

New Westminster Citywide Integrated Stormwater Management Plan

VOLUME I

Vision, Principles & Actions

NEW WESTMINSTER

Structure of the New Westminster Integrated Stormwater Management Plan

The New Westminster Integrated Stormwater Management Plan (ISMP) covers all areas of the City of New Westminster. The City is undergoing a phased transition from combined sewers to separated sanitary and stormwater sewer systems. The ISMP area includes several different conditions that affect stormwater management, including the lowland Queensborough area with pumped drainage, other parts of the City that will have piped drainage to the Brunette River, and remaining areas that will have stormwater flow to the Fraser River.

Credits

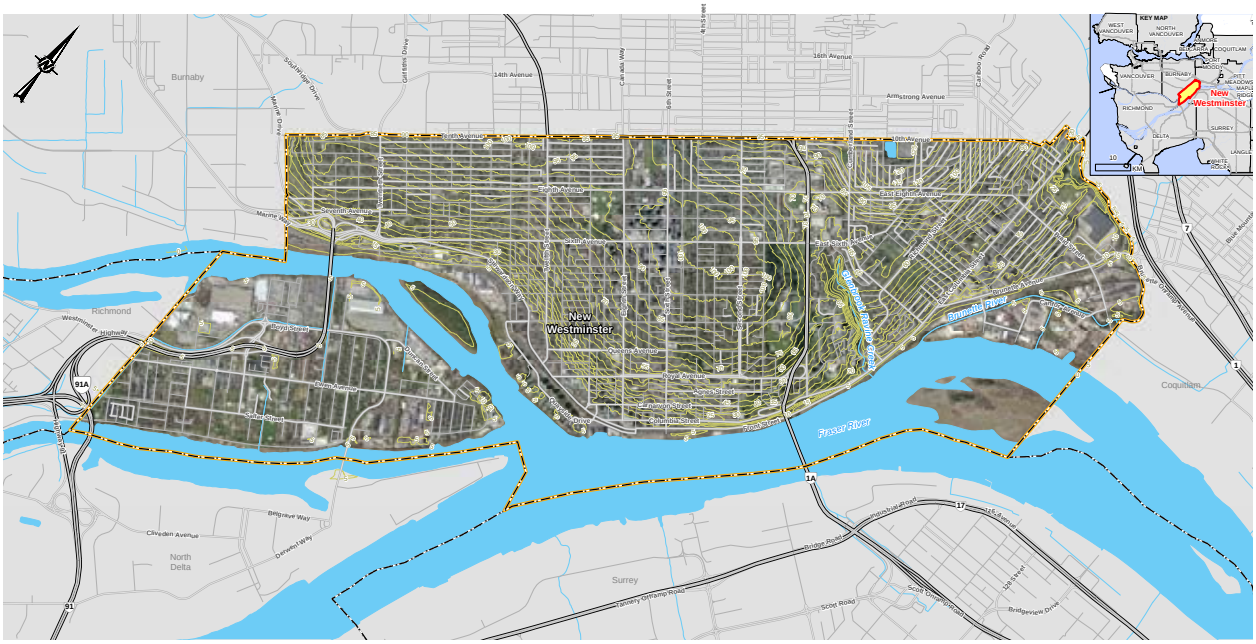
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Adapted from Original Work for
City of Vancouver IRMP, 2016

March 2017

Figure I-1 New Westminster - Stormwater Management Area



The New Westminster Integrated Stormwater Management Plan is presented in three volumes:

I. **Vision, Principles and Actions** – a summary of why stormwater management is required, introduction to targets and programs / actions to address priorities. (this document)

II. **Best Practice Toolkit** – a guide to common tools to address stormwater management in New Westminster, highlighting their strengths and challenges.

III. **Technical Background Report** – a detailed record of process, alternatives, technical and financial analysis, program details and action plan.

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VISION FOR THE CITYWIDE ISMP

- Stormwater is treated as a valuable resource in New Westminster.
- New Westminster manages stormwater to renew river habitats, urban forests and ecosystems, and to support intelligent urban design in a resilient community.

Heavy rainfall at Westminster Pier Park.



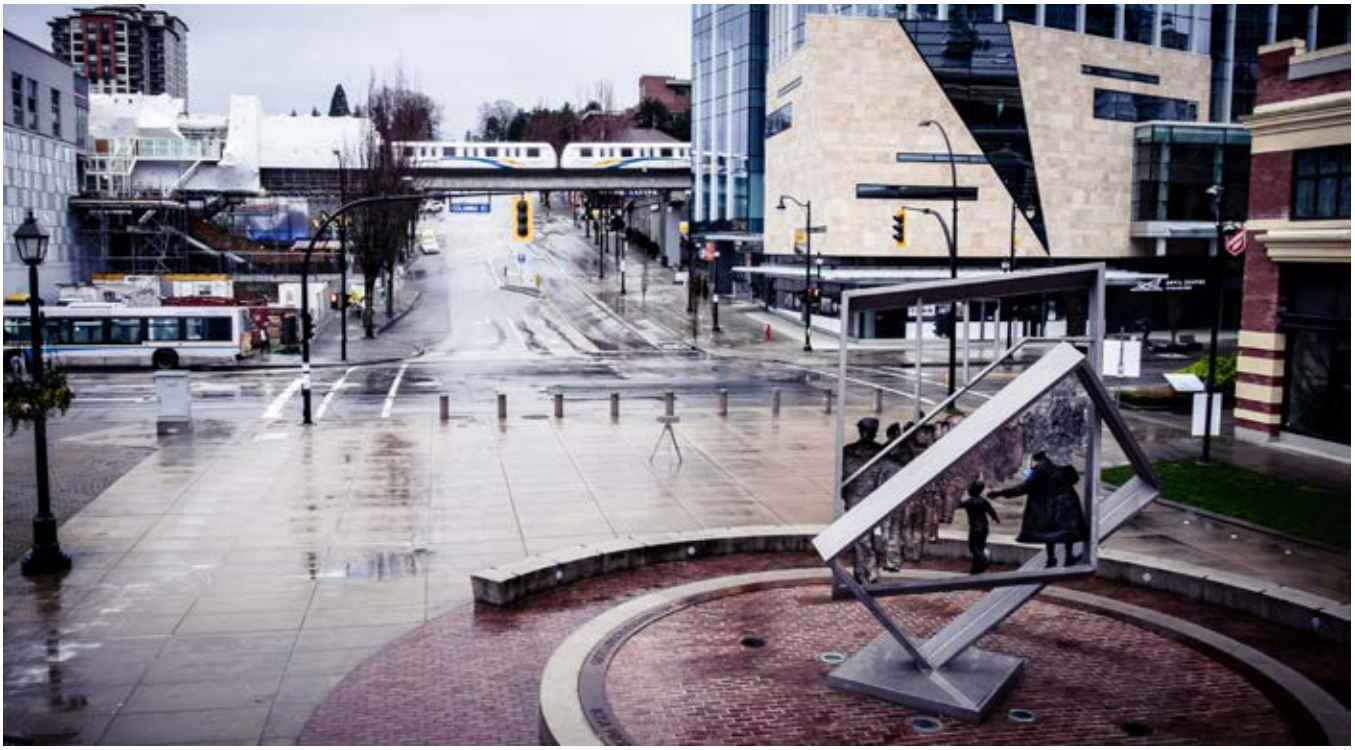
1.0 WHY STORMWATER MANAGEMENT?

The stormwater in City pipes, after separation of combined sewers, will flow to the sensitive fisheries of the Brunette and Fraser Rivers. Supporting salmon, aquatic ecosystems, and waterfront enjoyment are all fundamental objectives of the Citywide ISMP. Other City of New Westminster policies also reinforce stormwater management, including:

- from Envision 2032 (Integrated Community Sustainability Plan) Description of Success: the habitat and recreation value of local waters and wetlands . . . is being restored . . . Green Infrastructure is being utilized to reduce stormwater impacts and to recreate the original hydrology of the area to the extent possible.
- from OUR CITY 2041 (Official Community Plan draft): Protect, enhance and connect natural habitat areas and ecological systems, including the Fraser River, Brunette River, Glenbrooke Ravine and large treed parks . . . New green spaces should be incorporated into or enhanced as a part of City projects to increase the capacity for stormwater storage . . .

The City of New Westminster has supported the Blue Dot Campaign. Key applicable phrases from the Blue Dot Campaign include: Management of Water, Clean and Safe Water, Pollution Reduction, Green Infrastructure, Sustainable Development, Resilient Community, Strong Public Support and Local Government Action.

Winter storm in Hyack Square.



Supporting Nature's Ecosystems

How the city is designed and operated has a direct effect on stormwater and runoff quality and quantity. Cumulatively, management of the city urban design determines the health of New Westminster's watersheds and receiving waters, including high habitat values along shorelines of the Fraser and Brunette Rivers, key waterways and canals in Queensborough, and in the Glenbrook Ravine.



Urban Watershed Health is determined by Urban Design (Brunette River, New Westminster).





Stormwater Source Controls, like this rain garden in Hume Park, are part of Climate Change Adaptation green infrastructure.

Preparing for Climate Change and Severe Weather

Climate change is predicted to produce wetter winters, and dryer summers, in the New Westminster area. The city has also recently seen summer cloudbursts, which can lead to damage to buildings and utilities. Flooding occurs when intense rainfall overcome the piped system capacity, which has been designed to handle peak flows from historical data that did not anticipate climate change.

Stormwater Management should include actions that reduce impervious areas that create runoff, or redirect stormwater to areas where it can soak in or be stored. These 'stormwater source controls', as shown in the BMP Toolkit (ISMP Volume II), can play a significant role in maintaining water quality and reducing flow volumes.

Reduction in peak flows in the piped stormwater system also provides additional capacity to allow for climate-related changes in rainfall patterns.

Stormwater Management should include actions that reduce impervious area, or redirect stormwater to areas where it can soak in or be stored.

Protecting Sensitive Waterbodies

MAINTAINING WATER QUALITY

A primary driver in stormwater management in New Westminster is to maintain the water quality of receiving waters. This is particularly important where receiving waters are sensitive, including salmon habitat areas of the Brunette River, and areas with recreational use, such as areas along the Waterfront Esplanade and Sapperton Landing Park, and riparian areas in Hume Park and along the Central Valley Greenway.

Urban stormwater includes many common pollutants: e.g. petroleum hydrocarbons and heavy metals from vehicles, sediment from construction sites, excess nutrients from fertilizer, and bacteria from organic waste. As untreated stormwater is redirected by pipe to the water bodies surrounding New Westminster, the quality of water in these receiving waters may decline compared to today.







Urban Runoff Carries Pollutants (New Westminster and Vancouver).



MAINTAINING WATER QUALITY FOR RECREATION

Water quality is particularly important where receiving waters are confined, including areas with reduced dilution or dispersion of pollutants.

The bank of the Fraser River has a long history of industrial and railway use. Public access to the shoreline is gradually increasing, and the area may be more accessible from land in the future.

The riverbank along the Brunette River is also heavily wooded in some areas, and features trails systems and parks that are interspersed with industrial operations.

These features are increasingly important to as recreational assets to the citizens of New Westminster. Keeping these receiving waters clean is important for habitat reasons, but it is also important for New Westminster's quality of life.

The ISMP and its action plan can help the people of New Westminster reconnect with the watersheds and ecosystems that support them.

Westminster Pier Park (New Westminster).



Reducing Combined Sewer Overflows

The volume of water that flows into City sewers is also an issue.

The City was constructed historically with sewers that combine sanitary sewage and stormwater drainage. Combined sewer overflows (CSOs) occur when the volume of rainfall mixing with sewage in the combined sewer overcomes the capacity of the pipe, with the overflow draining to receiving waters such as Brunette or Fraser Rivers.

The City has an established program to convert combined sewers into separated systems of sanitary sewers and storm drains. Already well underway, the program should be completed by Year 2075. When the sewer separation is complete, instead of stormwater currently piped to the regional wastewater treatment plants, there will be new flows of stormwater directly into tidal and estuarine receiving waters around the city.

Although the stormwater outflows will be significantly less polluting than existing combined sewer overflows, the water quality of stormwater remains a concern. Implementation of the best practices for stormwater source control treatment that are recommended in the Action Plan would reduce stormwater flows and improve stormwater quality to meet regional guidelines.

Until such time as separated sewers are completed, there will be continuing combined sewer overflows (CSOs) during periods of heavy rain. These CSOs have impacts on both recreation and ecosystems.

Reduction in the volume of stormwater reaching combined sewers in the interim period until sewer separation is complete will support the intent to reduce the frequency, size and impacts of CSOs.







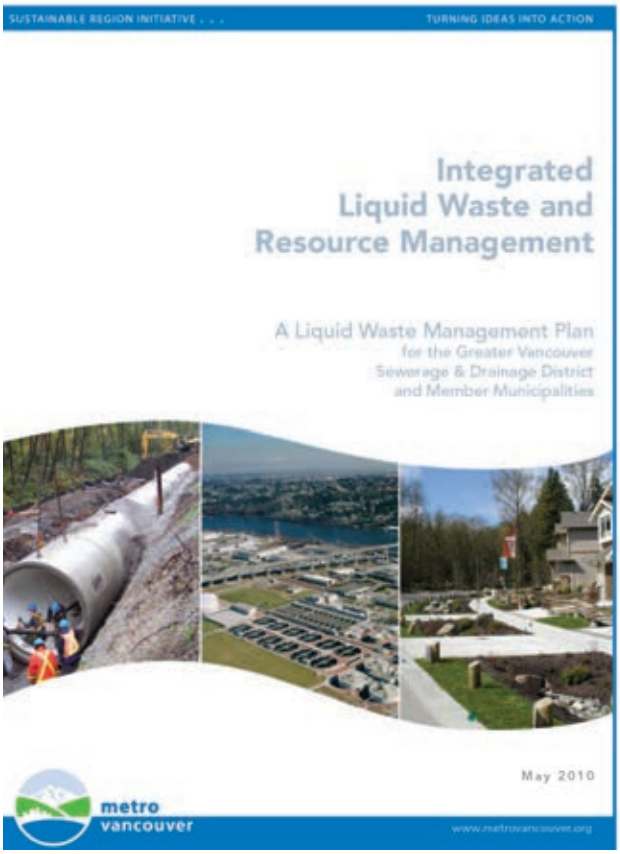
Fraser River and Marine Habitat is at Risk (New Westminster and Vancouver).

Meeting Regulatory Requirements

The City needs to meet Water Quality Guidelines that are established under senior levels of government. Environment Canada establishes guidelines for water quality and urban runoff. Fisheries and Oceans Canada establishes requirements for protection of aquatic habitat. The Province of British Columbia, through BC Environment and the Ministry of Health, set and administer requirements for the protection of the environment and public health. These senior government requirements inform a region-specific implementation strategy through the Metro Vancouver Integrated Liquid Waste and Resource Management Plan (ILWRMP). The City of New Westminster and other members of Metro Vancouver are committed to creating and monitoring Integrated Stormwater Management Plans in response to these guidelines and regulations.

This Citywide Integrated Stormwater Management Plan (ISMP) is one of the City of New Westminster's responses to the ILWRMP requirements. The three volumes of the ISMP analyze the issues and opportunities, summarize stakeholder input, and identify programs, tools and adaptation actions customized to the Citywide context and vision.

These documents work together to also meet the needs of senior government regulators for certainty around New Westminster's commitment to sustainable development and redevelopment in its watersheds.



The Metro Vancouver Integrated Liquid Waste and Resource Management Plan provides a region-specific implementation strategy.

Honouring New Westminster's Stormwater Resource

New Westminster's First Nations and early European settlers lived in economies that depended on the food and timber resources provided by the rainforest and shorelines. Over the 19th and early 20th centuries, New Westminster's development advanced with little regard for the watersheds and watercourses that dissected it. Most streams were culverted, and ravines were filled for development.

In the Citywide study area, all drainage is piped, and the entire area has fully developed urban conditions. New Westminster Citywide ISMP issues and solutions require a customized approach that recognizes the existing and evolving piped systems. Figure I - 1 on the inside cover illustrates the extent of the Citywide ISMP area.

Rain: New Westminster. The two seem inseparable. New Westminster's abundant rainfall is a key ingredient of its character— a part of life living here.

Stormwater on the River Market pedestrian overpass (New Westminster).



2.0 THE NATURE OF RAINFALL IN NEW WESTMINSTER

Rainfall Spectrum in New Westminster

Stormwater Management requires an understanding of the rainfall spectrum.

In South Coast BC, including New Westminster, the great majority (+/- 70%) of rainfall volume in an average year falls as light showers and normal rainfall. A further +/-20% is heavy rainfall but within the average mean annual rainfall volume. Only +/-10% of the rainfall volume in an average year is large storms that might create widespread flooding. The rainfall distribution varies from year to year (+/-), but Figure I - 2 represents averages.

With this insight into rainfall characteristics, Stormwater Management in New Westminster can capture, through infiltration or reuse, the rainfall from drizzle and small storms. Both normal and heavy rainfall—representing +/-90% of the average annual rainfall volume, can be treated using stormwater source controls (see Volume II) to improve water quality to Metro Vancouver's Monitoring and Adaptive Framework yellow or green standards.

For the rare large storm events, conveyance in roadside, gutters and other major overland flow paths is necessary to protect from flood damage.

Figure I - 2: Rainfall Spectrum

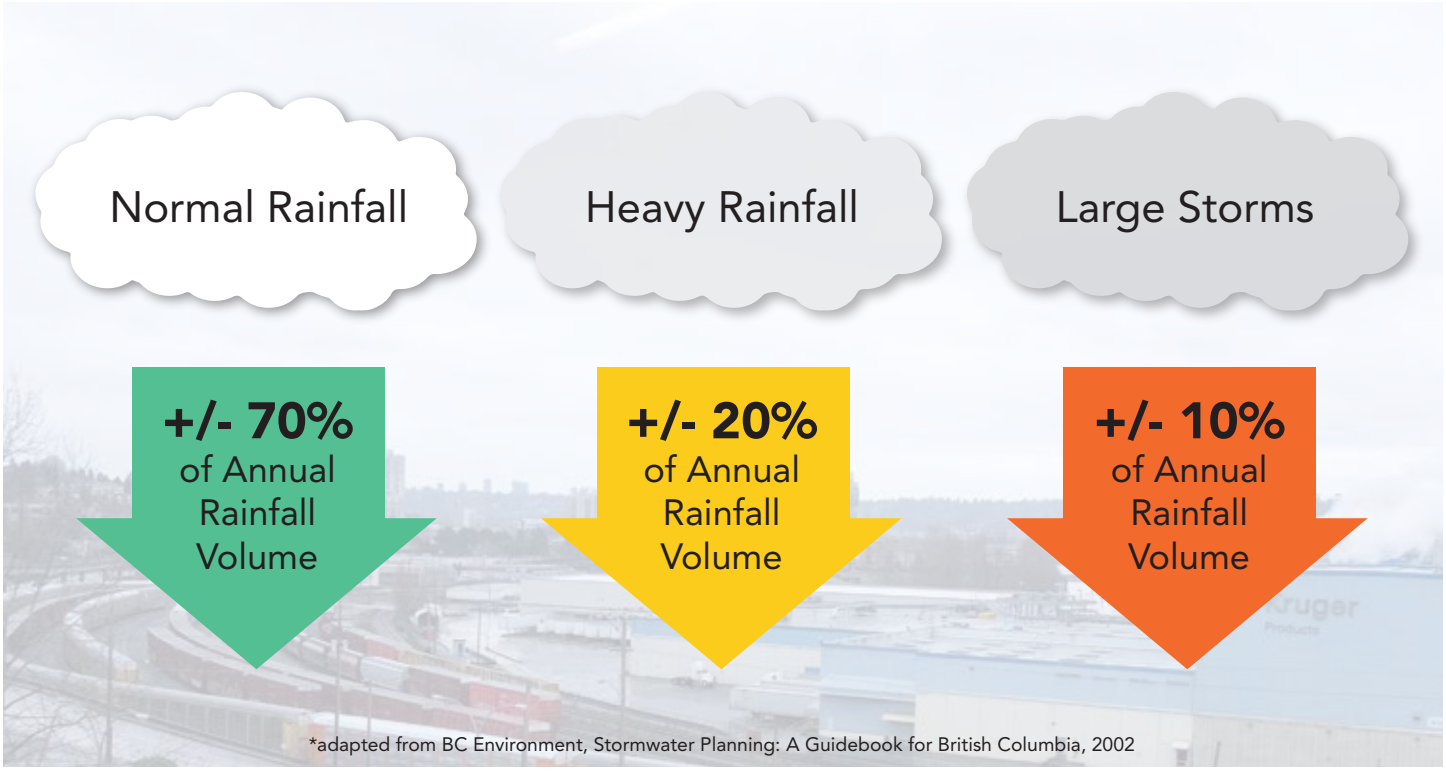
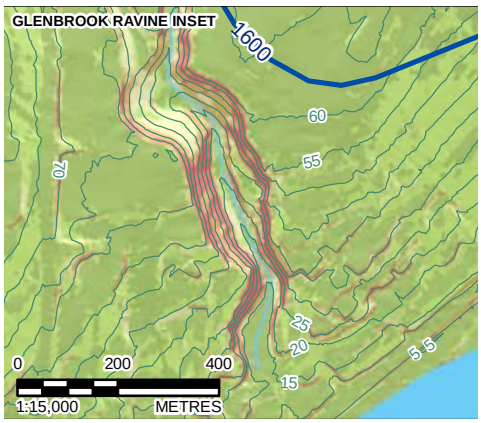


