B.C. (BC CDC, 2014).

Black cottonwood–red alder /salmonberry Forest is ranked as Vulnerable (S3) in B.C. (BC CDC, 2014), and was likely prevalent in many floodplains adjacent to the Fraser River before infilling, and diking, infilling, and development. Poplar Island is representative of this ecological community, and smaller patches occur on the floodplain islands. However, we considered the black cottonwood riparian forest found along the Fraser River to be too narrow and too disturbed (e.g., trails, invasive plants) to be considered a rare community.

Appendix A – Metro Vancouver Biodiversity Strategy Mapping (2006)

Appendix B – Natural Area Inventory Plots

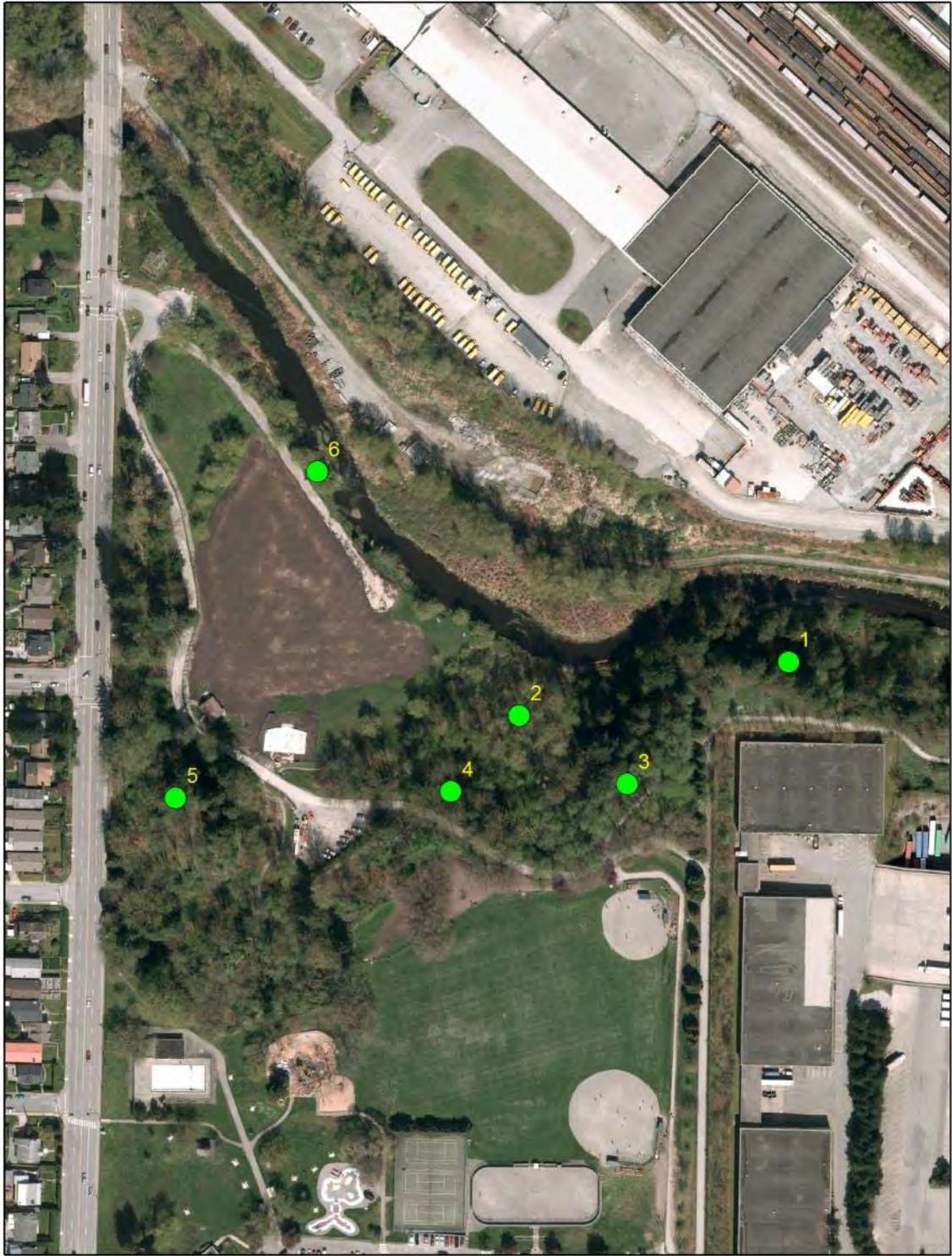


Figure 4. Plot locations in Hume Park

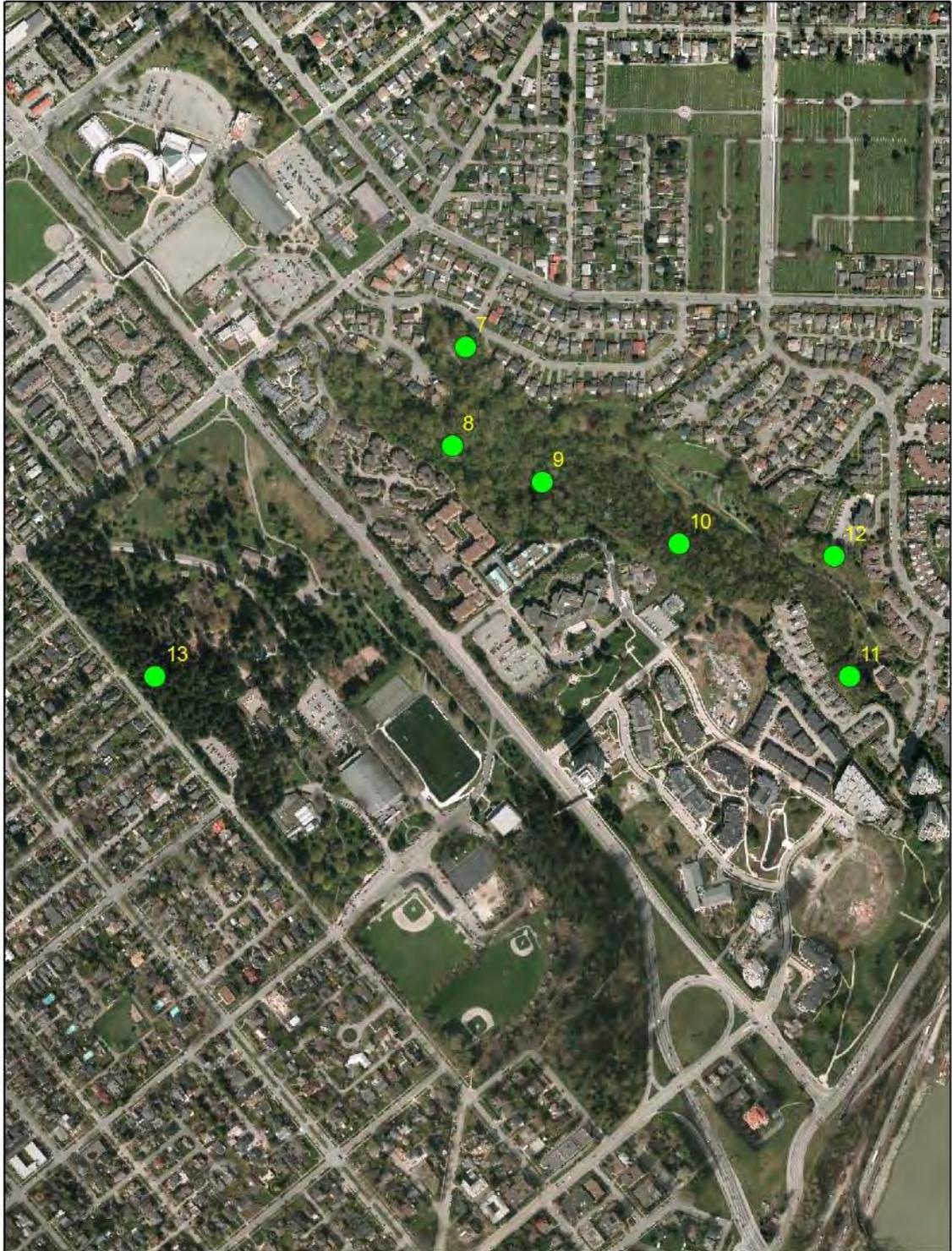