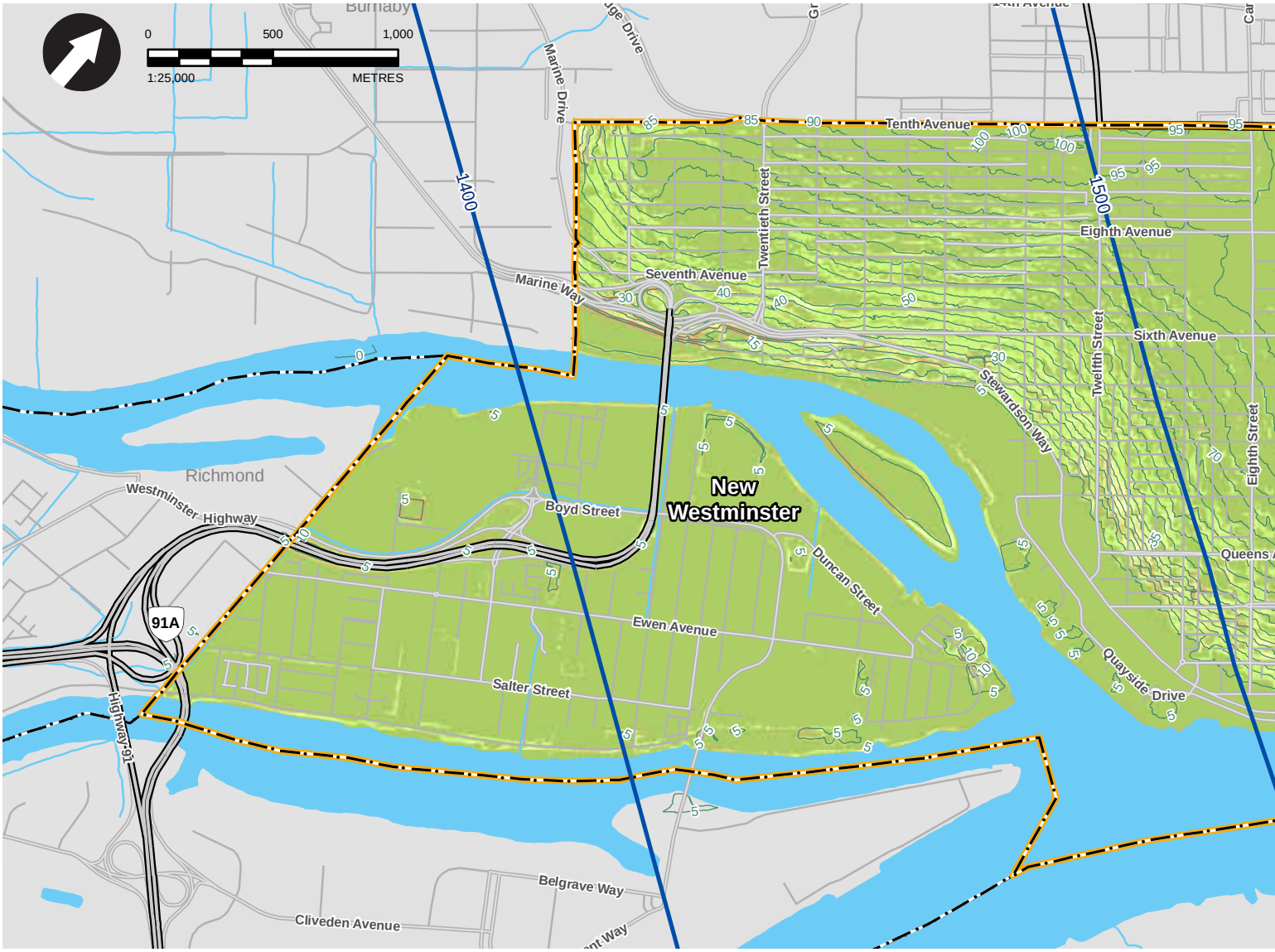
Figure I - 3:

Topography & Areas of Average Annual Precipitation

The pattern of rainfall in New Westminster is influenced by prevailing winds and the effect of the North Shore Mountains that force moisture-laden clouds to rise, cool, and therefore drop their rainfall.

Figure I - 3 shows the increase in average annual rainfall (AAR) from 1400 mm AAR near the southwest edge up to 1600 mm AAR at the northeast edge. Using 1600 mm AAR is recommended for general planning purposes, with more site-specific rainfall potentially used for custom-design situations such as large surface parking areas.





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BASE DATA

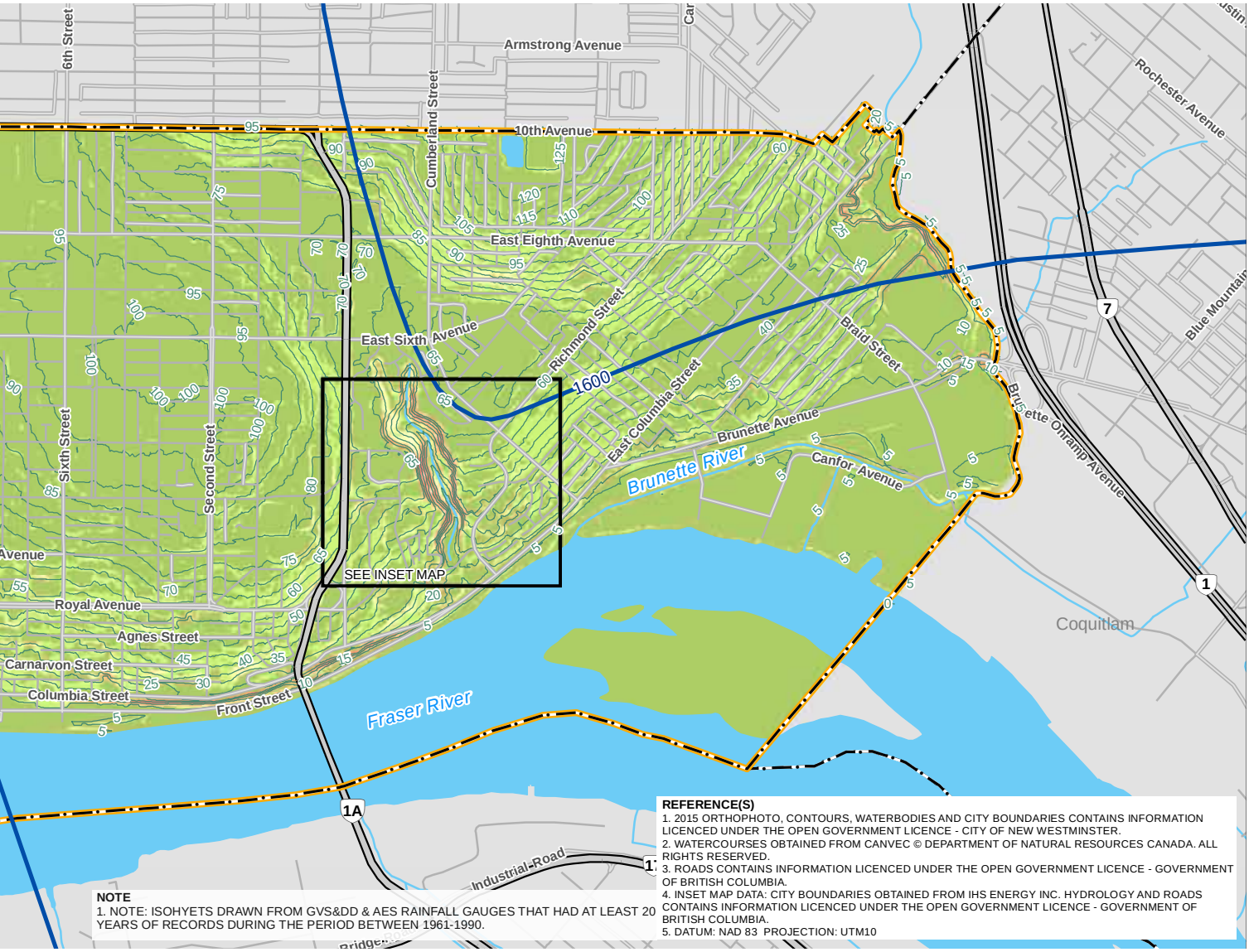
- PRIMARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- MAJOR CONTOUR (10 m)
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

PROJECT DATA

- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA

SLOPE

- 0-10%
- 10-20%
- 20-33%
- 33-50%
- >50%
- AVERAGE YEARLY PRECIPITATION BANDS (ISOHYETES) AND TOTALS (mm)



NOTE

1. NOTE: ISOHYETS DRAWN FROM GVS&DD & AES RAINFALL GAUGES THAT HAD AT LEAST 20 YEARS OF RECORDS DURING THE PERIOD BETWEEN 1961-1990.

REFERENCE(S)

1. 2015 ORTHOPHOTO, CONTOURS, WATERBODIES AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
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4. INSET MAP DATA: CITY BOUNDARIES OBTAINED FROM IHS ENERGY INC. HYDROLOGY AND ROADS CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF BRITISH COLUMBIA.
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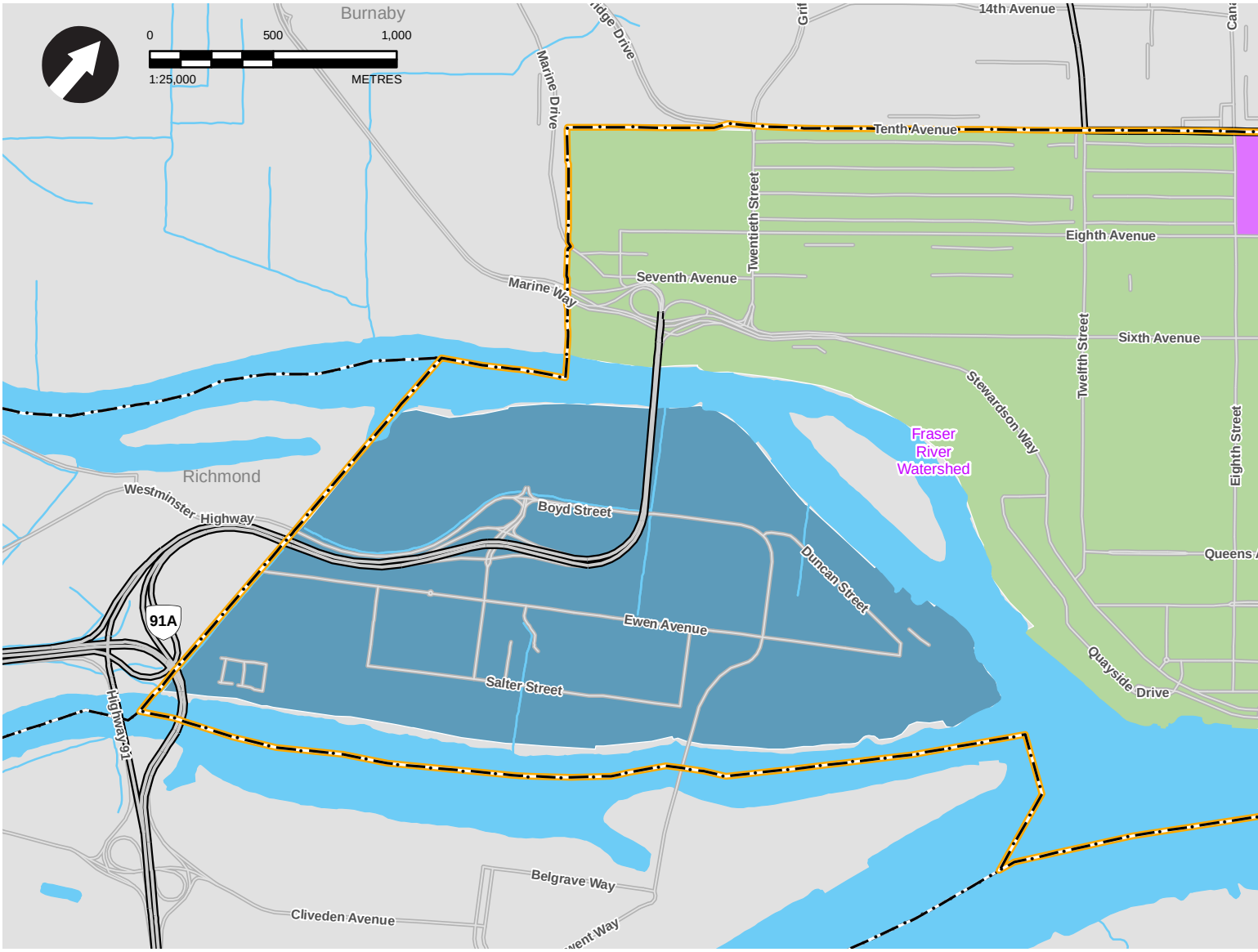
Figure I - 4:

Watersheds & Receiving Waters

On an historic pre-development basis, New Westminster's land would have drained to the Brunette River in the northwest corner, with the remainder of the City draining to the Fraser River either from the mainland slopes or from Queensborough.

With urban development came installation of combined sewers, with complex drainage boundaries. Until sewer separation is complete, most drainage is piped to the Annacis Island Wastewater Treatment Plant. After sewer separation, stormwater pipe outfalls are distributed along the waterfronts. In general, the northwest corner will flow to the Brunette, but part of the historic Brunette drainage (Sapperton) will outfall to the Fraser.

The remainder of the City, including, other large drainage basins such as Glenbrook Ravine and Queensborough also will outfall to the Fraser River.



LEGEND

BASE DATA

- PRIMARY HIGHWAY
- LOCAL ROAD
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

PROJECT DATA

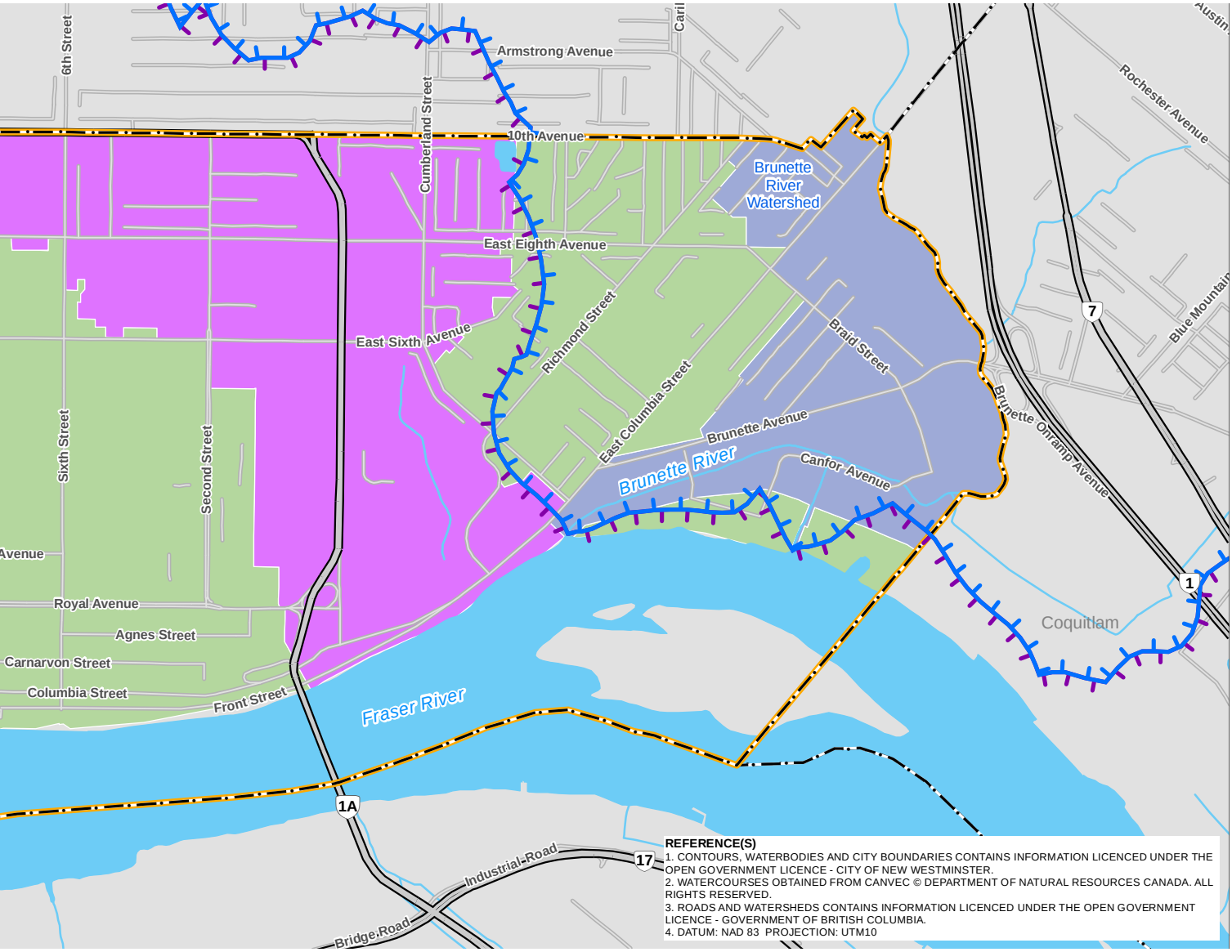
- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA

DRAINAGE AREA

- BRUNETTE RIVER DRAINAGE
- GLENBROOK RAVINE DRAINAGE AREA
- QUEENSBOROUGH PUMPED DRAINAGE TO FRASER RIVER
- FRASER RIVER DRAINAGE

WATERSHED

- BRUNETTE RIVER WATERSHED
- FRASER RIVER WATERSHED



REFERENCE(S)

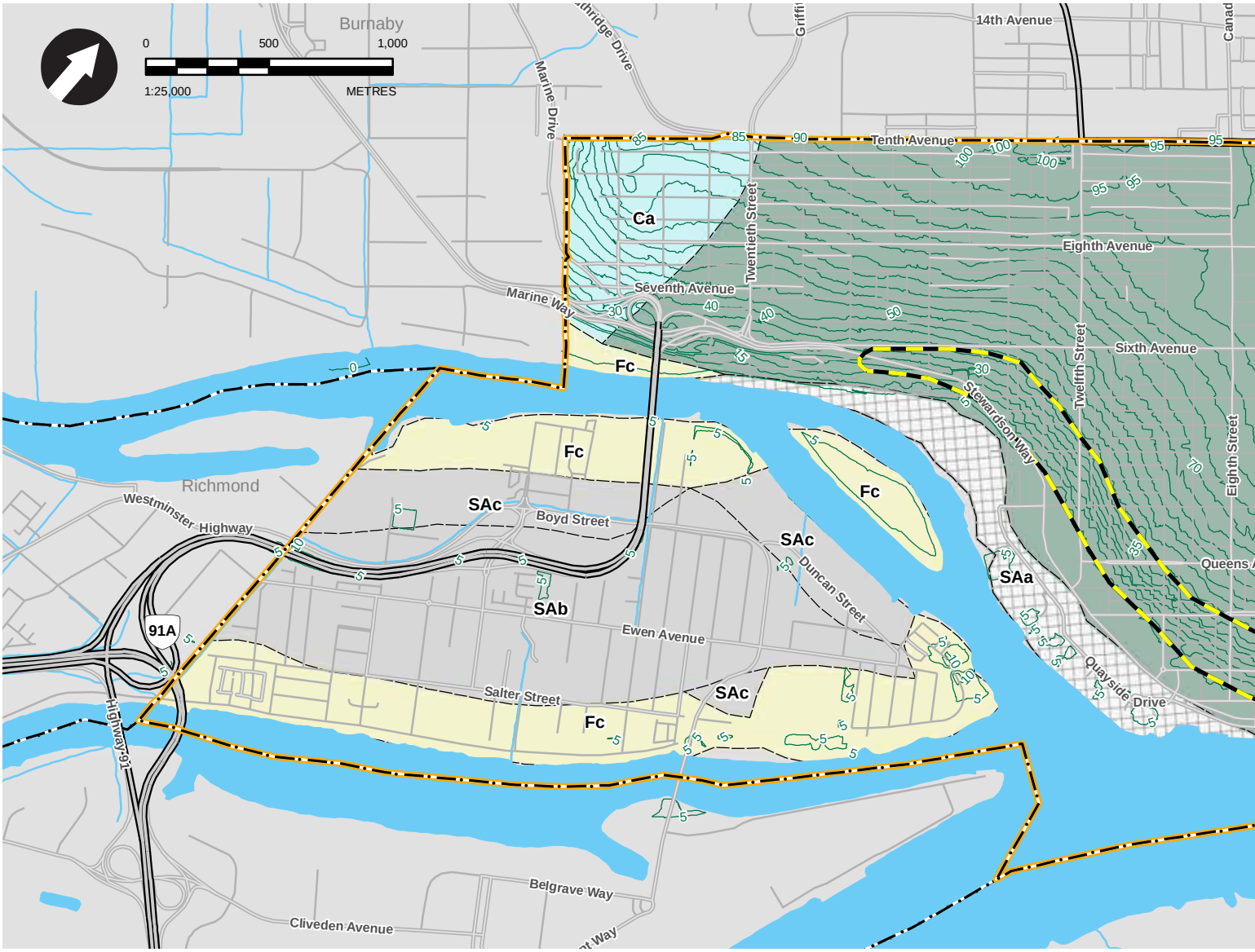
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Figure I - 5:

Our Geology and Soils

Figure I - 5 provides general information on the ground conditions (surficial geology) that underlay the City. The City geology has been influenced by glaciers, leaving subsoils that are highly variable. See Figure I - 6 for a summary of predominate infiltration potential.

Landfill has also been a significant part of the City history – including major fill areas along the Brunette and Fraser River shorelines. Limited areas of the City have steep slopes which could be made less stable by increased groundwater.



QUATERNARY SURFICIAL GEOLOGY

POSTGLACIAL

SALISH SEDIMENTS

Landfill including sand, gravel, till, crushed stone, and refuse

Bog, swamp, and shallow lake deposits: SAb, lowland peat up to 8 m thick overlying Fb,c; SAc, lowland peat up to 1 m thick, underlying Fb (up to 2 m thick); SAd, organic-rich sandy loam to clay loam 15 to 45 cm thick overlying Fd; SAe, upland peat up to 8 m or more thick overlying VC units

Lowland and mountain stream deltaic, channel fill, and overbank sediments: SAh, lowland stream channel fill and overbank sandy loam to clay loam, also organic sediments: up to 8 m thick; SAi, mountain stream marine deltaic medium to coarse gravel and minor sand up to 15 m or more thick. SAj, mountain stream channel fill sand to gravel up to 8 m thick

FRASER RIVER SEDIMENTS

Deltaic and distributary channel fill sediments overlying and cutting estuarine sediments and overlain in much of the area by overbank sediments: Fc, overbank silty to silt clay loam normally less than 2 m thick overlying 15 m or more of Fd; Fd*, deltaic and distributary channel fill (includes tidal flat deposits), 10 to 25 m interbedded fine to medium sand and minor silt beds; may contain organic and fossiliferous material

CAPILANO SEDIMENTS

Raised marine, deltaic, and fluvial deposits: Ca, raised marine beach, spit, bar, and lag veneer, poorly sorted sand to gravel (except in bar deposits) up to 10 m thick mantling older sediments and containing fossil marine shell casts up to 175 m above sea level

PRE-VASHON DEPOSITS

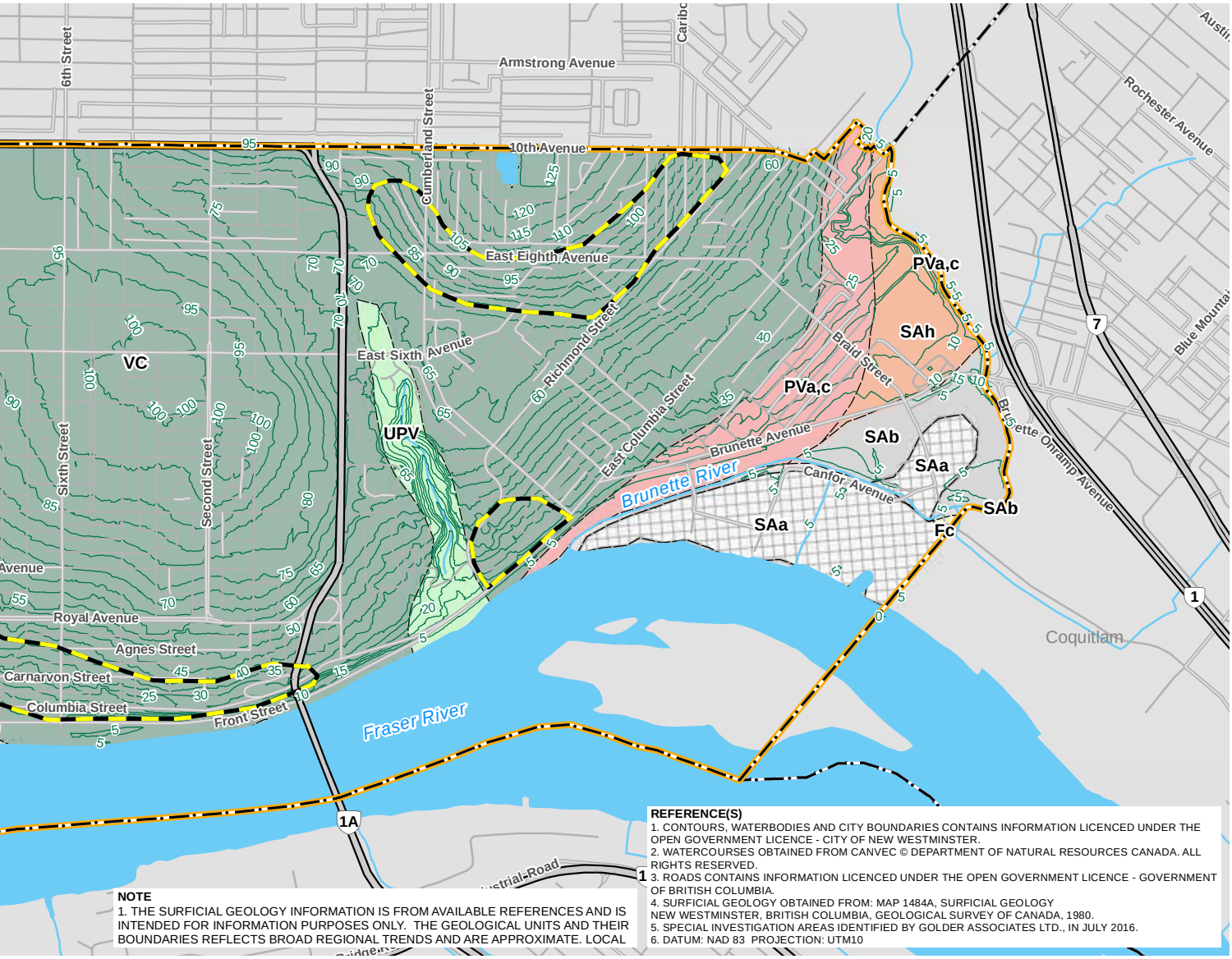
Pre-Vashon glacial, nonglacial, and glaciomarine sediments: PVa, Quadra fluvial channel fill and floodplain deposits, crossbedded sand containing minor silt and gravel lenses and interbeds

UNDIVIDED VASHON DRIFT (UPV)

Till, glaciofluvial, glaciolacustrine, fluvial marine, and organic sediments

VASHON DRIFT AND CAPILANO SEDIMENTS

Glacial drift including; lodgment and minor flow till, lenses and interbeds of substratified glaciofluvial sand to gravel, and lenses and interbeds of glaciolacustrine laminated stony silt; up to 25 m thick; in most places correlated with Va,b; overlain by glaciomarine and marine deposits similar to Cd, normally less than 3 m but in places up to 10 m thick. Marine derived (Ca) lag gravel normally less than 1 m thick containing marine shell casts has been found mantling till and glaciomarine deposits up to 175 m above sea level; above 175 m till is mantled by bouldery gravel that may be in part ablation till, in part colluvium, and in part marine. VCa, bedrock within 10 m or less of the surface; VCb, bedrock more than 10 m below surface



NOTE

1. THE SURFICIAL GEOLOGY INFORMATION IS FROM AVAILABLE REFERENCES AND IS INTENDED FOR INFORMATION PURPOSES ONLY. THE GEOLOGICAL UNITS AND THEIR BOUNDARIES REFLECTS BROAD REGIONAL TRENDS AND ARE APPROXIMATE. LOCAL

REFERENCE(S)

1. CONTOURS, WATERBODIES AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
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4. SURFICIAL GEOLOGY OBTAINED FROM: MAP 1484A, SURFICIAL GEOLOGY NEW WESTMINSTER, BRITISH COLUMBIA, GEOLOGICAL SURVEY OF CANADA, 1980.
5. SPECIAL INVESTIGATION AREAS IDENTIFIED BY GOLDER ASSOCIATES LTD., IN JULY 2016.
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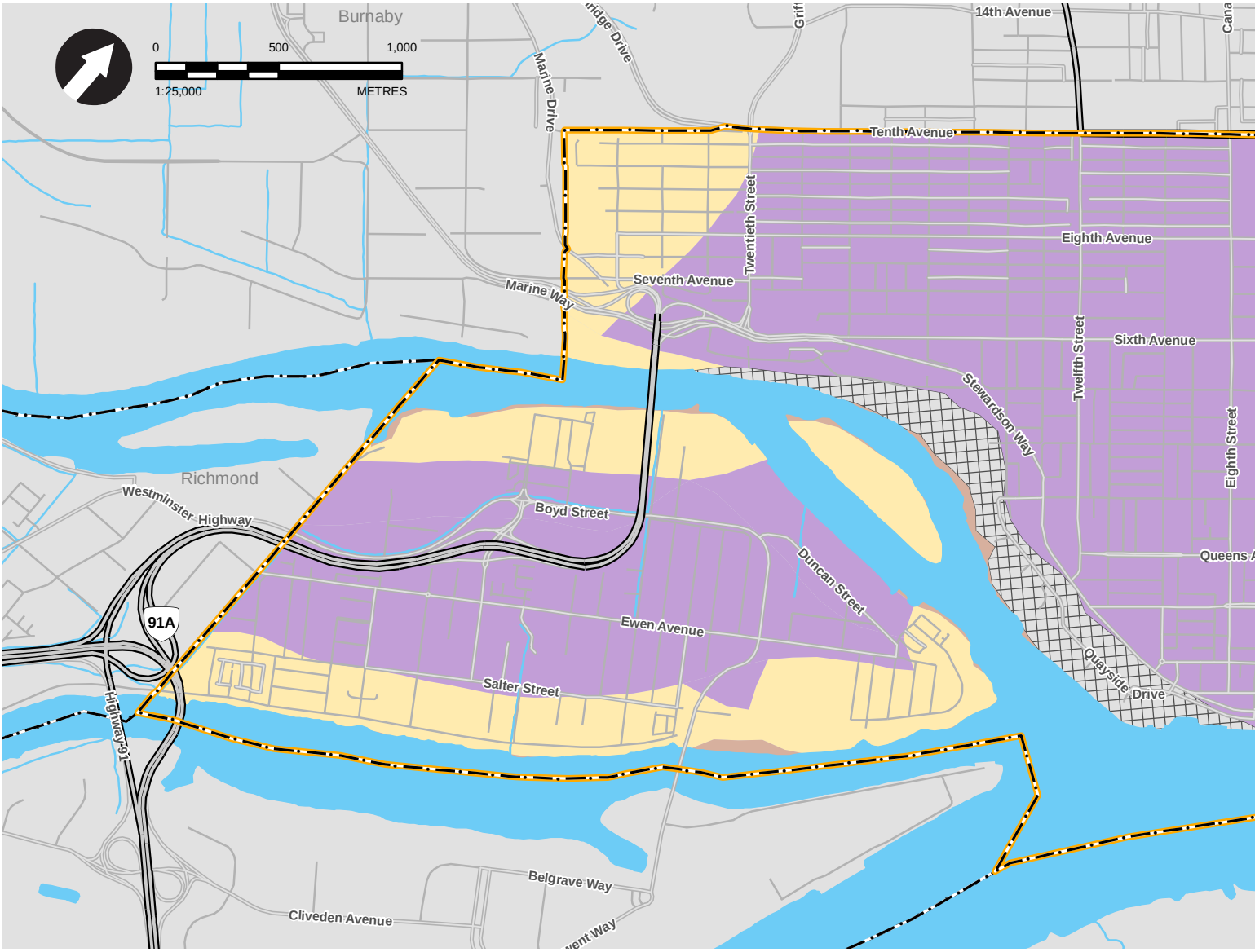
Figure I - 6:

Predominant Infiltration Potential

Most of the study area has predominantly low infiltration potential although some local areas may have moderate subsoil infiltration rates which should be confirmed by local testing. For this study the precautionary principle is used by assuming limited infiltration rates into subsoils (in the range of 1–2mm/hr (average 1.5mm/hr).

However, note that even these low rates of subsoil infiltration—not visible to the naked eye within a short time period – represent 24–48mm of infiltration over a 24 hour period. This slow infiltration is still very relevant to meeting the proposed targets for stormwater capture that are introduced in this report.

Areas planned for concentrated infiltration, and in particular areas of fill or steep slope, should have site-specific investigations of hydrogeology conditions and risks prior to implementing groundwater infiltration practices.



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BASE DATA

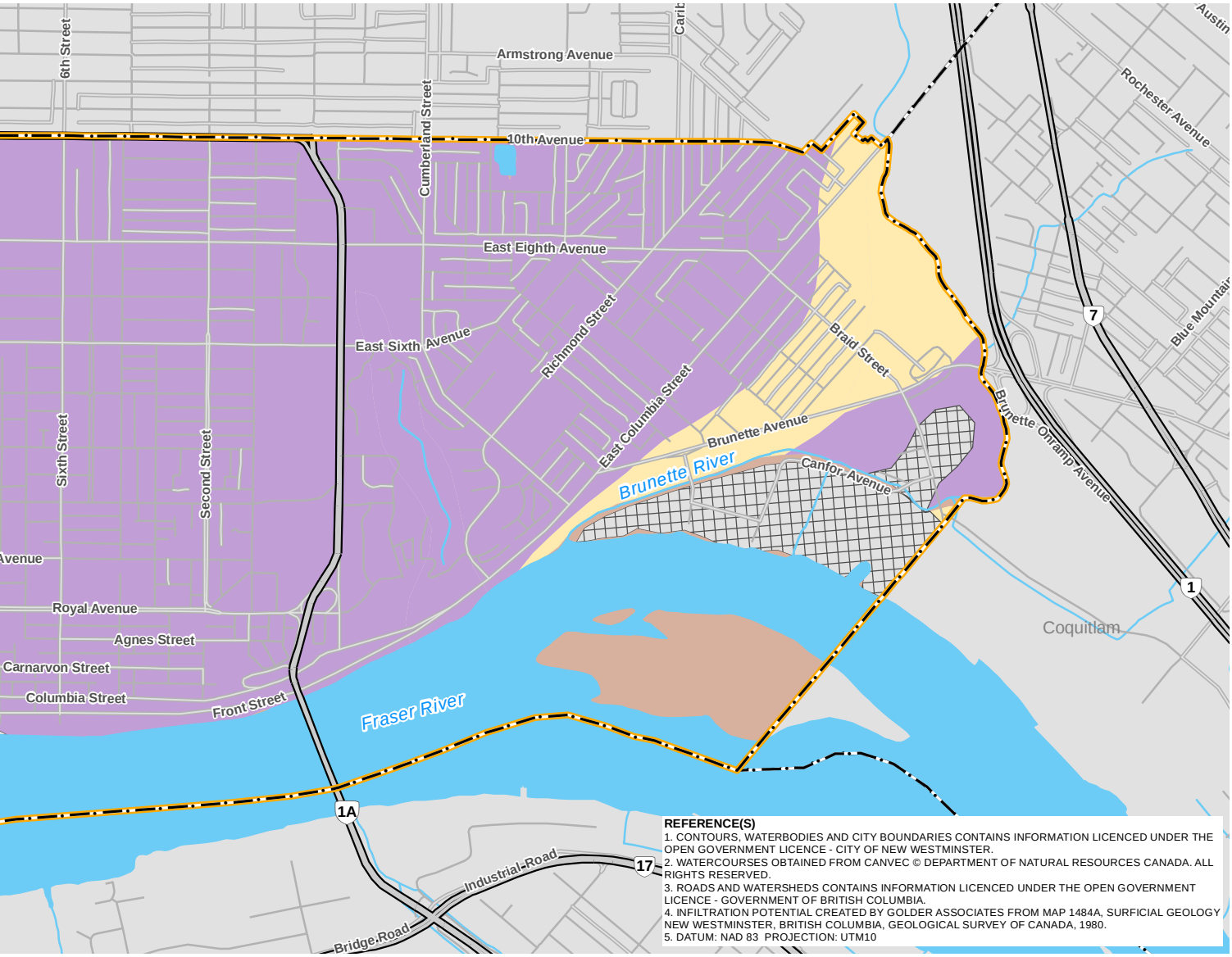
- PRIMARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- MAJOR CONTOUR (10 m)
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

PROJECT DATA

- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA

PREDOMINATE INFILTRATION POTENTIAL

- PREDOMINATELY LOW INFILTRATION POTENTIAL
- PREDOMINATELY MODERATE INFILTRATION POTENTIAL
- NO INFILTRATION POTENTIAL
- SPECIAL INVESTIGATION AREA - LANDFILL



REFERENCE(S)

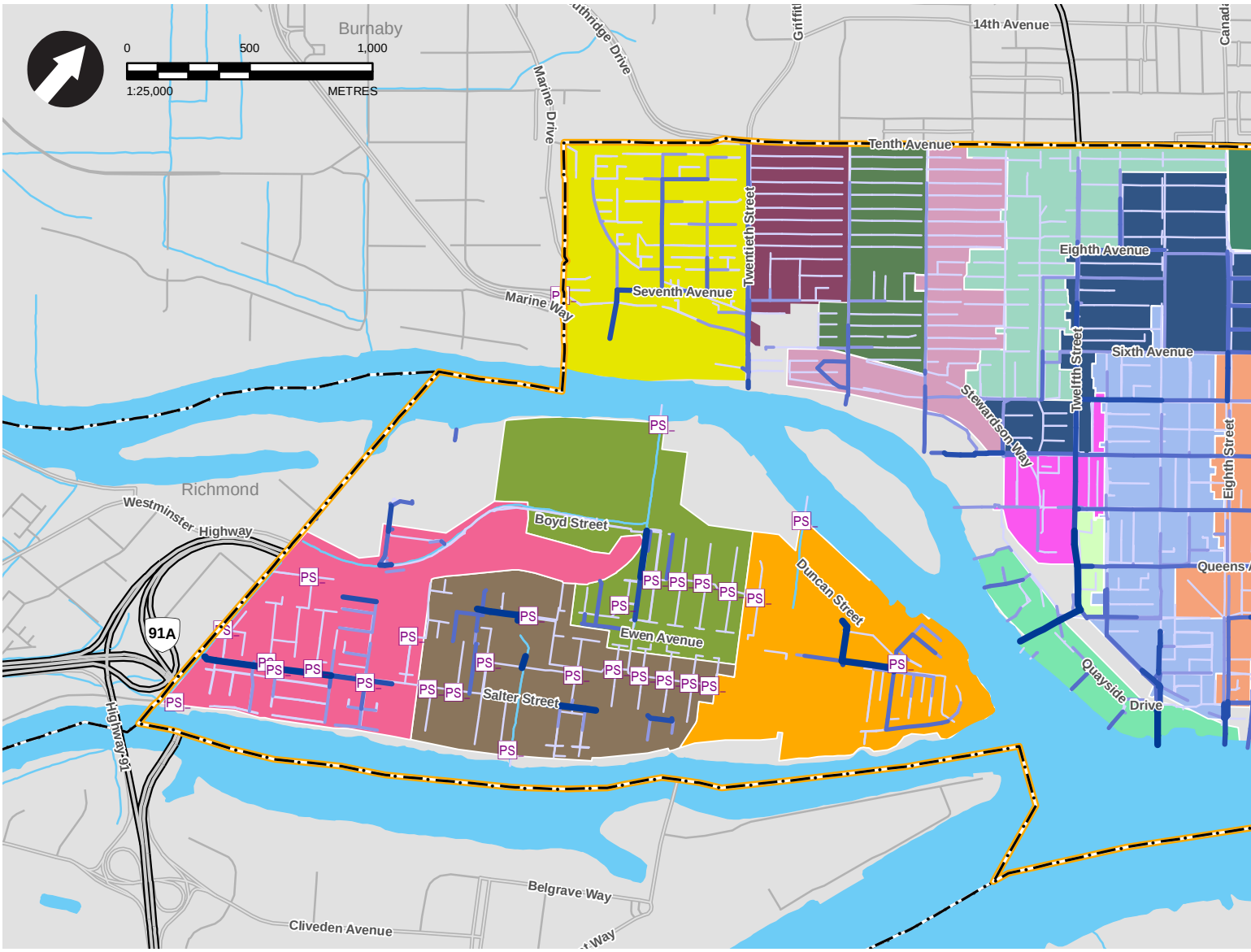
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4. INFILTRATION POTENTIAL CREATED BY GOLDER ASSOCIATES FROM MAP 1484A, SURFICIAL GEOLOGY NEW WESTMINSTER, BRITISH COLUMBIA, GEOLOGICAL SURVEY OF CANADA, 1980.
5. DATUM: NAD 83 PROJECTION: UTM10

Figure I - 7:

Sewer Catchment Areas - Today

New Westminster's piped sewers were developed in the first half of the last century, and at that time it was common to construct combined sewers that received both sanitary (toilet, dish, laundry water) and stormwater (roof, site and pavement drainage). Figure I - 7 shows drainage catchment areas and major sewer pipes, which drain under most weather conditions via Metro Vancouver sewer collectors to wastewater treatment plants and after treatment to the Fraser River and Strait of Georgia.