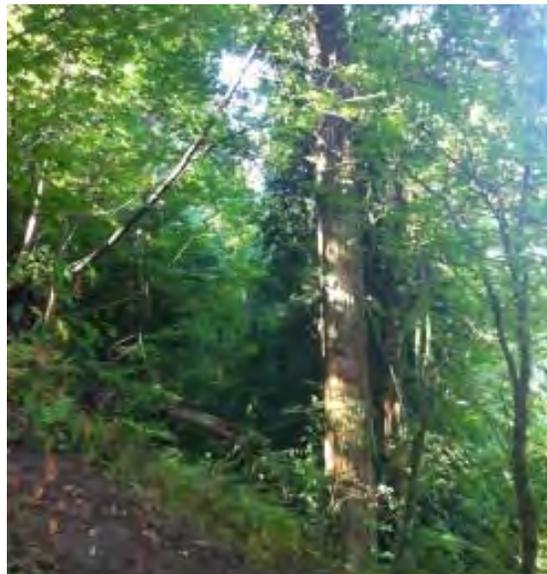
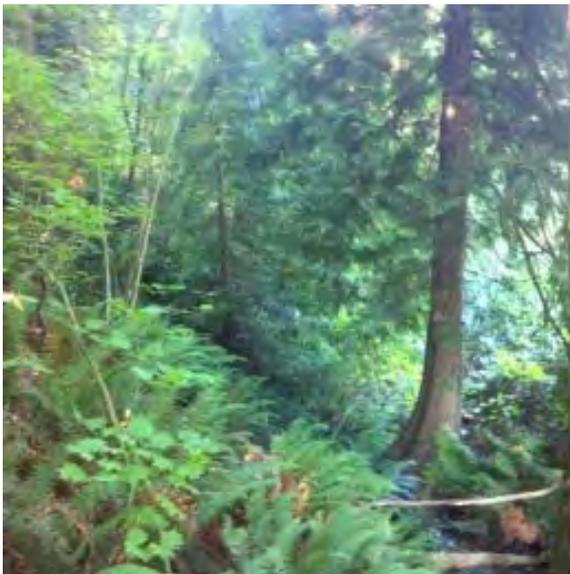
Figure 5. Plots locations in Glenbrook Ravine and Queens Park

Plot 1:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Loamy sand	4/D	Moder/3	CWHdm 05
UNDERSTORY VEGETATION (60% cover)			
>50%	26-50%	11-25%	6-10%
	<i>Polystichum munitum</i>	<i>Oemleria cerasiformis</i>	
		<i>Rubus spectabilis</i> <i>Acer circinatum</i>	
1-5%	Trace (+)	Invasive Species	
<i>Streptopus amplexifolius</i>	<i>Urtica dioica ssp. gracilis</i>	<i>Ilex aquifolium</i>	
<i>Vaccinium parvifolium</i>		<i>Hedera helix</i>	
<i>Aruncus dioicus</i>		<i>Impatiens parviflora</i>	
<i>Gymnocarpium dryopteris</i>			

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)	Fd100%	Mb60% Cw20% Dr10% Hw10%	Dr20% Mb60% Cw20%	Mb70% Cw20% Dr10%	
Density (stems/ha)	20	250	100	100	
Tree diameter at breast height (cm)	70	55	35	8	
Tree height (m)	42	28	17	4	
Live crown ratio	50	65	50	40	
Crown closure (%)	45				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow)



Plot 2:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy loam	5-6/D	Moder/3	CWHdm 08 (floodplain)
UNDERSTORY VEGETATION (80% cover)			
>50%	26-50%	11-25%	6-10%
<i>Rubus spectabilis</i>		<i>Oemleria cerasiformis</i>	<i>Cornus stolonifera</i>
		<i>Acer circinatum</i>	
		<i>Carex Sp.</i>	
1-5%	Trace (+)	Invasive Species	
<i>Polystichum munitum</i>		<i>Ilex aquifolium</i>	
<i>Aruncus dioicus</i>		<i>Hedera helix</i>	
<i>Athyrium filix-femina</i>		<i>Impatiens parviflora</i>	
		<i>Ranunculus repens</i>	
		<i>Sorbus aucuparia</i>	