In extreme storm events, the capacity of existing pipes can be overcome by stormwater, and mixed sanitary and storm water can create combined sewer overflows (CSOs) to some of the existing outfalls shown in Figure I - 7. This brings high diluted, but polluted, water into receiving waters of the Brunette and Fraser Rivers.



LEGEND

BASE DATA

- PRIMARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- MAJOR CONTOUR (10 m)
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

PROJECT DATA

- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA

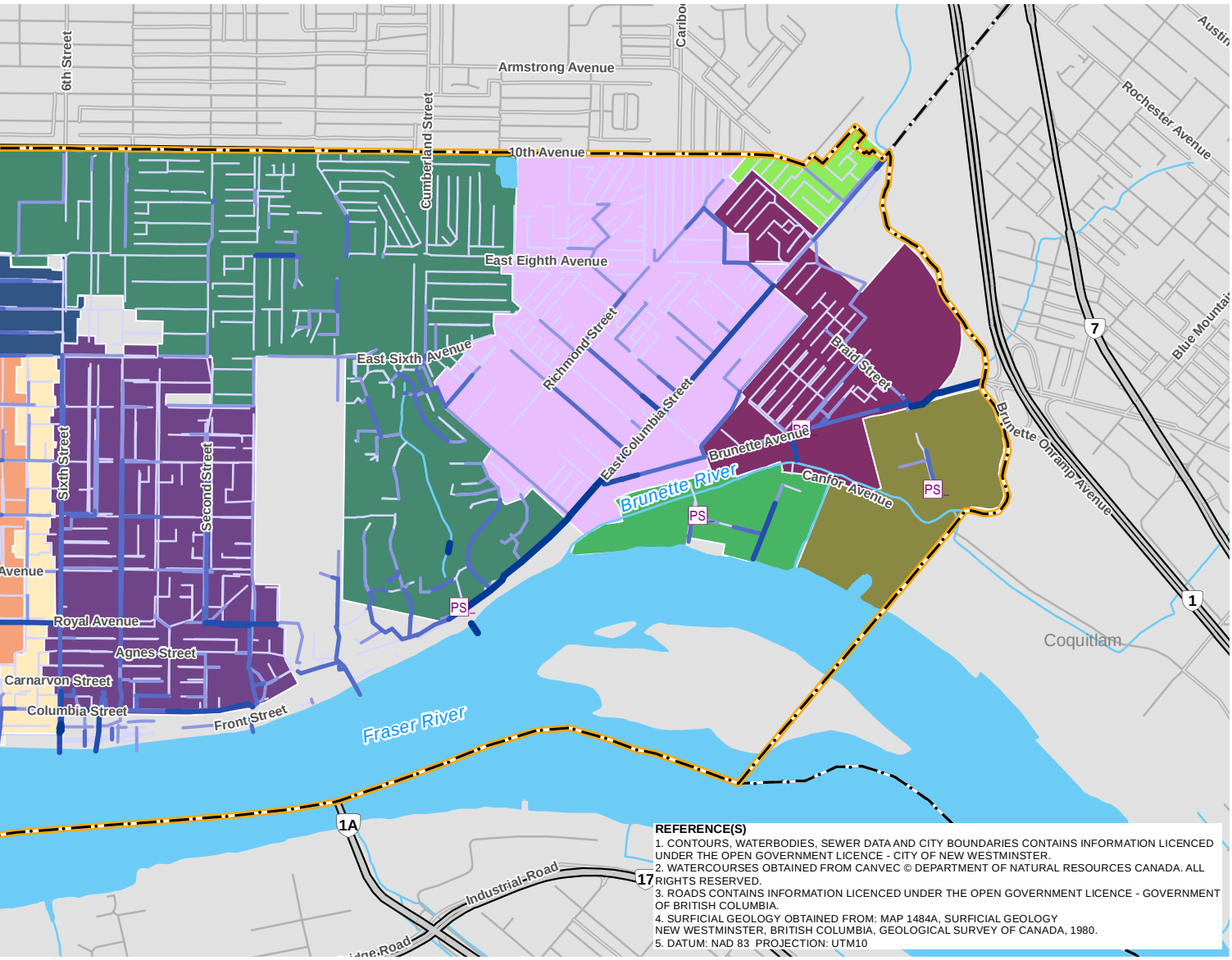
SEWER CATCHMENT AREA

- BEGBIE CATCHMENT AREA
- BRUNETTE INTERCEPTOR CATCHMENT AREA
- EAST COLUMBIA CATCHMENT AREA
- EAST SAPPERTON CATCHMENT AREA
- EIGHTEENTH ST CATCHMENT AREA
- EIGHTH ST CATCHMENT AREA
- FOURTH AVE CATCHMENT AREA
- GLENBROOK CATCHMENT AREA
- HIRD AVE CATCHMENT AREA
- NORTH SAPPERTON CATCHMENT AREA
- QUAYSIDE SEPARATE CATCHMENT AREA
- QUEENSBOUROUGH CATCHMENT AREA 1
- QUEENSBOUROUGH CATCHMENT AREA 2
- QUEENSBOUROUGH CATCHMENT AREA 3
- QUEENSBOUROUGH CATCHMENT AREA 4
- ROYAL AVE CATCHMENT AREA
- SIXTEENTH ST 1 CATCHMENT AREA
- SIXTEENTH ST 2 CATCHMENT AREA
- SIXTH ST CATCHMENT AREA
- TENTH ST CATCHMENT AREA
- TWENTIETH ST CATCHMENT AREA
- WEST OF TWENTIETH CATCHMENT AREA
- WEST SAPPERTON CATCHMENT AREA

SEWER MAINS

DIAMETER (mm)

- 0 - 250
- 251 - 400
- 401 - 600
- 601 - 900
- 901 - 1800
- PS SEWER PUMP STATION



REFERENCE(S)

1. CONTOURS, WATERBODIES, SEWER DATA AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
2. WATERCOURSES OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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4. SURFICIAL GEOLOGY OBTAINED FROM: MAP 1484A, SURFICIAL GEOLOGY NEW WESTMINSTER, BRITISH COLUMBIA, GEOLOGICAL SURVEY OF CANADA, 1980.
5. DATUM: NAD 83 PROJECTION: UTM10

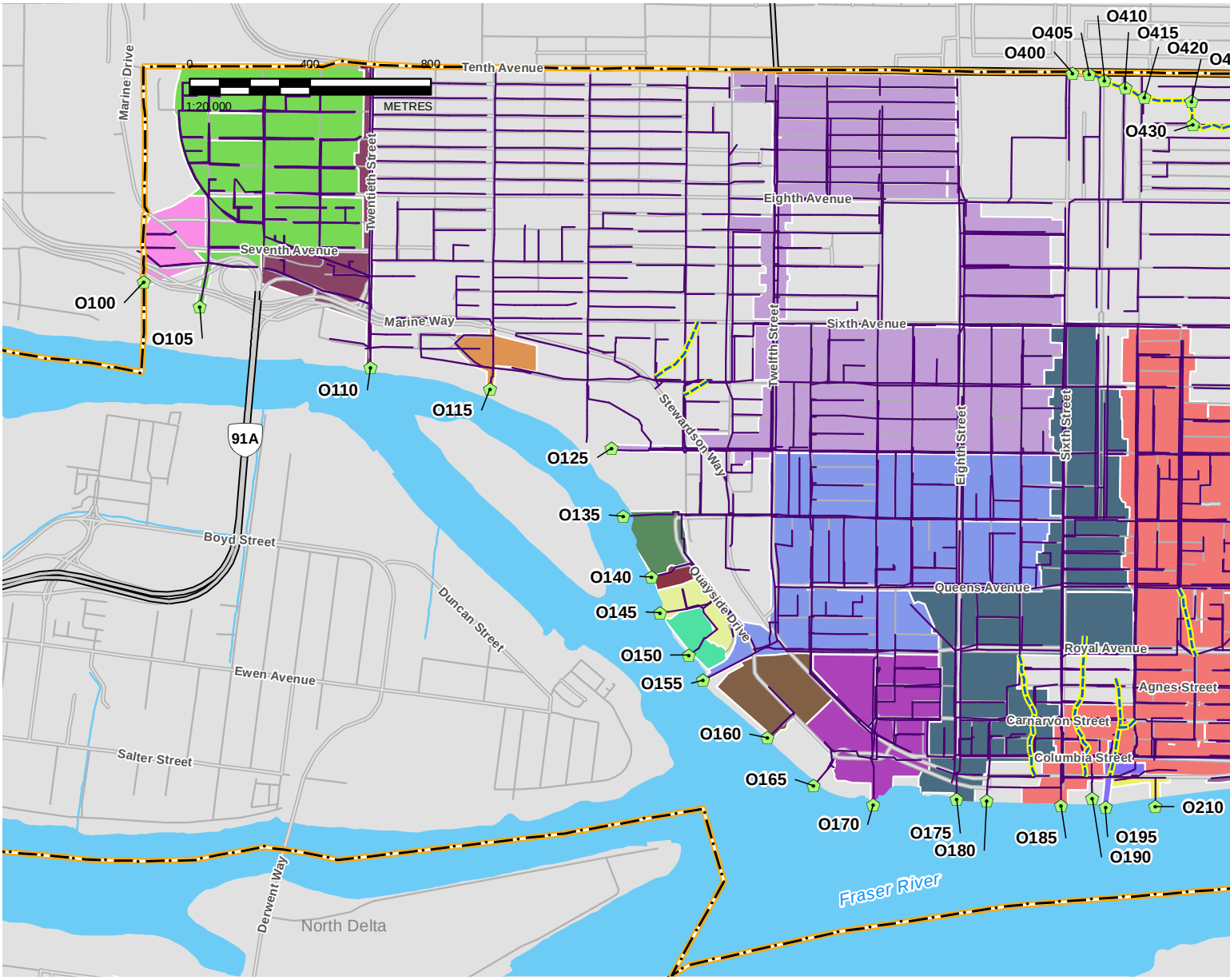
Figure I - 8:

Historic Streams and Future Separated Stormwater Catchments

To eliminate Combined Sewer Overflows (CSOs) and provide more sewer capacity, the City has an established program under the regional Integrated Liquid Waste Management Plan to separate combined sewers into separated systems of sanitary and storm sewers, with on-going implementation. However, until such time as the sewer separation is completed, there will be continuing CSOs. Reductions in stormwater volume in this interim period will reduce the frequency and size of these CSO events.

Once completed, and with changes in the Metro Vancouver major sewer collectors, the new stormwater system will bring runoff from streets and land uses in the City direct to receiving waters of the Brunette and Fraser Rivers. Although the heavy organic pollution from sewage flows has been separated, the remaining stormwater, if untreated, can bring other pollutants such as petroleum hydrocarbons and heavy metals from parking areas to these sensitive receiving waters, with impacts on habitat as well as recreation and waterfront property values.

An aspiration of the ISMP is to have the future separated storm system mimic the environmental function of streams and watersheds that pre-dated development.



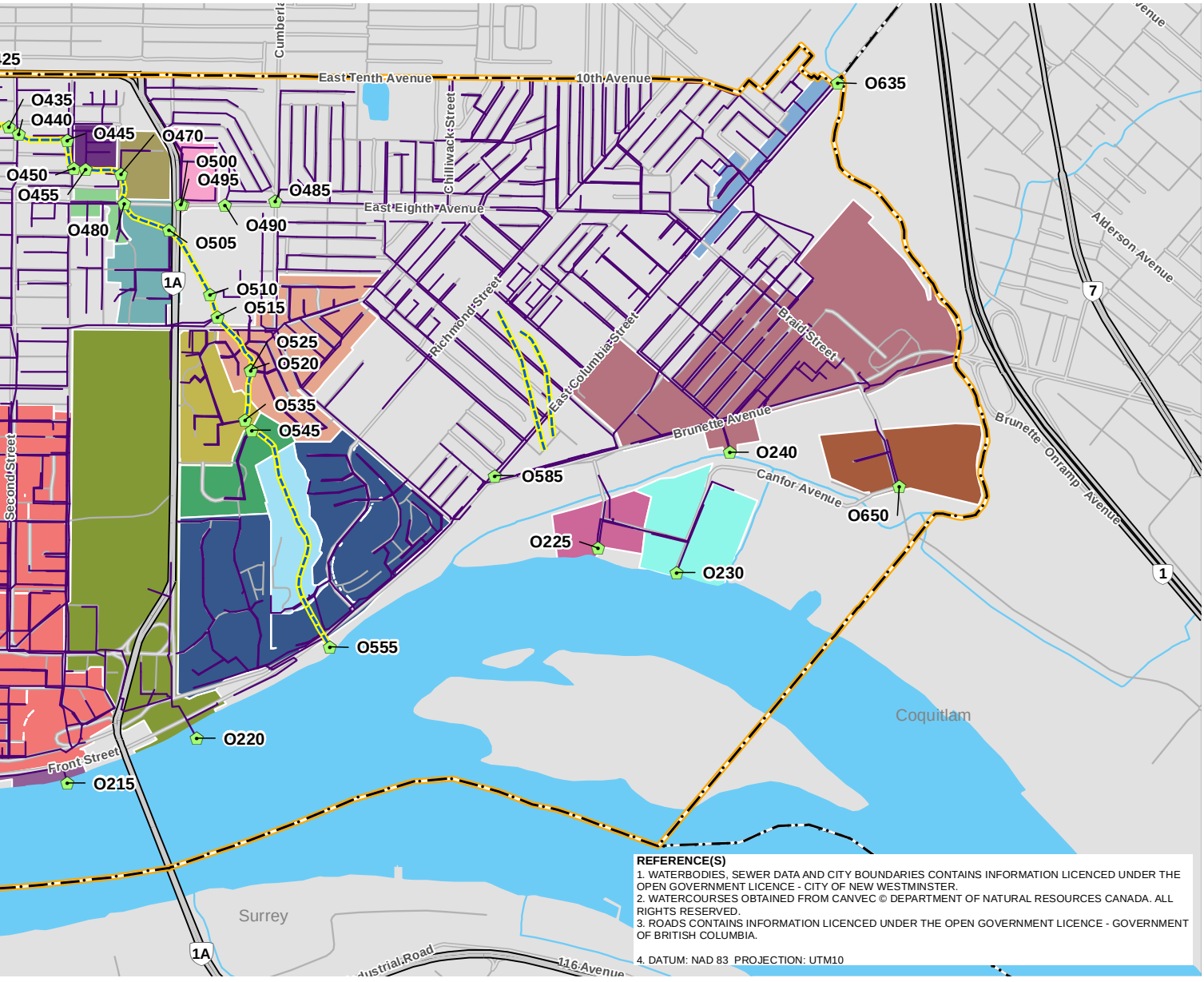
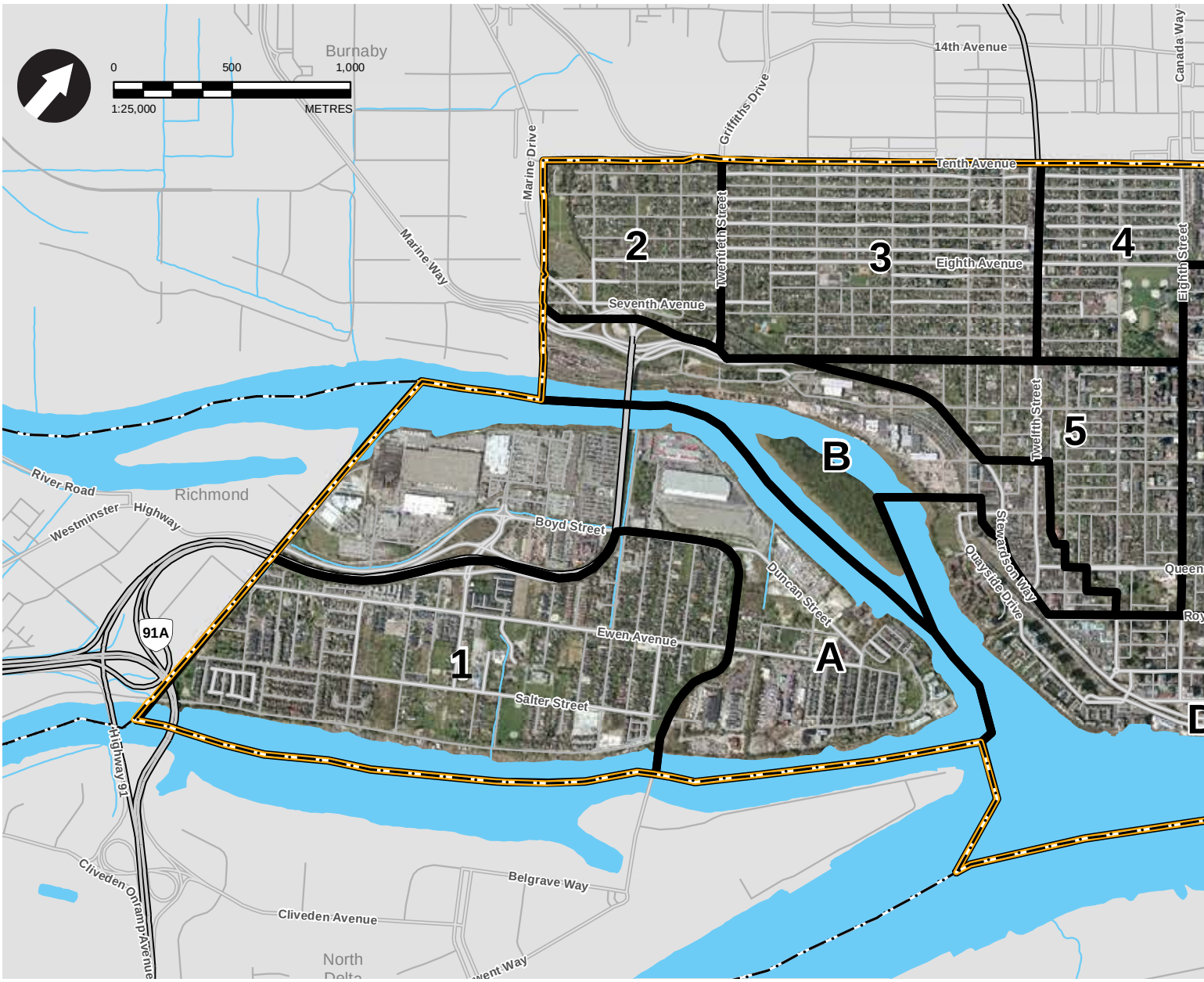

LEGEND
BASE DATA
PRIMARY HIGHWAY
LOCAL ROAD
LOCAL STREET
MAJOR CONTOUR (10 m)
WATERCOURSE
WATERBODY
MUNICIPAL BOUNDARY
PROJECT DATA
CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA
HISTORIC STREAM
FUTURE SEPARATED STORMWATER CATCHMENTS BY PRIMARY OUTFALL
O100 O105 O110 O115 O125 O135 O140 O145 O150 O155 O160
O170 O175 O185 O195 O210 O215 O220 O225 O230 O240 O455
O470 O480 O500 O505 O525 O535 O545 O555 O635 O650 O660
FUTURE SEWER MAINS
CATCHMENT OUTFALL
East Tenth Avenue
10th Avenue
East Eighth Avenue
Chilliwack Street
Richmond Street
East Columbia Street
Braid Street
Brunette Avenue
Canfor Avenue
Brunette Onramp Avenue
Alderson Avenue
Second Street
Front Street
116 Avenue
Coquitlam
Surrey
1A
7
1
REFERENCE(S)
1. WATERBODIES, SEWER DATA AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
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4. DATUM: NAD 83 PROJECTION: UTM10

Figure I - 9:

Neighbourhood Planning Areas

For purposes of long-range planning, New Westminster has been divided into 'Neighbourhood Planning Areas', shown on Figure I - 9.