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)		Act100%	Act70% Dr30%	Dr60% Mb30% Oak10%	
Density (stems/ha)		200	300	300	
Tree diameter at breast height (cm)		50	35	10	
Tree height (m)		38	17	6	
Live crown ratio		60	50		
Crown closure (%)	60				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow)

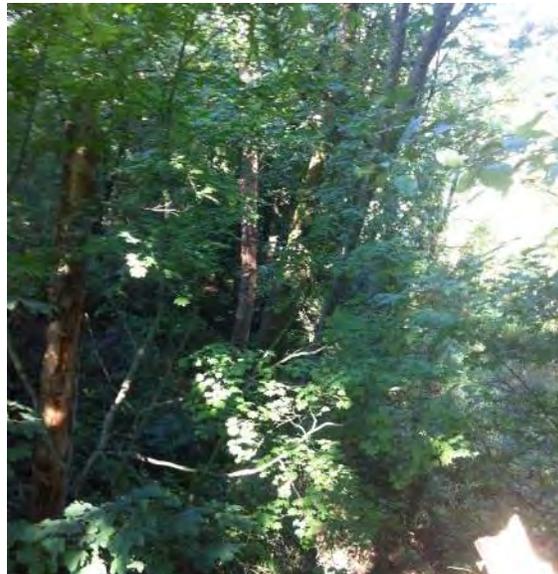


Plot 3:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Loamy sand	4/D	Moder/4	CWHdm 05
UNDERSTORY VEGETATION (40% cover)			
>50%	26-50%	11-25%	6-10%
		<i>Polystichum munitum</i>	<i>Rubus spectabilis</i>
		<i>Acer circinatum</i>	
		<i>Oemleria cerasiformis</i>	
1-5%	Trace (+)	Invasive Species	
<i>Athyrium filix-femina</i>		<i>Impatiens parviflora</i>	
<i>Aruncus dioicus</i>		<i>Convolvulus arvensis</i>	
<i>Mahonia nervosa</i>		<i>Sorbus aucuparia</i>	

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)		Mb20% Dr80% Cw+%	Dr100%	Mb100% Cw+%	Mb100%
Density (stems/ha)		350	100	500	100
Tree diameter at breast height (cm)		35	25	4	
Tree height (m)		28	20	5	
Live crown ratio		60	50	70	
Crown closure (%)	50				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow)



Plot 4:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	4/D	Moder/3	CWHdm 05
UNDERSTORY VEGETATION (50% cover)			
>50%	26-50%	11-25%	6-10%
		<i>Polystichum munitum</i>	
		<i>Oemleria cerasiformis</i>	
1-5%	Trace (+)	Invasive Species	
<i>Streptopus amplexifolius</i>		<i>Impatiens parviflora</i>	
<i>Rubus spectabilis</i>		<i>Sorbus aucuparia</i>	

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)		Mb80% Dr2% Hw+%	Mb70% Dr20% Cw10%	Mb90% Cw+%	Mb100%
Density (stems/ha)		150	100	20	10
Tree diameter at breast height (cm)		60	45	10	
Tree height (m)		35	20	5	
Live crown ratio		65	60		
Crown closure (%)	60				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow)

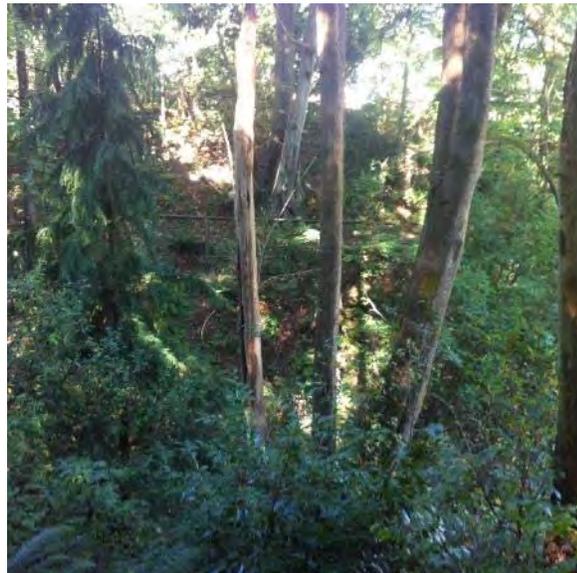


Plot 5:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	4-5/D	Moder/6	CWHdm 05 (70%) 07(30%)
UNDERSTORY VEGETATION (75% cover)			
>50%	26-50%	11-25%	6-10%
		<i>Rubus spectabilis</i>	<i>Polystichum munitum</i>
			<i>Streptopus amplexifolius</i>
			<i>Oemleria cerasiformis</i>
1-5%	Trace (+)	Invasive Species	
<i>Maianthemum dilatatum</i>	<i>Lysichiton americanus</i>	<i>Impatiens parviflora</i>	
<i>Corylus cornuta</i>	<i>Aruncus dioicus</i>	<i>Sorbus aucuparia</i>	
<i>Athyrium filix-femina</i>		<i>Ilex aquifolium</i>	
<i>Blechnum spicant</i>		<i>Hedera helix</i>	
<i>Pteridium aquilinum</i>		<i>Rubus armeniacus</i>	
		<i>Prunus laurocerasus</i>	
		<i>Fallopia japonica</i>	

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)	Act60% Fd40%	Mb60% Dr20% Cw20%	Mb70% Dr20% Cw10%	Mb100%	Mb80% Cw20%
Density (stems/ha)	30	150	100	30	10
Tree diameter at breast height (cm)	80	60	30	5	
Tree height (m)	40	32	25	5	
Live crown ratio	70	60	50		
Crown closure (%)	40				

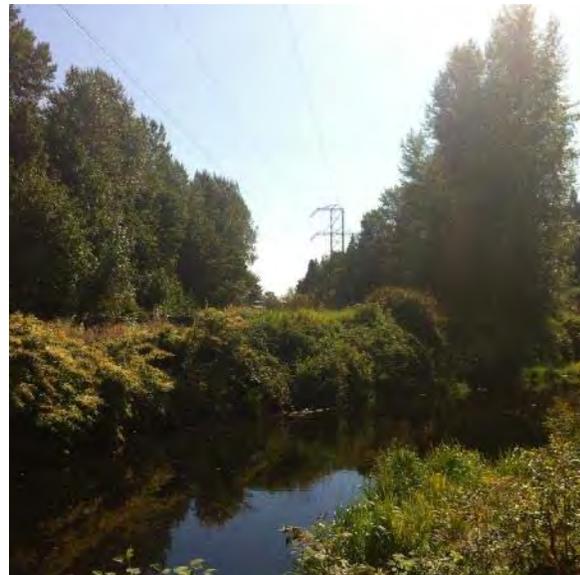
¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow)



Plot 6:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	5-6/D	Moder/5	CWHdm 08
UNDERSTORY VEGETATION (90% cover)			
>50%	26-50%	11-25%	6-10%
			<i>Grass sp.</i>
			<i>Rubus spectabilis</i>
1-5%	Trace (+)	Invasive Species	
<i>Corylus cornuta</i>		<i>Rubus armeniacus</i> (60%)	
<i>Urtica dioica ssp. gracilis</i>		<i>Fallopia japonica</i> (30%)	
		<i>Impatiens glandulifera</i> (5%)	

This plot is located along the BC Hydro right-of-way and the riparian area of the Burnette River.