Names of neighourhoods flow from the long history and culture of the place, and many other names and variations may be in public use. Neighourhood boundaries may not be precise - but the designated neighourhoods on Figure I - 9 are the same as in the OUR CITY 2041 plan, mapped here for convenience when referencing parts of the City.



LEGEND

BASE DATA

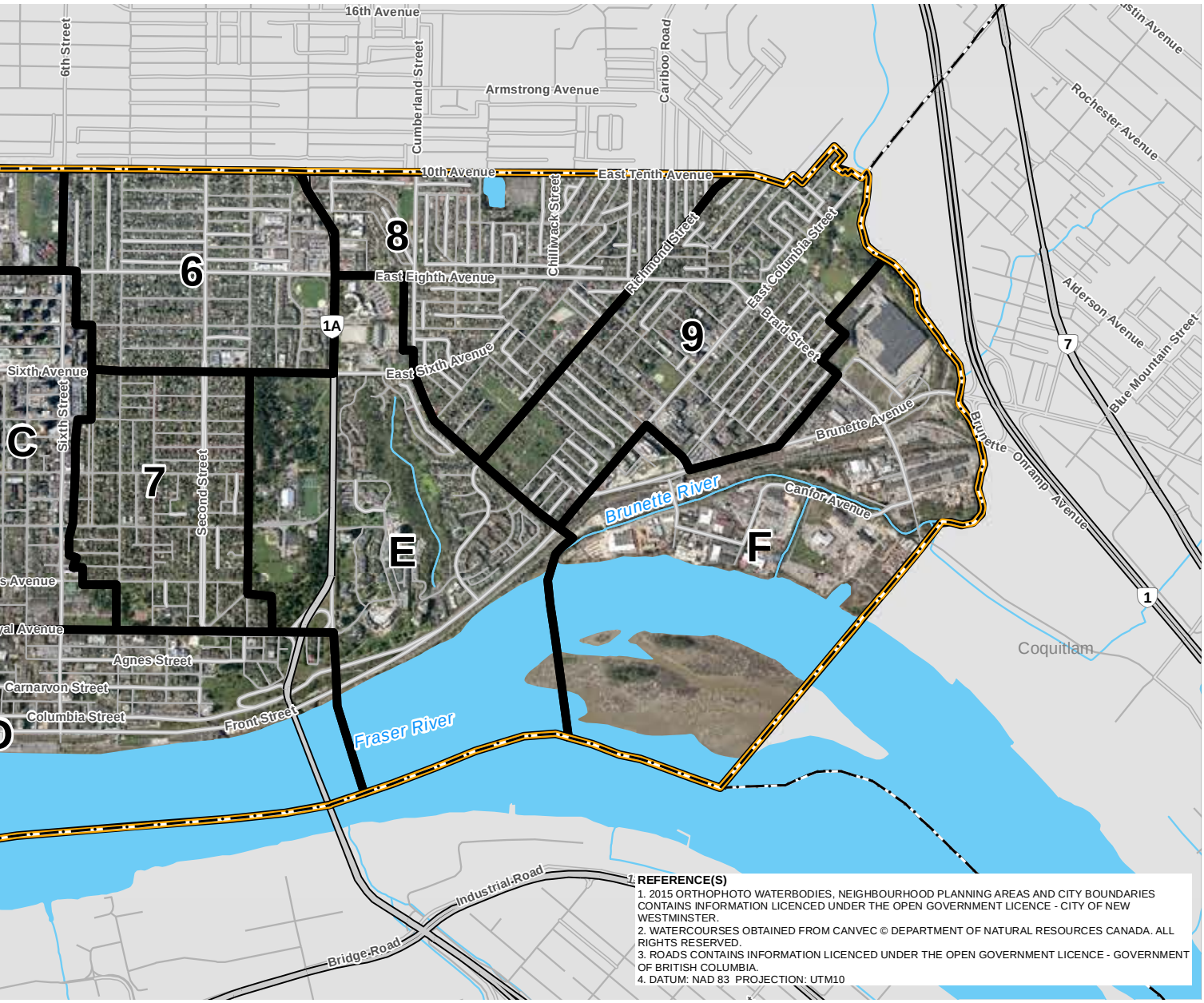
- PRIMARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- MAJOR CONTOUR (10 m)
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

PROJECT DATA

- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA
- NEIGHBOURHOOD PLANNING AREA

1 QUEENSBOROUGH
2 CONNAUGHT HEIGHTS
3 WEST END
4 KELVIN
5 BROW OF THE HILL
6 GLENBROOK NORTH
7 QUEEN'S PARK
8 VICTORY HEIGHTS (INCLUDES MASSEY HEIGHTS)
9 SAPPERTON

A NORTH ARM SOUTH
B NORTH ARM NORTH
C UPTOWN
D DOWNTOWN
E GLENBROOKE SOUTH
F BRUNETTE CREEK



REFERENCE(S)

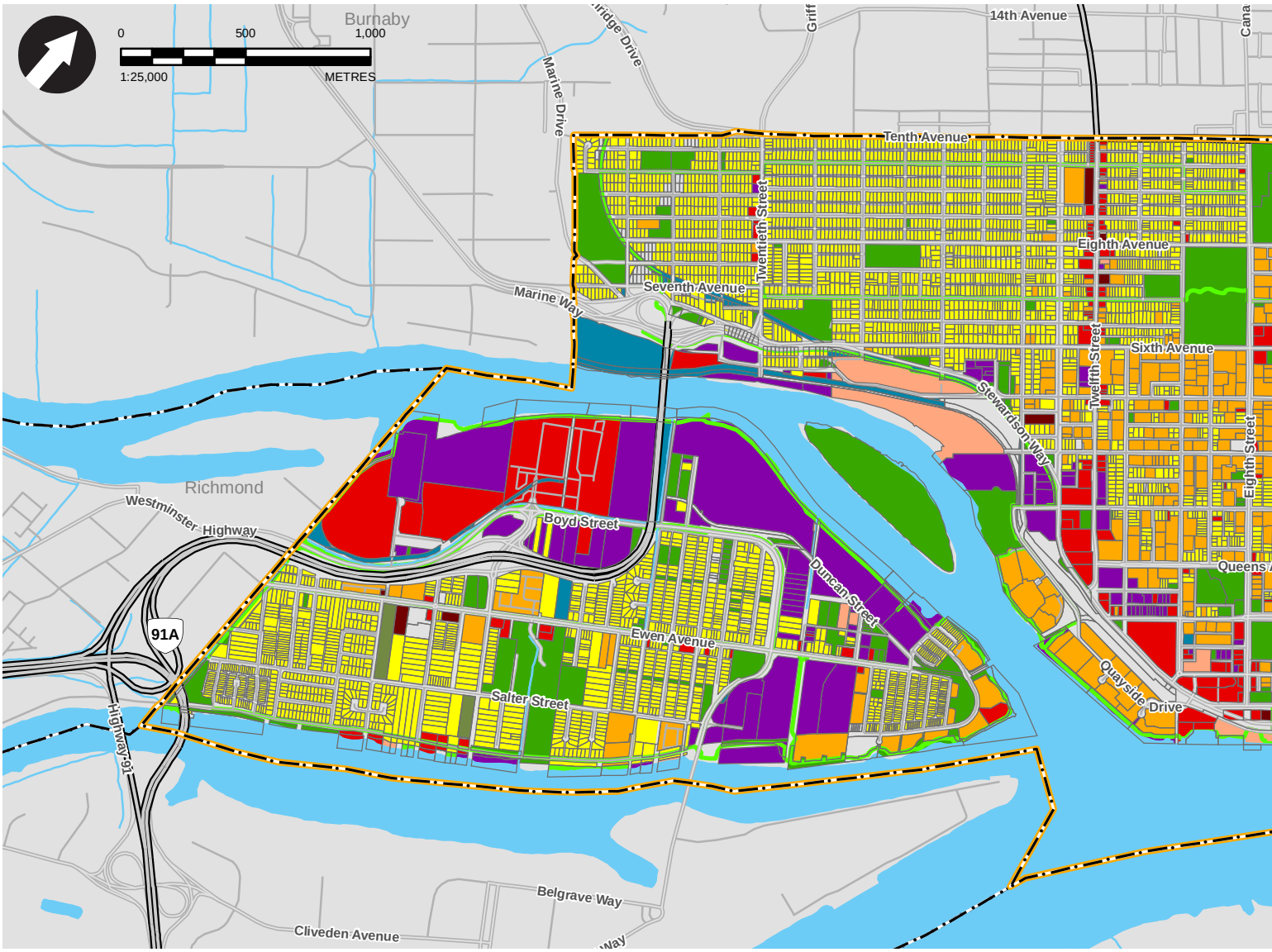
1. 2015 ORTHOPHOTO WATERBODIES, NEIGHBOURHOOD PLANNING AREAS AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
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4. DATUM: NAD 83 PROJECTION: UTM10

Figure I - 10:

Current Land Use

Figure I - 10 summarizes the current land use designations (as of 2016). The amount of absorbent landscape that soaks up rainfall is directly related to land use designations and zoning, as well as the details of development urban design such as impervious area coverage, green roof or underground parking covered with absorbent landscape.

Although there is more potential runoff per hectare from higher density uses - arterial streets, industrial, commercial, and some institutional land uses - the cumulative area of these higher uses is small compared to the area of low density single family uses across the city.



LEGEND

BASE DATA

- PRIMARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- MAJOR CONTOUR (10 m)
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

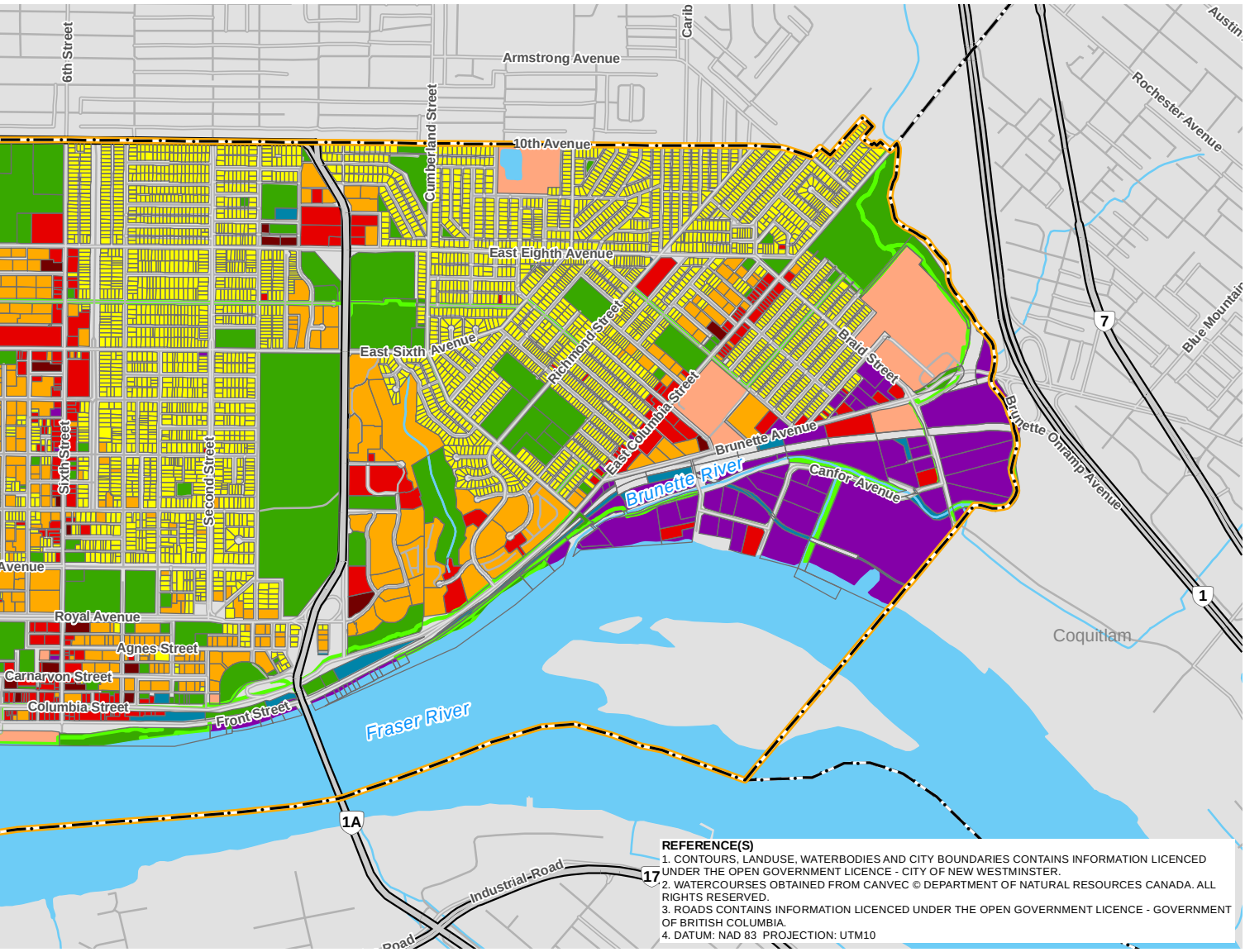
PROJECT DATA

- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA
- PARCEL

LAND USE

- UNKNOWN
- SINGLE FAMILY RESIDENTIAL
- MULTI-FAMILY
- MULTIPLE USE
- MIXED USE (COMMERCIAL/RESIDENTIAL)
- COMMERCIAL
- INDUSTRIAL
- FARM
- CIVIC-RECREATION (PARK)
- NATURAL

- UTILITY
- MAJOR GREENWAY



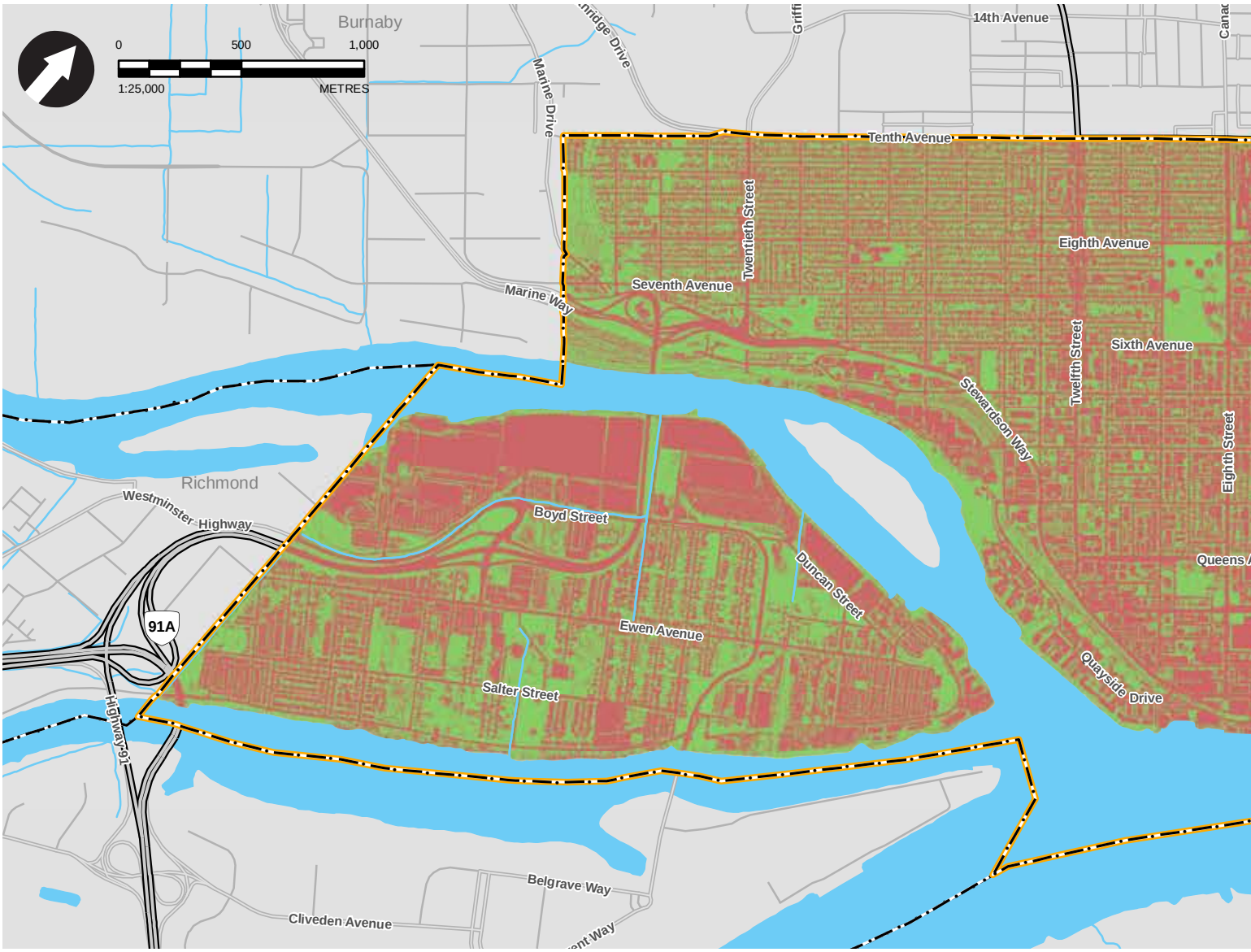
REFERENCE(S)

1. CONTOURS, LANDUSE, WATERBODIES AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
2. WATERCOURSES OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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Figure I - 11:

Impervious Areas

Figure I - 11 illustrates the balance of impervious to pervious surface in the study area, based on interpretation of air photo and satellite imagery.