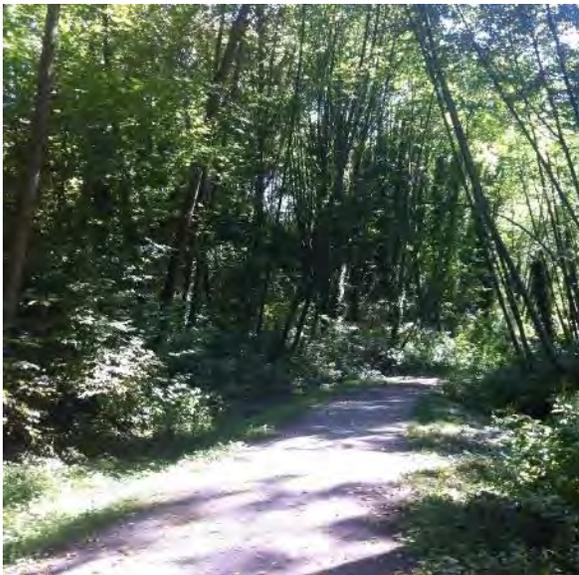


Plot 7:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	4-5/D	Moder/3	CWHdm 05 (70%) 07(30%)
UNDERSTORY VEGETATION (70% cover)			
>50%	26-50%	11-25%	6-10%
	<i>Rubus spectabilis</i>	<i>Oemleria cerasiformis</i>	
1-5%	Trace (+)	Invasive Species	
		<i>Hedera helix</i>	
<i>Corylus cornuta</i>		<i>Rubus armeniacus</i>	
<i>Athyrium filix-femina</i>		<i>Fallopia japonica</i>	
<i>Polystichum munitum</i>			
<i>Cornus stolonifera</i>			

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)	Act100%	Mb60% Dr30% Act20%	Dr70% Mb30%	Dr50%Mb50%	Mb80% Cw20%
Density (stems/ha)	150	250	200	30	10
Tree diameter at breast height (cm)	50	40	20	5	
Tree height (m)	37	29	18	6	
Live crown ratio	60	50	35		
Crown closure (%)	50				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow)



Plot 8:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	4-7/D	Moder/4	CWHdm 05 (70%) 07(20%)12(10%)
UNDERSTORY VEGETATION (70% cover)			
>50%	26-50%	11-25%	6-10%
	<i>Rubus spectabilis</i>		<i>Polystichum munitum</i>
	<i>Oemleria cerasiformis</i>		<i>Acer circinatum</i>
1-5%	Trace (+)	Invasive Species	
<i>Symphoricarpos albus</i>		<i>Hedera helix</i>	
<i>Athyrium filix-femina</i>		<i>Rubus armeniacus</i>	
<i>Gymnocarpium dryopteris</i>		<i>Ilex aquifolium</i>	
<i>Blechnum spicant</i>		<i>Prunus laurocerasus</i>	

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)	Act100%	Mb80% Dr20%	Mb70% Dr30%	Mb100%	Mb80% Cw20%
Density (stems/ha)	40	100	250	150	10
Tree diameter at breast height (cm)	90	60	15	5	
Tree height (m)	45	30	18	8	
Live crown ratio	60	50	40		
Crown closure (%)	35				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow)



Plot 9:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	5-6/D	Moder/4	CWHdm 07(90%) 12(10%)
UNDERSTORY VEGETATION (90% cover)			
>50%	26-50%	11-25%	6-10%
<i>Rubus spectabilis</i>		<i>Oemleria cerasiformis</i>	<i>Gymnocarpium dryopteris</i>
			<i>Cornus stolonifera</i>
1-5%	Trace (+)	Invasive Species	
<i>Polystichum munitum</i>	<i>Lysichiton americanus</i>	<i>Hedera helix</i>	
<i>Athyrium filix-femina</i>	<i>Rhamnus purshiana</i>	<i>Rubus armeniacus</i>	
<i>Urtica dioica ssp. gracilis</i>			
<i>Equisetum arvense</i>			

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)		Dr50% Mb50%	Dr80%Mb20%	Dr70% Cs20% Mb10%	
Density (stems/ha)		200	100	50	
Tree diameter at breast height (cm)		35	20	5	
Tree height (m)		28	15	6	
Live crown ratio		60	40		
Crown closure (%)	40				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Cs (cascara)