LEGEND

BASE DATA

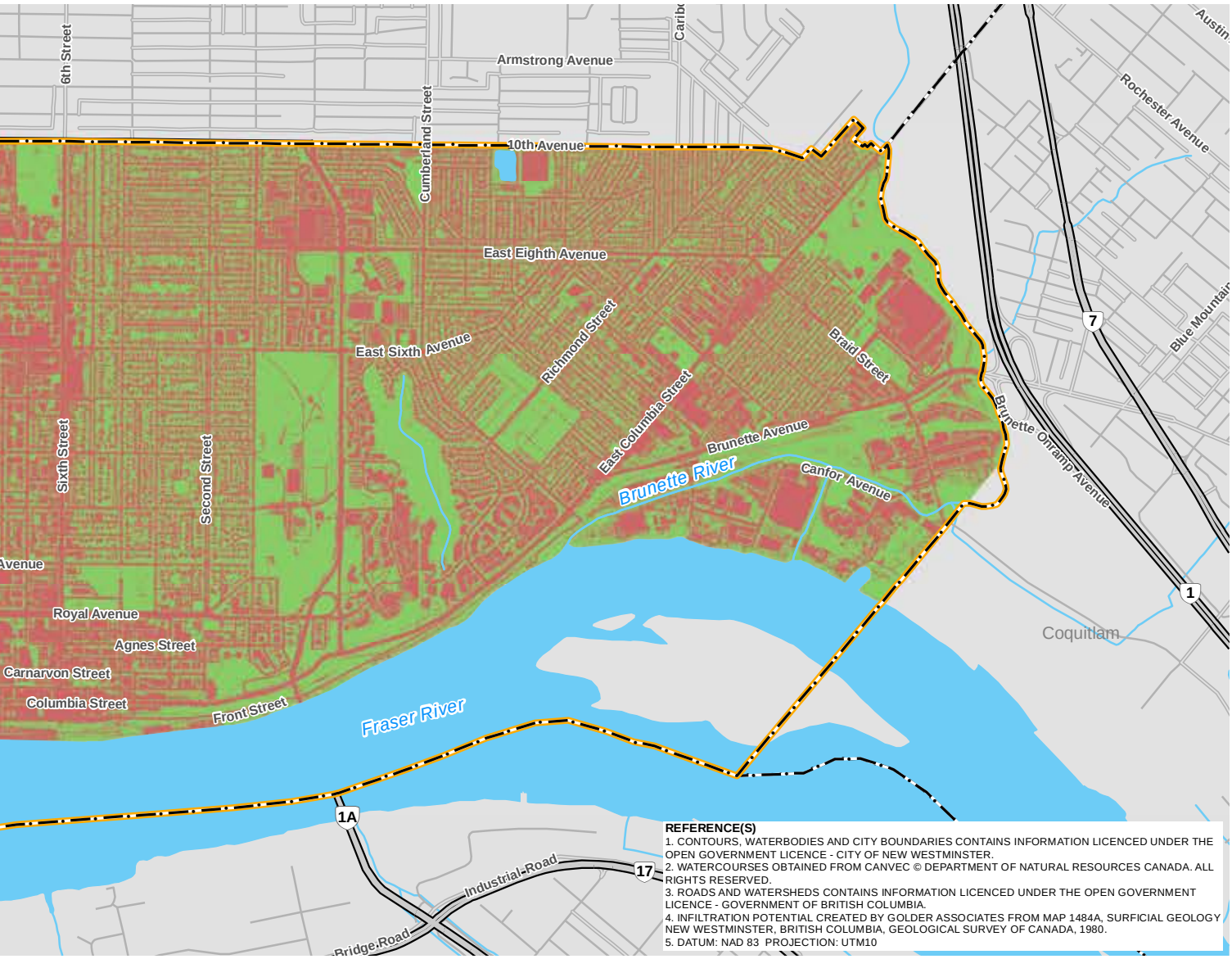
- PRIMARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- MAJOR CONTOUR (10 m)
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

PROJECT DATA

- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA

PERVIOUS AND IMPERVIOUS AREA

- IMPERVIOUS AREA (815.7 ha)
- PERVIOUS AREA (711.8 ha)



REFERENCE(S)

1. CONTOURS, WATERBODIES AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
2. WATERCOURSES OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
3. ROADS AND WATERSHEDS CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF BRITISH COLUMBIA.
4. INFILTRATION POTENTIAL CREATED BY GOLDER ASSOCIATES FROM MAP 1484A, SURFICIAL GEOLOGY NEW WESTMINSTER, BRITISH COLUMBIA, GEOLOGICAL SURVEY OF CANADA, 1980.
5. DATUM: NAD 83 PROJECTION: UTM10

Figure I - 12:

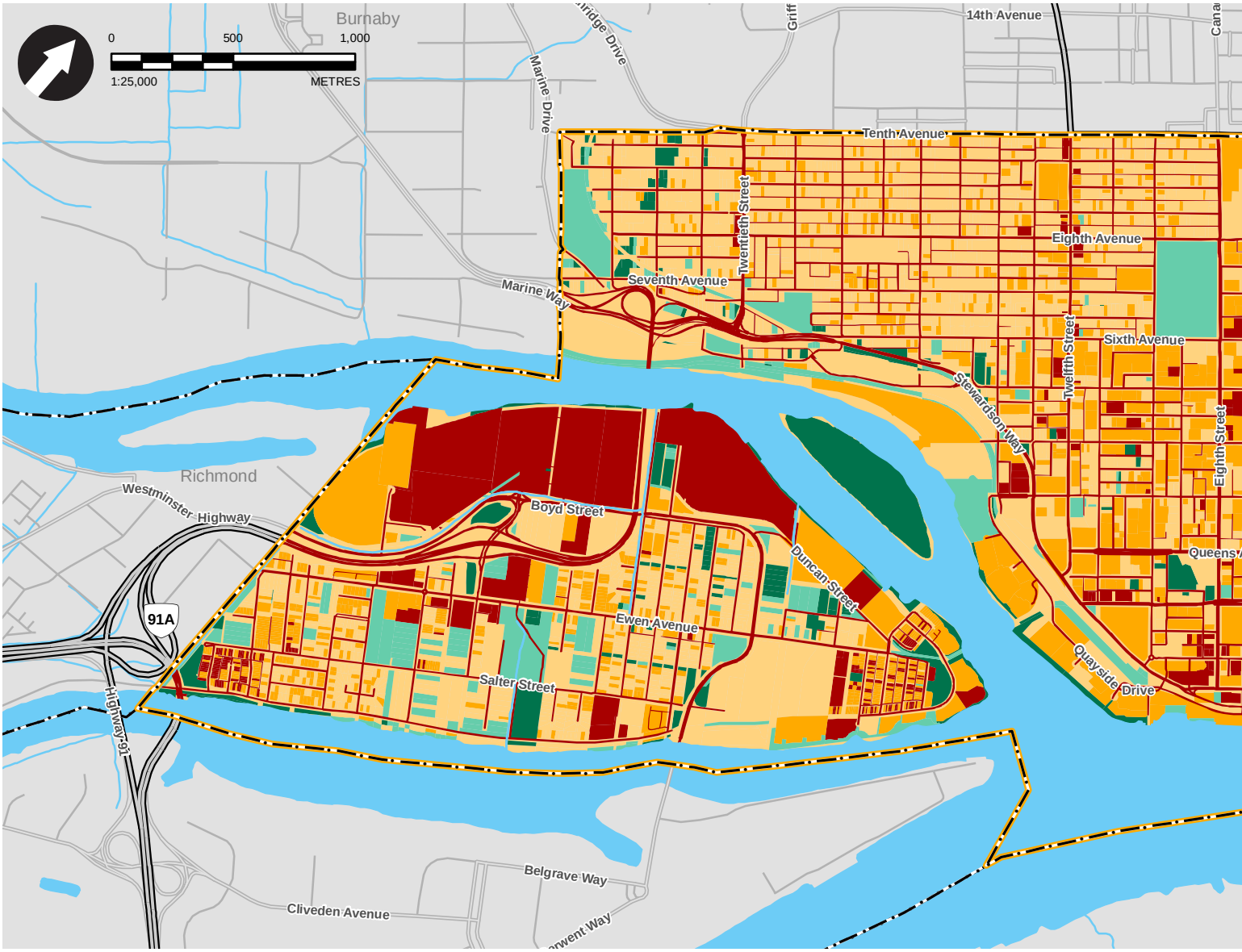
Impervious Area by Parcel

The Impervious Surface Area per parcel is the percent of each lot or street right of way that would create runoff – including roof, patios, driveways, parking areas and street travel lanes.

New high-density residential may reduce surface parking and replace it with underground parking with absorbent landscape above the garage, thereby in some cases reducing effective impervious area.

New single family residential in many cases involves greater building and paving coverage than older homes, resulting in an increase in effective impervious area.

Without use of stormwater best management practices or green infrastructure, the majority of rainfall falling in impervious surfaces creates runoff to the sewer system and from there to receiving waters in the Brunette and Fraser Rivers.



LEGEND

BASE DATA

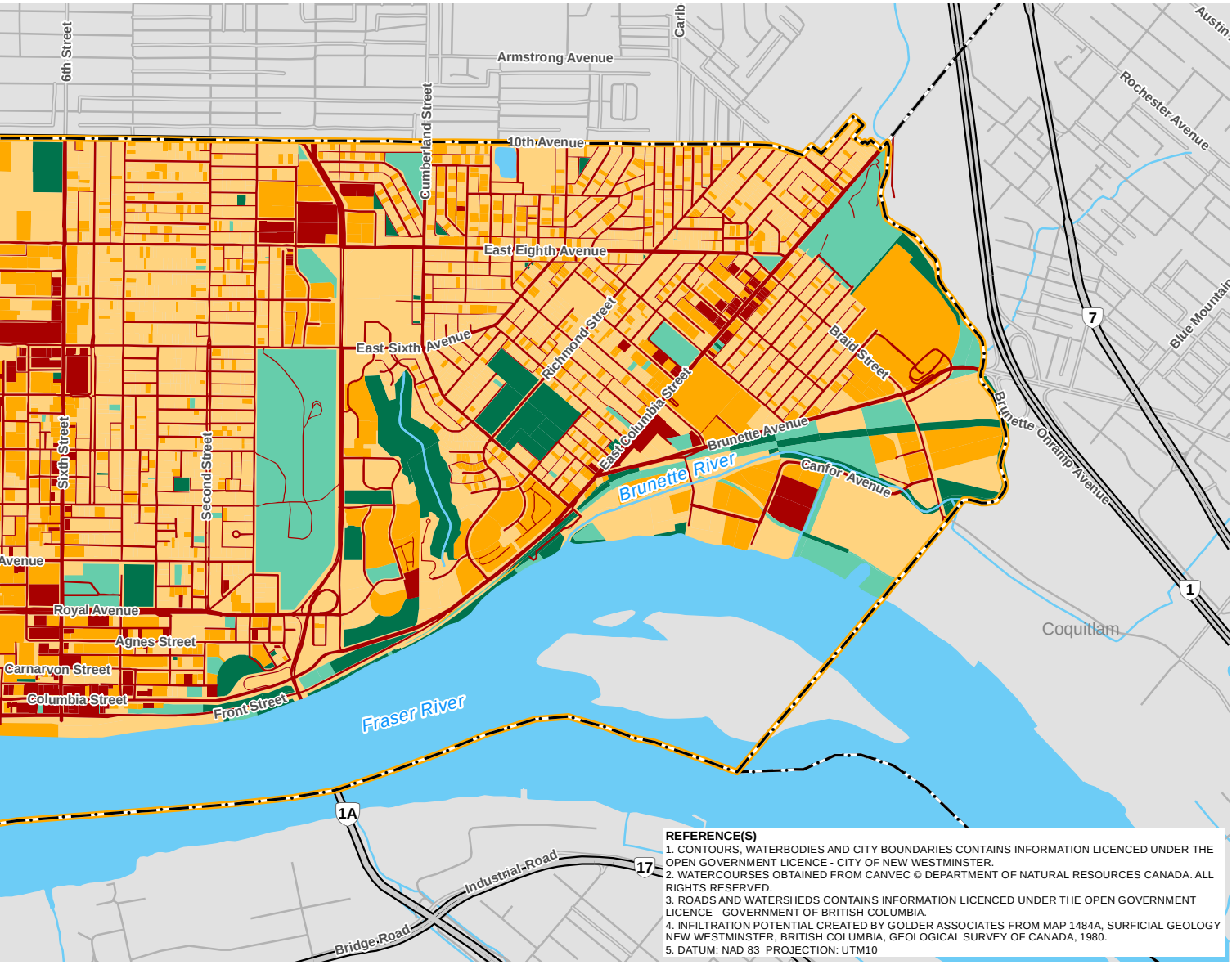
- PRIMARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- MAJOR CONTOUR (10 m)
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

PROJECT DATA

- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA

IMPERVIOUS AREA PER PARCEL (%)

- 0 - 9
- 10 - 24
- 25 - 59
- 60 - 79
- 80 - 100



REFERENCE(S)

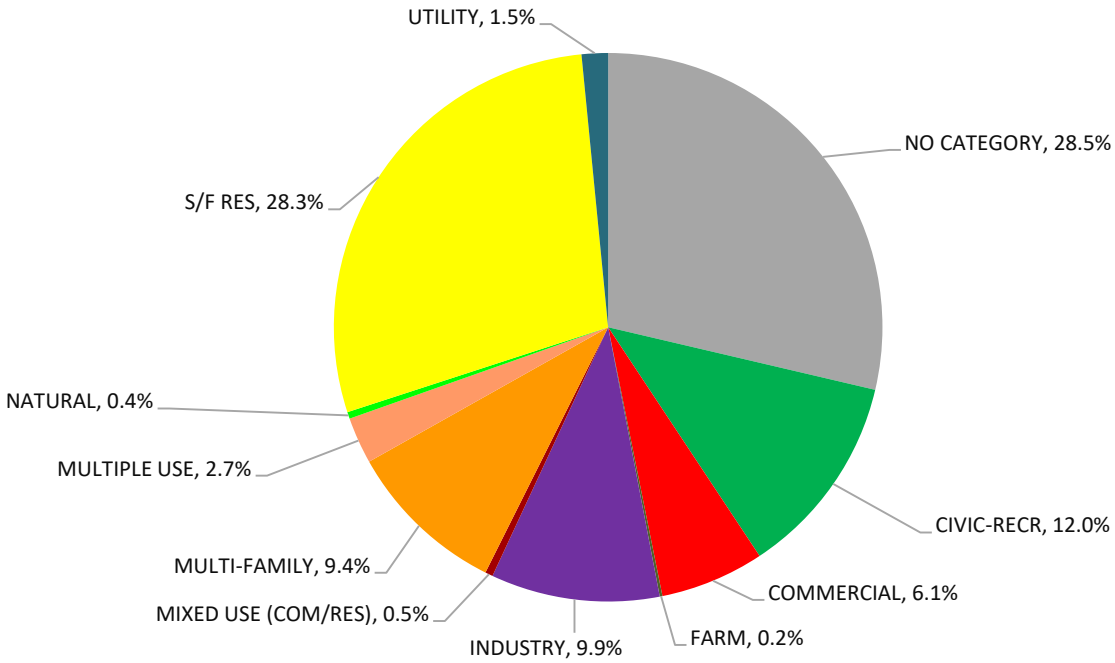
1. CONTOURS, WATERBODIES AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
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5. DATUM: NAD 83 PROJECTION: UTM10

Impervious Areas by Land Use Type

Although higher density areas like City Centre, Uptown and Shopping Centres show the highest percent impervious area per parcel, it is actually lower density areas (one and two family dwellings and local streets) that provide by far the greatest quantity of impervious area in the city. Figure I - 13 illustrates that one/two dwelling residential and local streets and lanes make up more than 50% of the study area. Figure I - 14 shows how this translates into distribution of impervious road, building and site paving across land use typologies. Solutions need to be sought across all land uses in the city.

Figure I - 11 shows graphically the percent of impervious area across the city, as of 2013 (details of comprehensive developments are not shown).

Figure I - 13: Land use percentage of total study area

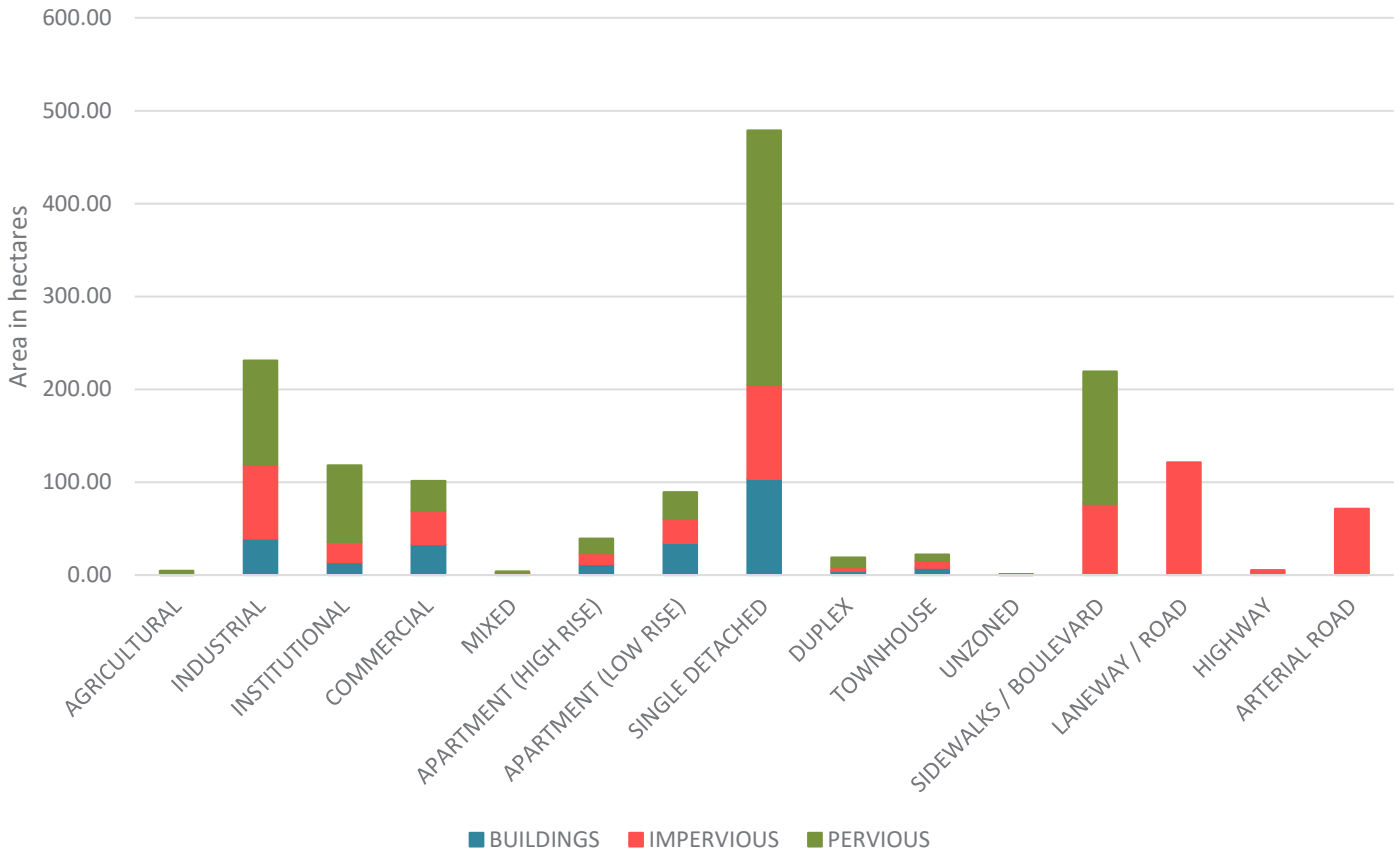


The percent of land use compared to the total Citywide study area is shown in the pie chart (Figure 1 - 13). About 40% of the study area is One/Two Family Dwellings, Local Streets, and Laneways. Arterial streets make up 5%. Industrial areas represent 15%, with some of these converting to other uses through comprehensive development. The remainder, in high density, institutional and commercial uses make up only 24% of the total land area.

The bar graph in Figure 1 - 14 further breaks down each land use type into road and other impervious area, building area, and pervious area. Across the city, it is one/two family residential and streets/lanes that make up a large portion of impervious area.

For that reason it is important to include green infrastructure strategies for these low density areas and streets, in addition to high density sites, to reduce the cumulative impact of polluted stormwater on New Westminster's receiving waters.

Figure I - 14: Areas of Land Use Typologies



3.0 WHAT DO WE NEED TO DO DIFFERENTLY?

Treating Stormwater as a Resource

Stormwater in New Westminster should be treated as a resource, as articulated in the Vision for the Citywide ISMP that has been created through stakeholder engagement.

But, like any resource, there is a need for thoughtful management.

The Greening of Land Use and Streets

A long-term focus of this Integrated Stormwater Management Plan is both to minimize runoff volume and to reduce the risks and consequences of pollutants in stormwater runoff.

The focus on stormwater management starts where the rainfall hits the city—in its urban forest, its soils, its streets and land uses.

Without use of stormwater best management practices, the majority of rainfall landing on impervious surfaces—roof, streets, parking areas and other paved surfaces—creates runoff to the sewer system.

New Westminster's future as a 'Blue Dot Movement' City includes joining leading cities around the world that are mimicking natural ecological systems as the city is gradually reconstructed through building and infrastructure asset life cycles.

Stormwater management is also a part of objectives expressed in the City's Envision 2032, Environment Strategy (ongoing) and OUR CITY 2041 plan.

With better urban design as we redevelop our buildings and streets when they wear out, we can incorporate Green Infrastructure (GI) approaches to protect our stormwater and water resources.

There are also opportunities to store, treat or infiltrate stormwater and runoff in parks, recreation and playing field areas, skateboard bowls, surface parking areas and other civic facilities. Maintaining and increasing the tree canopy of the City also intercepts rainfall and increases evapotranspiration.

To meet objectives, Green Infrastructure will need to be implemented broadly across the City's drainage areas, streets and land uses.

Returning Stormwater to Natural Pathways

Part of New Westminster's policies for the future is recognizing the role of the urban forest and soils in soaking up, cleaning and slowly releasing stormwater. Minor changes can increase the capacity of existing landscape areas to be more absorbent. New rain gardens and infiltration swales can slow down and treat runoff from streets and parking areas. Pervious paving can be used in select locations to reduce impervious area. Capture and local treatment of roof stormwater can provide water for irrigation, toilet and urinal flushing, and other non-potable uses, and reduce the city's reliance on potable water. These tools are introduced on the following page, and explored in Volume II: BMP Toolkit.

The City and private sector have piloted many of these tools – through civic facilities, at new LEED Gold Certification developments, as well as in private residences and lane housing. Review of these pilots is providing insights for improved BMPs.

All of these actions together can help the city avoid water quality problems that have been problematic for many cities around the world. For example, the nutrients in stormwater runoff can cause elevated algae and vegetation growth that, in addition to adversely impacting the receiving environment and aquatic habitat, can result in foul odour due to decay. The results can be aesthetically unappealing – affecting recreation and land values. Further the costs of remediating the excess of nutrients, related excessive plant growth and low oxygen (eutrophication) can be extremely high.

Stormwater management and Green Infrastructure approaches should reduce these risks proactively.

Urban forest (native and planted) as well as urban soils and rain gardens all mimic the evapotranspiration and infiltration that are natural flow pathways for stormwater (New Westminster).