Plot 10:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	5-6/D	Moder/3	CWHdm 05(70%) 07(30%)
UNDERSTORY VEGETATION (70% cover)			
>50%	26-50%	11-25%	6-10%
	<i>Polystichum munitum</i>	<i>Oemleria cerasiformis</i>	<i>Rubus spectabilis</i>
			<i>Geum macrophyllum</i>
			<i>Acer circinatum</i>
1-5%	Trace (+)	Invasive Species	
<i>Rubus parviflorus</i>		<i>Hedera helix</i>	
<i>Sambucus racemosa</i>			
<i>Corylus cornuta</i>			

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)	Act100%	Mb100%	Mb90%Dr10%	Mb100%	
Density (stems/ha)	10	250	200	40	
Tree diameter at breast height (cm)		45	25	5	
Tree height (m)		27	18	7	
Live crown ratio		60	40		
Crown closure (%)	65				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Cs (cascara)



Plot 11:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/ Soil Nutrient	Humus Type/ Depth (cm)	BEC Site Series
Sandy Loam	4-5/D	Moder/3	CWHdm 05
UNDERSTORY VEGETATION (70% cover)			
>50%	26-50%	11-25%	6-10%
	<i>Polystichum munitum</i>		<i>Corylus cornuta</i>
	<i>Oemleria cerasiformis</i>		
1-5%	Trace (+)	Invasive Species	
<i>Athyrium filix-femina</i>		<i>Hedera helix</i>	
<i>Sambucus racemosa</i>		<i>Rubus armeniacus</i>	
<i>Streptopus amplexifolius</i>		<i>Lamium galeobdolon</i>	
<i>Rubus parviflorus</i>			

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)	Act100%	Mb100%	Mb100%Dr+%	Mb90%Hw10%	
Density (stems/ha)	20	100	50	50	
Tree diameter at breast height (cm)	60	45	20	8	
Tree height (m)	37	27	16	6	
Live crown ratio	60	50	40		
Crown closure (%)	65				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Cs (cascara)



Plot 12:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/Soil Nutrient	Humus Type/Depth (cm)	BEC Site Series
Sandy Loam	4-5/D	Moder/3	CWHdm 05
UNDERSTORY VEGETATION (70% cover)			
>50%	26-50%	11-25%	6-10%
		<i>Oemleria cerasiformis</i>	<i>Symphoricarpos albus</i>
			<i>Rubus spectabilis</i>
1-5%	Trace (+)	Invasive Species	
<i>Polystichum munitum</i>		<i>Hedera helix</i>	
<i>Equisetum arvense</i>		<i>Rubus armeniacus</i>	
<i>Rubus parviflorus</i>		<i>Clematis</i>	
		<i>Convulvulus arvensis</i>	
		<i>daphne laureola</i>	
		<i>Tanacetum vulgare</i>	

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)	Act100%	Mb90%Dr10%	Mb80%Dr20% Fd+%	Mb100%	
Density (stems/ha)	50	150	50	40	
Tree diameter at breast height (cm)	60	45	25	8	
Tree height (m)	38	32	15	7	
Live crown ratio	60	60	40		
Crown closure (%)	50				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Cs (cascara)



Plot 13:

ECOLOGICAL CHARACTERISTICS			
Soil Texture/Coarse Fragment Content	Soil Moisture/Soil Nutrient	Humus Type/Depth (cm)	BEC Site Series
Sandy Loam	5/D	Moder/4	CWHdm 05
UNDERSTORY VEGETATION (5% cover)			
>50%	26-50%	11-25%	6-10%
1-5%	Trace (+)	Invasive Species	
<i>Polystichum munitum</i>	<i>Streptopus amplexifolius</i>	<i>Hedera helix</i>	
<i>Sambucus racemosa</i>	<i>Maianthemum dilatatum</i>		
<i>Acer circinatum</i>	<i>Corylus cornuta</i>		
	<i>Vaccinium parvifolium</i>		
	<i>Mahonia nervosa</i>		

STAND CHARACTERISTICS					
Canopy Layer	Dominant Trees	Co-Dominant Trees	Intermediate Trees	Suppressed Trees	Regeneration
Species ¹ (% by volume; + denotes <10%)		Fd90%Cw10%	Fd60%Cw40%	Hw40%Cw30% Fd30%	
Density (stems/ha)		200	150	5	
Tree diameter at breast height (cm)		70	50	12	
Tree height (m)		42	32	12	
Live crown ratio		70	70		
Crown closure (%)	45				

¹ Species codes: Fd (Douglas-fir), Hw (western hemlock), Cw (western redcedar), Act (black cottonwood), Mb (bigleaf maple), Dr (red alder), Pr (bitter cherry), W (willow), Cs (cascara)





Appendix C – Description of Habitat Types

Forest

No old growth forests exist in the City. All trees are second growth of varying ages that established following forest harvesting and subsequent land clearing.