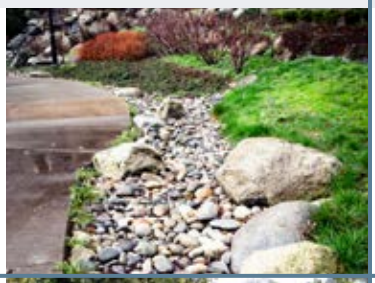
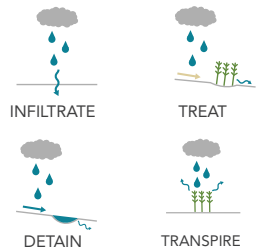


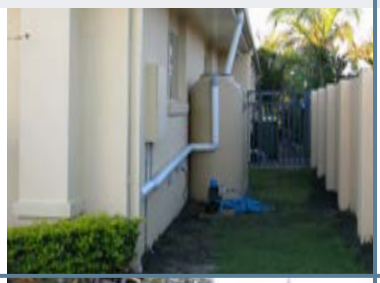
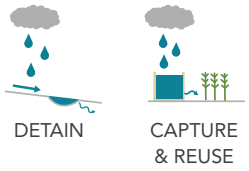


Green Infrastructure Tools for Stormwater Management

The summary matrix below introduces a range of Green Infrastructure practices to improve stormwater management. These tools are in common use in other jurisdictions around Metro Vancouver, the Pacific Northwest, and in developed areas around the world.

For more information on Green Infrastructure, see the BMP Toolkit (ISMP Volume II)

TOOL		IMPACTS ON WATER	BENEFITS
Absorbent Landscapes			• intercept and clean stormwater through soil pores, allowing gradual infiltration into subsoils to recharge groundwater
Infiltration Swales			• reduce runoff volume and increase water quality by capturing, detaining, treating, and conveying stormwater
Rain Gardens & Infiltration Bulges			• reduce runoff volume and improve water quality by infiltrating, capturing, and filtering stormwater • an overflow conveys extreme rainfall volumes
Pervious Paving			• reduce runoff volume and improve water quality by infiltrating and treating stormwater while still providing a hard, drivable surface
Green Roofs			• reduce stormwater volume, depending on depth of growing medium • benefit buildings by providing insulation and by reducing the heat island effect • provide urban habitat
Tree Well Structures			• adequate soil volume will retain excess stormwater and help to remove pollutants from stormwater runoff • support a healthy tree canopy which intercepts rainfall

TOOL		IMPACTS ON WATER	BENEFITS
Rainwater Harvesting			• runoff from roof surfaces can be captured, stored and used for non-potable uses like landscape irrigation, laundry, and toilets, subject to approval of authorities having jurisdiction.
Infiltration Trenches			• reduce the volume and rate of runoff by holding and infiltrating water into subsurface soils • water quality pre-treatment is advisable
Water Quality Structures			• capture petroleum hydrocarbons, coarse grit and coarse sediment • provide some water quality benefits except for soluble nutrients and pollutants
Detention Tanks			• reduce flooding and in-stream erosion by collecting and storing stormwater runoff during a storm event, and releasing it at controlled rates to the downstream drainage system
Daylighted Streams & Channel Improvements			• may provide in-stream detention, water quality improvements, and essential habitat for aquatic life • contribute to the liveability of an area and establish a sense of place if properly designed
Constructed Wetlands			• provide detention, storage, habitat, and treat stormwater runoff through natural processes prior to discharging it into the downstream drainage system

CONSIDERATIONS IN EVALUATING PERFORMANCE

New Westminster's Citywide ISMP is different than many other watershed-based stormwater management plans, in that the New Westminster Citywide study area is entirely serviced with piped stormwater systems. Whereas most ISMPs would aim to protect the water quality and hydrological flow systems of surface streams, the Citywide ISMP is focused on managing piped systems that discharge to tidal or estuarine receiving waters.

In this context, there is a need for the Citywide ISMP to revisit common criteria for evaluating performance of stormwater best management practices (BMPs). Volume II also evaluates the performance of the tools in two sets of criteria: function and cost.

Functional Criteria

- Maximize Water Quality Treatment
- Maximize Volume Control (reduced CSOs)
- Maximize Aesthetic Benefits
- Maximize Biodiversity Benefits
- Maximize Public Education, Culture and Health Values

Cost Criteria

- Minimize Land or Space Cost
- Minimize Material and Construction Cost
- Minimize Maintenance Cost
- Maximize Property Value
- Maximize Longevity

As well as evaluating performance of the tools in isolation, it is also beneficial to know how the tools work together as a system at the City-wide and drainage basin scales (i.e., what is the optimum combination of tools for each land use type?). ISMP Volume III Technical Background Report provides a full analysis of alternative scenarios that combine tools.

4.0 WHAT DO WE WISH TO ACHIEVE?

It is essential to have a clear understanding of 'what are we trying to achieve?' with implementation of best practices. The following section introduces key principles and customized targets for the Citywide study area, to address both water quality and water volume issues in the watersheds.

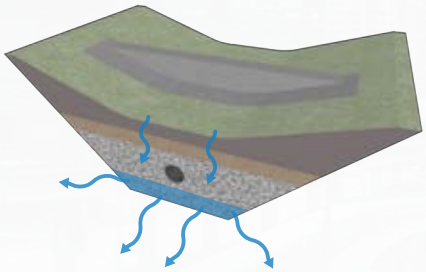
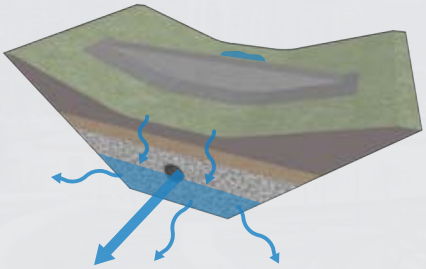
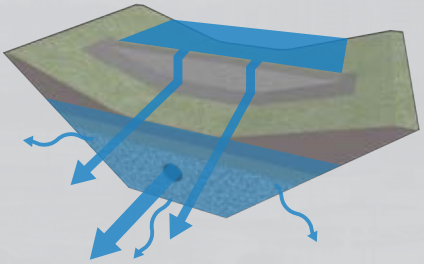
Key Principles for Results

- Reduce Combined Sewer Overflows (CSOs) into New Westminster's tidal and river waters.
- Reduce the demands on capacity for sewage treatment through replacement of combined sewers with separated storm drainage systems and sanitary sewage systems.
- Redirect stormwater into natural pathways, including infiltration to subsoils and aquifers, evaporation, and evapotranspiration through the leaves of plants.
- Allow for reserve capacity in the City's piped drainage system, to be resilient to changes in precipitation patterns related to climate change.
- Protect water quality in rivers and groundwater by using green infrastructure to provide pollution treatment by filtering surface water through soil and organic layers.
- Consider how green infrastructure and installed deep soil/ organic compost layers could also provide healthier landscapes and water conservation benefits.
- Add to the biodiversity, environmental health and urban design diversity of New Westminster by integrating plantings, the urban forest, and constructed wetlands or rain gardens into both private landscapes and city parks, plazas and streets.

Targets: Soak it in! Clean it up! Convey it safely!

The graphic and summary on the following facing pages outline the objectives - expressed as quantitative targets – for the three levels of storm events: normal rainfall, heavy rainfall and large storms. The graphic and summary also explain the fundamentals of how green infrastructure can meet these targets.

Figure 15: Stormwater Management targets
in New Westminster Citywide Area

Normal Rainfall	Heavy Rainfall	Large Storms
+/- 70% of Annual Rainfall Volume	**+/- 20%** of Annual Rainfall Volume	**+/- 10%** of Annual Rainfall Volume
		
Soak it in!	**Clean it up!**	**Convey it safely!**
First **25mm to 50mm** per day	First **50mm** per day	**Remainder**
Capture (infiltrate) or reuse at source	Treat, ideally through surface soils	Provide runoff routes (pipes and/or overflow)

Water Quality Treatment Target

The Stormwater Quality Treatment target is generally the first 50 mm of rainfall a day, equal to 90% of the Average Annual Rainfall. A lower target is allowed for single family, duplex and triplex, to meet the MV Minimum Requirement for Stormwater Management on Single-lot Residential Developments.

Water Volume Reduction Target

The Stormwater Volume Reduction targets set objectives for return of rainfall into natural pathways of infiltration through subsoils to groundwater, evapotranspiration to air, or harvesting and reuse - removing this volume from stormwater pipes. Volume Targets will vary depending land use type and receiving water, generally:

Developments in Brunette River watershed areas: first 50 mm of rainfall per day
Developments in Fraser River watershed areas: first 25 mm of rainfall per day.
Local Streets and Lanes: first 25 mm of rainfall per day.
Queensborough and Collector/Arterial Roads: no target but volume reduction is encouraged incidental to water quality treatment.

SOAK IT IN!

- Soak up the first 25 - 50 mm in a day (24 hrs). Includes the common 'drizzle' up to small storms and occasional heavy rain.
- Objective is to infiltrate these rainfalls near where they land, providing benefits of water quality and reduced runoff.

HOW GREEN INFRASTRUCTURE WORKS

Even New Westminster's slow-draining subsoils will typically absorb 1 - 2 mm an hour, or 24 - 48 mm over 24 hours.

Good quality topsoil and organic compost will absorb and hold about 10-20% of its volume in rainfall – a 450 mm soil layer would hold at least 45mm, where the moisture would either slowly evaporate or soak into the subsoils.

CLEAN IT UP!

- Clean Up the first 50 mm of rainfall in a day (24 hrs).
- Includes common drizzle and occasional heavy rainfall.
- Objective is to treat for water quality in the runoff from these rainfalls near where they land, as well as to maximize the time available for rainfall to soak into the subsoils.

HOW GREEN INFRASTRUCTURE WORKS

A good topsoil/organic compost mix will typically absorb these volumes (rates of 12 mm up to 70 mm /hour infiltration into landscape soils are common) and will take out most storm runoff pollutants, including petroleum hydrocarbons, heavy metals from brake linings, sediment from erosion, excess nutrients and bacteria from fertilizers and pet/bird droppings.

A drain rock water reservoir under the topsoil layer would provide underground storage so that the water is given greater time to soak into the subsoils. A perforated underdrain at the top of the drain rock reservoir would take excess water to the City piped drainage system.

LARGE STORMS: CONVEY IT SAFELY!

- Addresses storm events that are over 50 mm in 24 hours, up to extreme events
- Extreme storms (>1 in 10 year, 1 in 100 year return period) can occur at any time, but on average do not happen once/year.
- Objective is to safely convey to outlets the excess runoff through both pipes and in extreme cases by the 'major drainage' system of surface gutters along street edges, channels and overflows.

HOW GREEN INFRASTRUCTURE WORKS

In these larger and extreme storms, the first 50 mm are still being treated by green infrastructure as described above.

The runoff from rainfall above 50 mm in 24 hours will be carried in pipes, surface routes or channels that minimize the damage to buildings or property.

This type of 'flood conveyance' stormwater management is inherent in all drainage system design, including grey infrastructure systems.

Because these events are rare, water quality is not specifically addressed other than by dilution.

INFORMATION ABOUT NEW WESTMINSTER'S CITYWIDE AREA RAINFALL:

Annual Rainfall amounts in a typical year vary from 1400 mm in Southwest New Westminster to 1600mm in Northeast New Westminster. For targets, the larger rainfall amount is used.

For area of New Westminster with 1600mm of rainfall in an average year:

6 month return period storm in 24 hour period = 50 mm rainfall (water quality storm)

2 year return period storm in 24 hour period = 70 mm rainfall (mean annual rainfall)

Support for These Targets

Targets introduced above follow the intent of guidelines from the federal Department of Fisheries and Oceans, and are adapted from Metro Vancouver Stormwater Source Control guidelines and the MV Integrated Liquid Waste and Resource Management Plan. They are similar to targets used elsewhere in the region.

The technical wording for targets are listed below, and described in more detail in Volume III: Technical Background. There will be variations on these targets based on land use type, and for Special Areas of New Westminster as identified on Page I-41.

Water Quality Targets:

For Single Family, Duplex, Triplex private lands: Meet the Metro Vancouver Minimum Requirements for Stormwater Management on Single-lot Residential Developments, which should treat about 28 mm / 24 hour of rainfall. Ground level paved surfaces (including driveways, patios, and walkways) should:

1. Drain to vegetation with deep (450 mm) soils, or
2. Use pervious paving, or
3. Collect and drain runoff through a sump prior to discharge to the storm sewer.

These practice standards should be applied to ground level paved surfaces preferentially in the order presented above.

For all other land uses and streets: Collect and treat the volume of the 24-hour precipitation event equaling 90% of the total rainfall from impervious areas with suitable BMPs. Rate-of-discharge will not be greater than required to provide suitable hydraulic retention time as to maximize the effectiveness of the specific BMP.

Water Volume Reduction Target:

Volume Targets will vary depending land use type and receiving water, generally:

- Developments in Brunette River watershed areas: first 50 mm of rainfall per day
- Developments in Fraser River watershed areas: first 25 mm of rainfall per day.
- Local Streets and Lanes: first 25 mm of rainfall per day.
- Queensborough and Collector/Arterial Roads: no target but volume reduction is encouraged incidental to water quality treatment.
- Also may vary due to objectives for Special Areas - see following pages.

Roof Drainage in Low Density Residential Land Use Areas:

Whereas existing roof drainage in low density residential land uses is required to be piped to the city sewer system, changes to regulations are encouraged to allow either harvest and reuse of this roof drainage, or 'disconnected roof leaders' which direct the roof drainage to on-site absorbent landscape areas. Disconnection of roof drainage should be subject to an approval process, and only in neighbourhoods with foundation drains at buildings. In cases where roof drainage is directed to the ground surface, the water quality target would apply to the roof drainage. This could be met by deep absorbent soils and/or properly sized rain gardens for infiltration of the small and large storm events from the roof and site, with provision for safe conveyance of extreme storm overflow from private property to the public major drainage flow path.

Detention or Rate Control Target:

For developments defined as 'large scale developments' in future bylaw updates, use detention and/or other best practices to reduce post-development rate and volume:

- For the New West Mainland, use detention or other Best Management Practice to reduce the 10 year post-development peak flow to the 2 year pre-development peak flow.
- For Queensborough, use detention or other Best Management Practice to reduce the 25 year post-development peak flow to the 25 year pre-development peak flow.
- Special Areas - see following pages - may have custom detention targets to be determined by future studies.

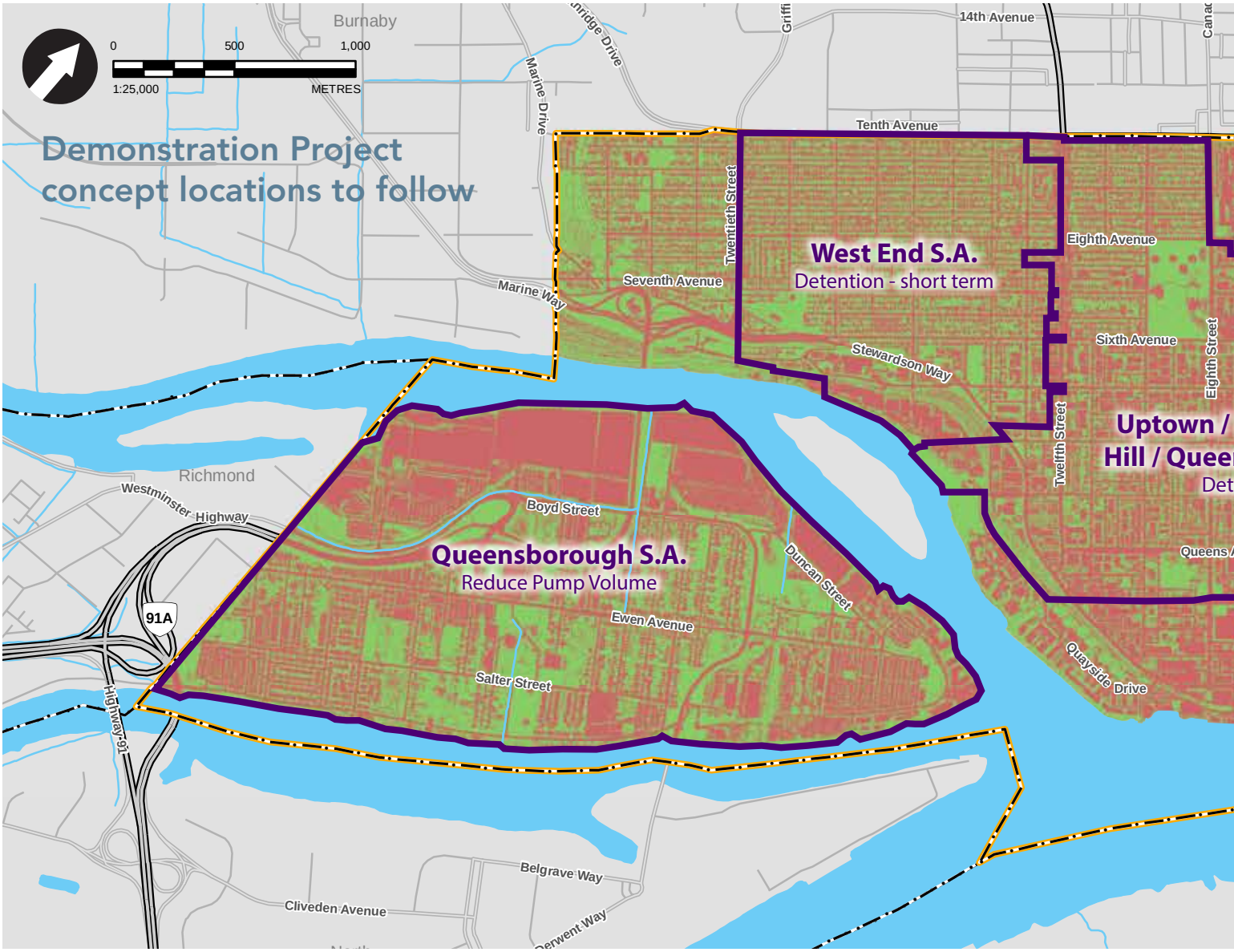
Monitoring and Adaptive Management:

Like all initiatives, the principle of 'what gets measured - gets done' applies within the Citywide study area. The implementation action plan includes a monitoring and adaptive management strategy, which should complete periodic review of meeting these targets, and allows for adjustment of strategies to ensure the targets are met in a practical and feasible manner.

Figure I - 16:

Special Areas Map

Across the Citywide study area, there are differences in capacity of existing stormwater pipe systems, in the destination of stormwater runoff to receiving waters, in dominant land use, and in the average age of sewer infrastructure. These differences are summarized in the Special Areas shown on Figure I-16.