Evergreen

Stands dominated by >80% conifer tree species.

Mixed Evergreen Deciduous

Stands dominated by a mix of conifer and deciduous tree species, neither of which composes more than 80% of the stand.

Deciduous

Stands dominated by >80% deciduous tree species.

Mature Forest (>60 yrs)

This habitat type includes trees older than 60 yrs. In the City, this includes mostly conifer trees that regenerated following tree harvesting at the turn of the century and have been retained within park areas.

Young Forest (10-60 yrs)

Most forest stands in the City are considered young. Young forests are relatively even-aged, moderately dense, and have a low structural diversity. These areas consist of mostly pioneer deciduous species.

Regen/Sapling (<10-60 yrs)

These include areas that have been recently cleared and are regenerating with tree species. These are found mostly along linear right-of-ways that are cut periodically.

Aquatic Communities

Freshwater aquatic communities include areas with flowing water (rivers), areas of open water (lakes, ponds), and areas where standing water occurs at or near the soil surface for all or part of the year (wetlands). Vegetation in these areas is characterized by hydrophilic plant species (i.e. plants tolerant of water saturated conditions).

Stream/Fraser River/Brunette River

A stream is a defined channel of flowing water. They can be part of natural or constructed drainage systems, and are often fed by smaller tributaries. Smaller streams are sometimes referred to as creeks. The two primary watercourses in the City include the Fraser River and the Brunette River. These are classified as follows:

- Red – Rearing habitat that is accessible to fish;
- Yellow – Inaccessible to fish but providing important food and nutrients;
- Green – Not fish habitat.

Ditch

These include watercourses that were constructed to manage waterflow. Some of these provide fish habitat or food and nutrients for downstream fish habitat. Most of the constructed ditches are found on Queensborough Island.

Lake/Pond

A lake is defined as a large body of open water surrounded by land. Ponds are sometimes differentiated from lakes on the basis of size and depth, although there is no consistent definition. Generally, ponds may be considered smaller and/or shallower.

Wetland

Wetlands include areas of fluctuating and/or standing water at or near the soil surface. Saturated conditions influence soil development and support specialized plant species that are adapted to these conditions. Wetlands are sub-classified as marshes, swamps, fens and bogs.

Shrub and Herb Communities**Herbaceous and grass**

These habitat types represent an early stage of ecological succession. They generally develop following recent forest clearing or are maintained in this vegetative state either because of environmental conditions (e.g. growing substrate, high water table) or by human activities. Vegetation in these habitats is dominated by grass and herbs; forest cover is generally less than 10%.

Shrub

Characteristic vegetation for this habitat type includes woody shrubs and short trees (<5 m tall). Due to increased sun exposure, these open areas are often dominated by invasive shrubs such as Himalayan blackberry.

Developed

Developed areas are highly influenced by human activity for residential, commercial, institutional, and industrial uses. These include areas that provide plant communities of significant size to provide habitat. Tree and plant species are not all native and area managed to a particular condition.

Urban Trees

These areas include rows and small patches of trees that are found within the urban matrix. Urban trees are found on large private lots as well as parks that are landscaped and maintained. The understory associated with these trees is often maintained (turf or garden).

Managed Grass

These areas are maintained and irrigated as turf grass. Grass condition can be manicured turf for golf courses, cemeteries, private yards, parks and sports fields. It also includes grass that is mowed but not maintained such as undeveloped lots, road right of ways and boulevards.

Garden

These include maintained landscape areas. Mostly these include areas associated with City parks. Most residential gardens are too small in size to be inventoried.