LEGEND

BASE DATA

- PRIMARY HIGHWAY
- LOCAL ROAD
- LOCAL STREET
- MAJOR CONTOUR (10 m)
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

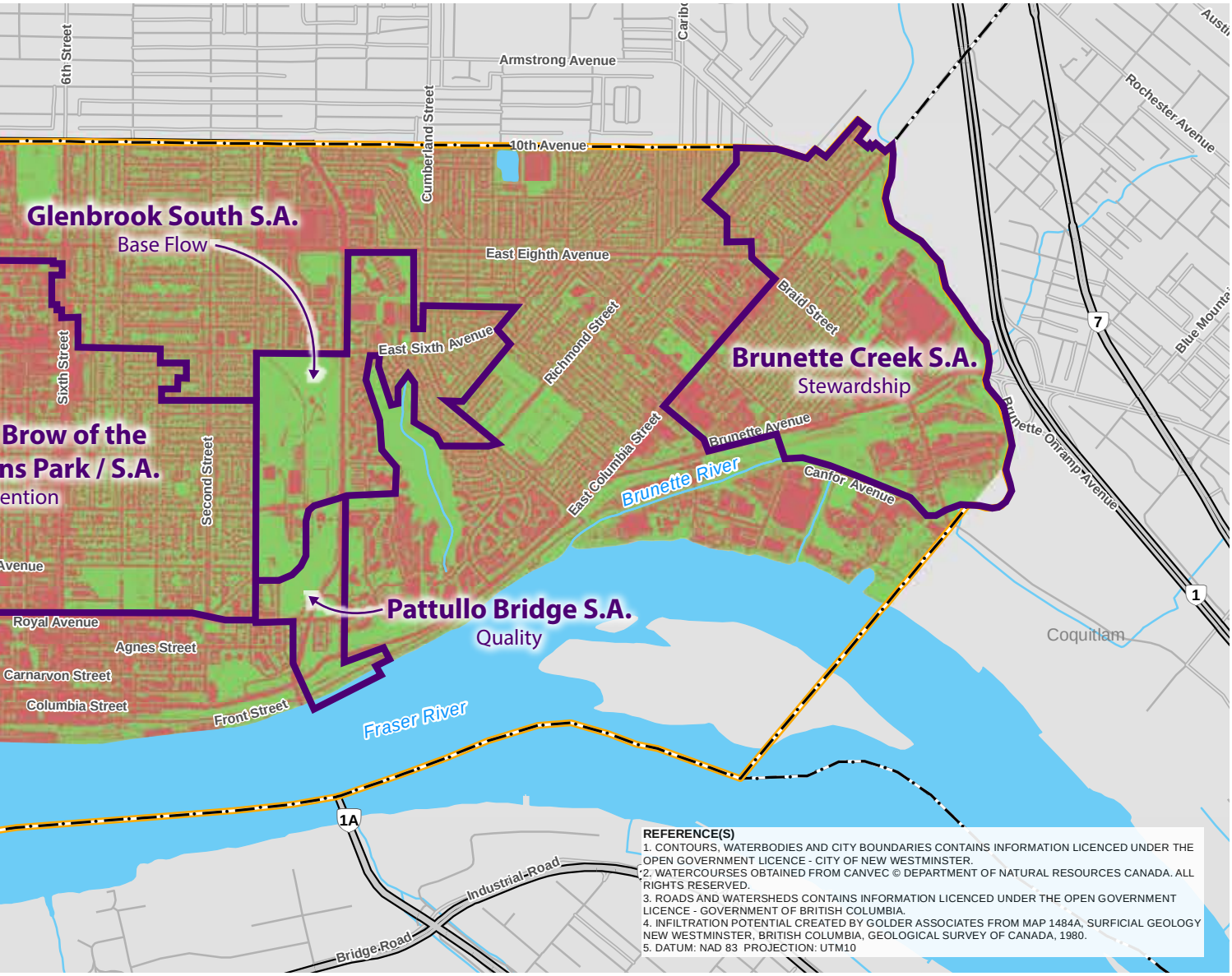
PROJECT DATA

- CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA

PERVIOUS AND IMPERVIOUS AREA

- IMPERVIOUS AREA (815.7 ha)
- PERVIOUS AREA (711.8 ha)
- SPECIAL AREAS

DEMONSTRATION PROJECT

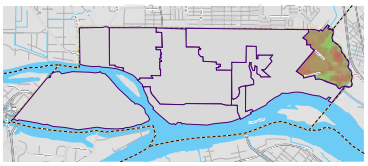


REFERENCE(S)

1. CONTOURS, WATERBODIES AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
2. WATERCOURSES OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
3. ROADS AND WATERSHEDS CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF BRITISH COLUMBIA.
4. INFILTRATION POTENTIAL CREATED BY GOLDER ASSOCIATES FROM MAP 1484A, SURFICIAL GEOLOGY NEW WESTMINSTER, BRITISH COLUMBIA, GEOLOGICAL SURVEY OF CANADA, 1980.
5. DATUM: NAD 83 PROJECTION: UTM10

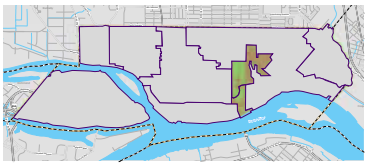
Special Areas

The ISMP targets may be applied in a nuanced way in Special Areas, or refined by catchment computer modeling, to meet the general objectives below. Individual projects may also use sophisticated engineering to respond to the targets in recognition of servicing issues, development plans and coordination with other infrastructure.



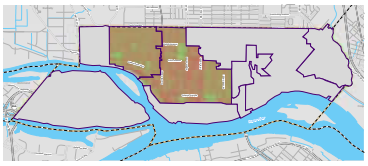
Brunette Creek Special Area

- Provide stream stewardship – apply higher targets for water quality and volume capture consistent with overall Brunette watershed partners. Refocus on riparian/instream habitat improvements.



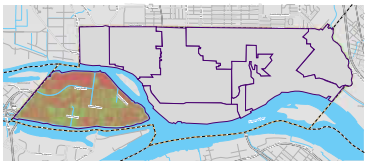
Glenbrook South / Patullo Bridge Special Areas

- Supply extended stream base flow to Glenbrook Ravine – from Queens Park constructed wetlands, Canada Games water harvesting and adjacent land uses.
- Encourage recognition of historic Glenbrook outfall habitat at Fraser River shoreline.



Uptown / Brow of the Hill / Queens Park / West End Special Area

- As well as Citywide objectives, reduce peak flows to restricted pipe sizes - to reduce flooding risk.
- To include detention requirements as a complement to water quality and volume reduction best practices.



Queensborough Special Area

- No Volume Reduction target, however encourage infiltration BMPs in areas where adjacent and adjoining grounds have been raised to the FCL (Flood Construction Level).
- Provide water quality treatment for vehicle-accessible impervious areas. Remove 80% by mass of the inflow TSS based on a typical year to maintain the ecological health of receiving water bodies.
- Water Quality Targets to recognize the "Unique Natural Conditions" in Queensborough as per Metro Vancouver Monitoring and Adaptive Management Framework for Stormwater Section 2.2.4.
- Use detention or other Best Management Practice to reduce the 25 year post-development peak flow to the 25 year pre-development peak flow.
- Refocus on riparian/instream habitat improvements of existing red and yellow coded waterways as per Figure I - 17.

Figure I - 17: Watercourse Classification in Queensborough, August 2012.

Type of work	Class A Rearing habitat that is accessible (or potentially accessible) to fish	Class B Inaccessible fish habitat (i.e. food and nutrient source only)	*Class B2 (property not City owned) Inaccessible fish habitat (i.e. food and nutrient source only)	Class C Not fish habitat
Large scale development next to ditch system (e.g. subdivision development, rezoning, development permit)	RAR requirements apply (QEP Assessment) Setbacks are determined in accordance with RAR DFO to be contacted; unavoidable impacts are to be offset by enhancement on a Class A or Class B watercourse	RAR requirements apply (QEP Assessment) Setbacks are determined in accordance with RAR DFO to be contacted; unavoidable impacts are to be offset by enhancement on a Class A or Class B watercourse	RAR requirements and QEP Assessment apply but not to the City You are advised to contact owner of property	RAR requirements do not apply (QEP assessment not required)
Small scale new works within ditch system (e.g. culvert installation, access crossings, utilities servicing)	City to notify DFO prior to starting work	City to notify DFO prior to starting work	Not applicable	No contact required
Large scale periodic ditch maintenance (e.g. dredging)	City to notify DFO prior to starting work; Work within dry weather only - June through September 30	City to notify DFO prior to starting work; Work within dry weather only - June through September 30	Not applicable	No contact required
Routine ditch maintenance and emergency works (e.g. mowing, trash or blockage removals)	Notification not required	Notification not required	Not applicable	No contact required

* The City of New Westminster has no jurisdiction over watercourses located on highway or railway properties. In these cases, permitting for impacts to such watercourses is the responsibility of the land owner .



The Watercourse Classification data shown on this map shall be used only as a guideline in determining the classification of stream habitat. Further environmental assessment may be required to verify the accuracy of the classification. The location of streams shown, and the presence of streams that may not be shown should be confirmed.
The data is compiled from various sources and is not warranted as to its accuracy or sufficiency by the City of New Westminster. This information is provided for information and convenience purposes only.

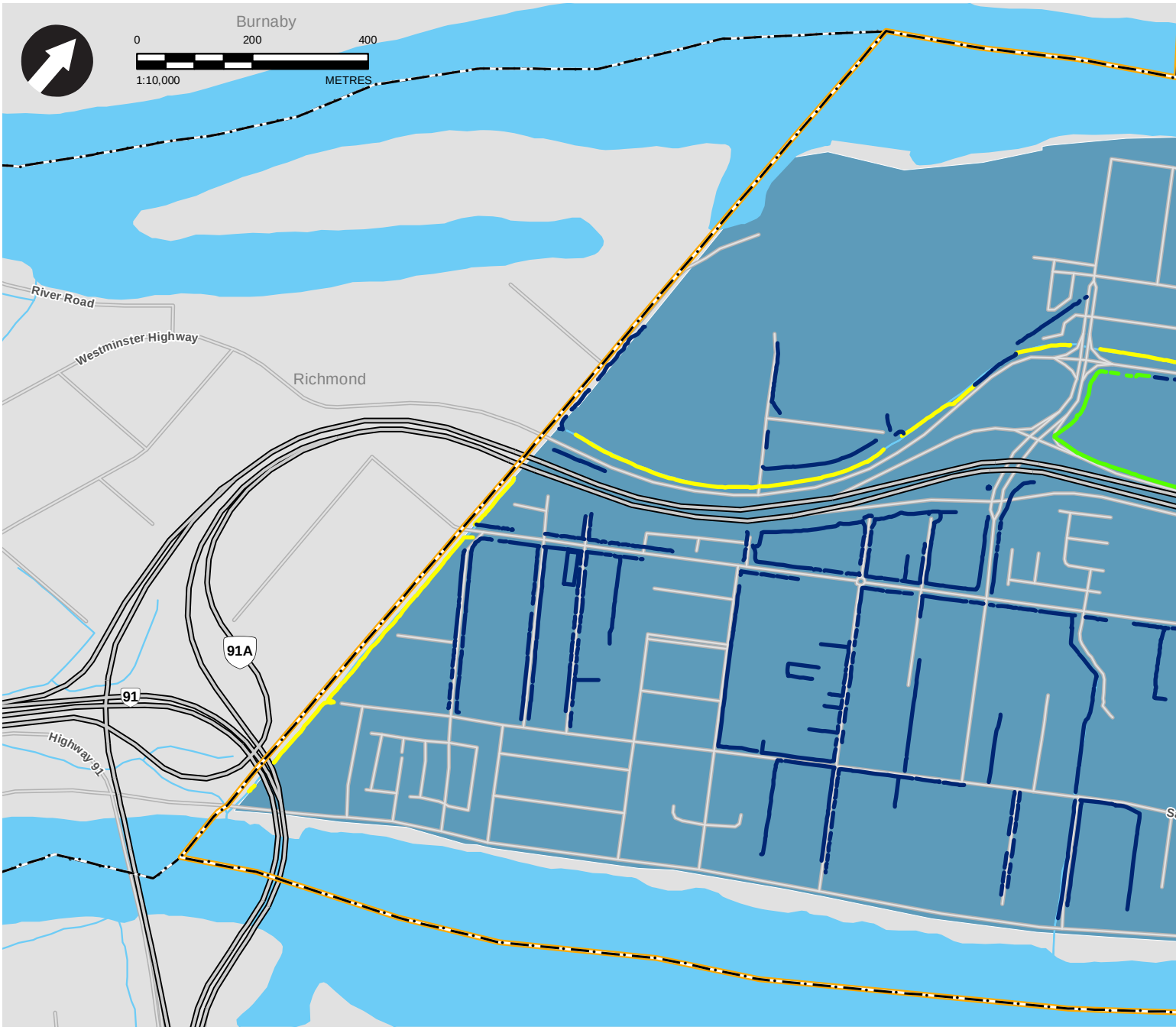
Volume III Technical Background Report recognizes that larger or custom developments may undertake custom engineering and sizing of green infrastructure to reflect local rainfall and infiltration conditions.

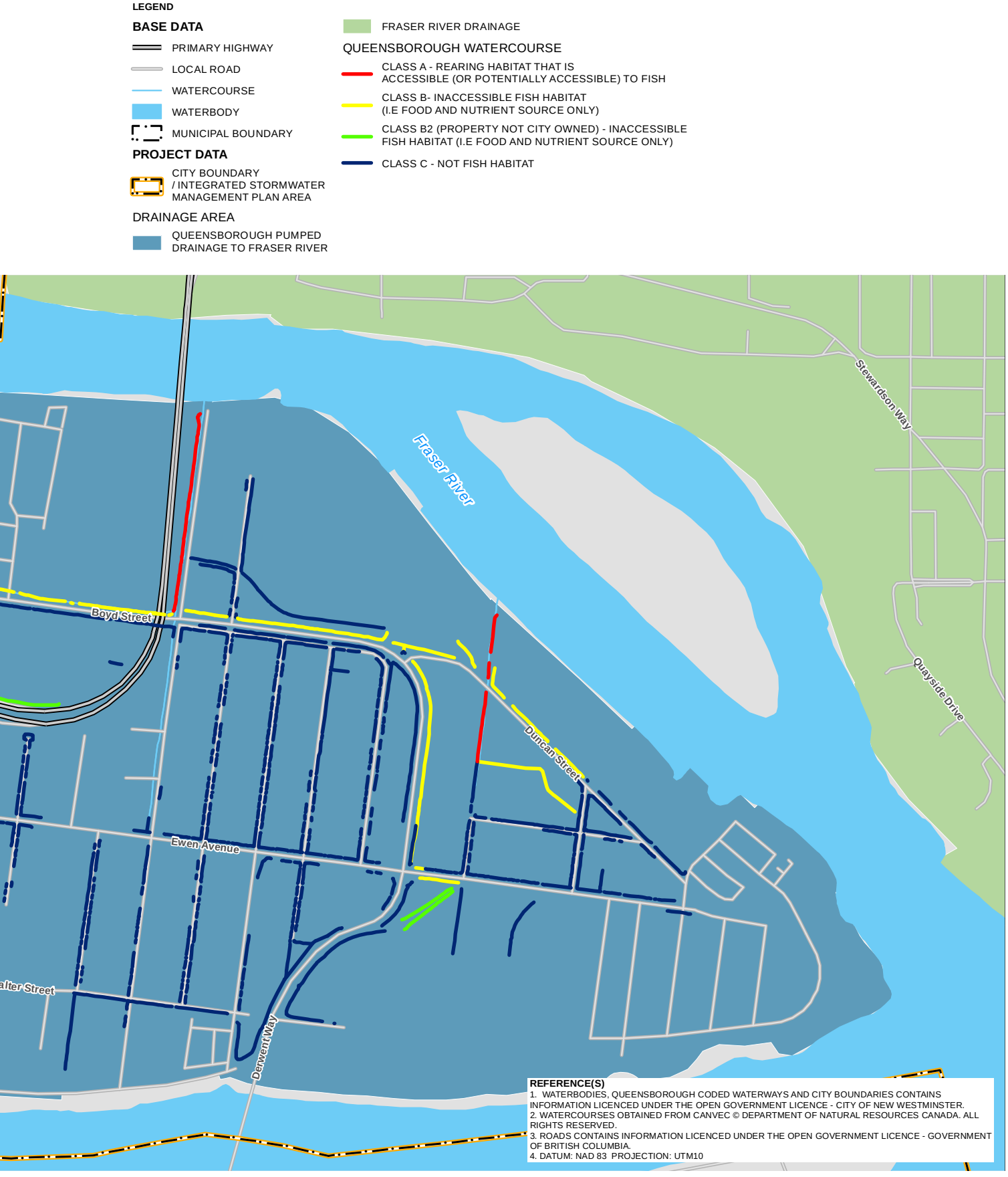
Figure I - 18:

Queensborough Special Area Watercourse Classification

Based on data from August 2012, Figure I - 18 classifies watercourses in the Queensborough area of New Westminster based on their fish habitat potential.

The locations of demonstration projects are on the following pages.




LEGEND
BASE DATA
PRIMARY HIGHWAY
LOCAL ROAD
WATERCOURSE
WATERBODY
MUNICIPAL BOUNDARY
PROJECT DATA
CITY BOUNDARY / INTEGRATED STORMWATER MANAGEMENT PLAN AREA
DRAINAGE AREA
QUEENSBOROUGH PUMPED DRAINAGE TO FRASER RIVER
FRASER RIVER DRAINAGE
QUEENSBOROUGH WATERCOURSE
CLASS A - REARING HABITAT THAT IS ACCESSIBLE (OR POTENTIALLY ACCESSIBLE) TO FISH
CLASS B- INACCESSIBLE FISH HABITAT (I.E FOOD AND NUTRIENT SOURCE ONLY)
CLASS B2 (PROPERTY NOT CITY OWNED) - INACCESSIBLE FISH HABITAT (I.E FOOD AND NUTRIENT SOURCE ONLY)
CLASS C - NOT FISH HABITAT
Fraser River
Stewardson Way
Quayside Drive
Boyd Street
Duncan Street
Ewen Avenue
alter Street
Derwent Way
REFERENCE(S)
1. WATERBODIES, QUEENSBOROUGH CODED WATERWAYS AND CITY BOUNDARIES CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - CITY OF NEW WESTMINSTER.
2. WATERCOURSES OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
3. ROADS CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - GOVERNMENT OF BRITISH COLUMBIA.
4. DATUM: NAD 83 PROJECTION: UTM10

Potential Demonstration Projects

An early priority in selected areas should be to create a visible 'water focal point' or best practice demonstrations in each watershed or special area - a place where the quality and quantity of water, and the life it supports, can be seen (and monitored / improved).

New focal points are conceptual at this point. Locations of potential or existing Green Infrastructure Demonstration Projects are described below, with the intent that widespread BMP adoption would follow across the City.

GLENBROOK SOUTH SPECIAL AREA

Stream Base Flow and Enhancement

- Green Infrastructure practices like infiltration bulges and rain gardens could be incorporated into streets and yards in the areas draining towards Queens Park and the Glenbrook Ravine.
- Redevelopment projects like Canada Games Pool could incorporate roof rainwater harvesting, parking area treatment and detention storage.
- As envisioned in the Queens Park Master Plan, surface swales and wetland areas could be restored.
- All of the above would provide increased summer base flow and water quality to an improved surface watercourse in Glenbrook Ravine.

GLENBROOK SOUTH / PATULLO BRIDGE SPECIAL AREA

Patullo Bridge Replacement

- Opportunities may exist to create surface water features and green infrastructure as part of this project.

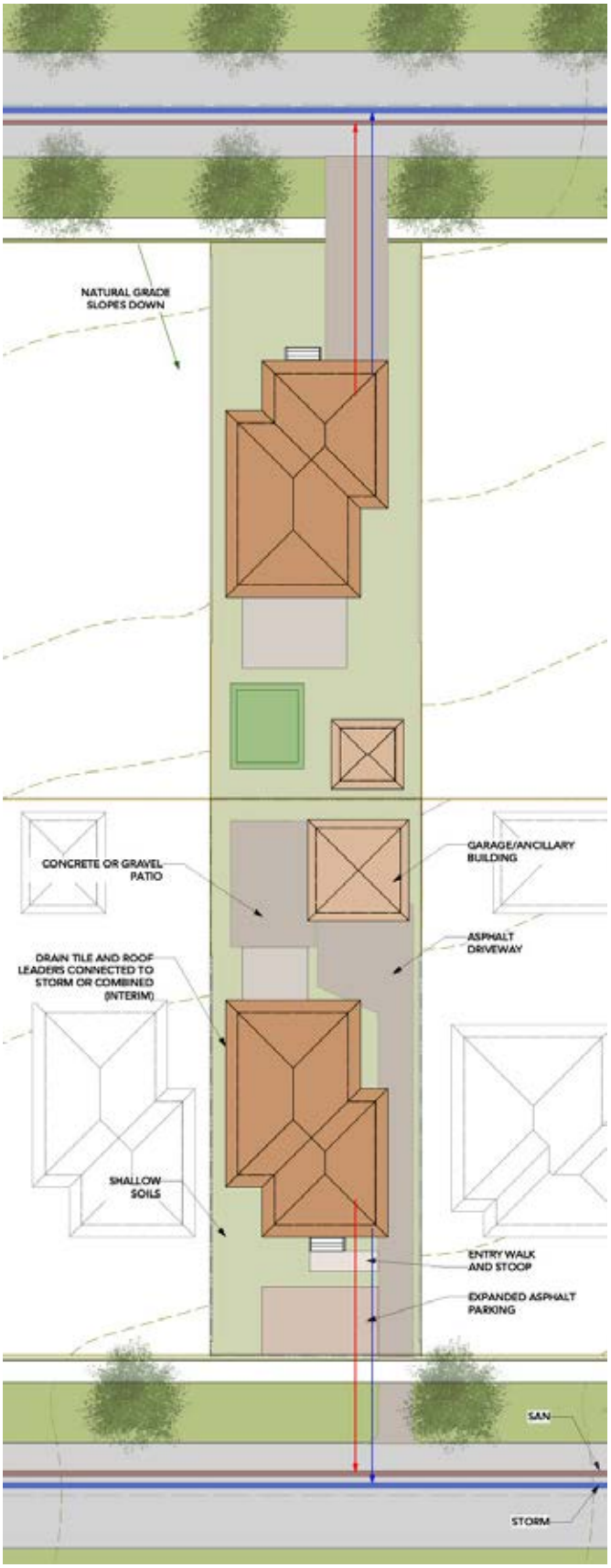
Demonstration project concepts around Glenbrook Ravine.



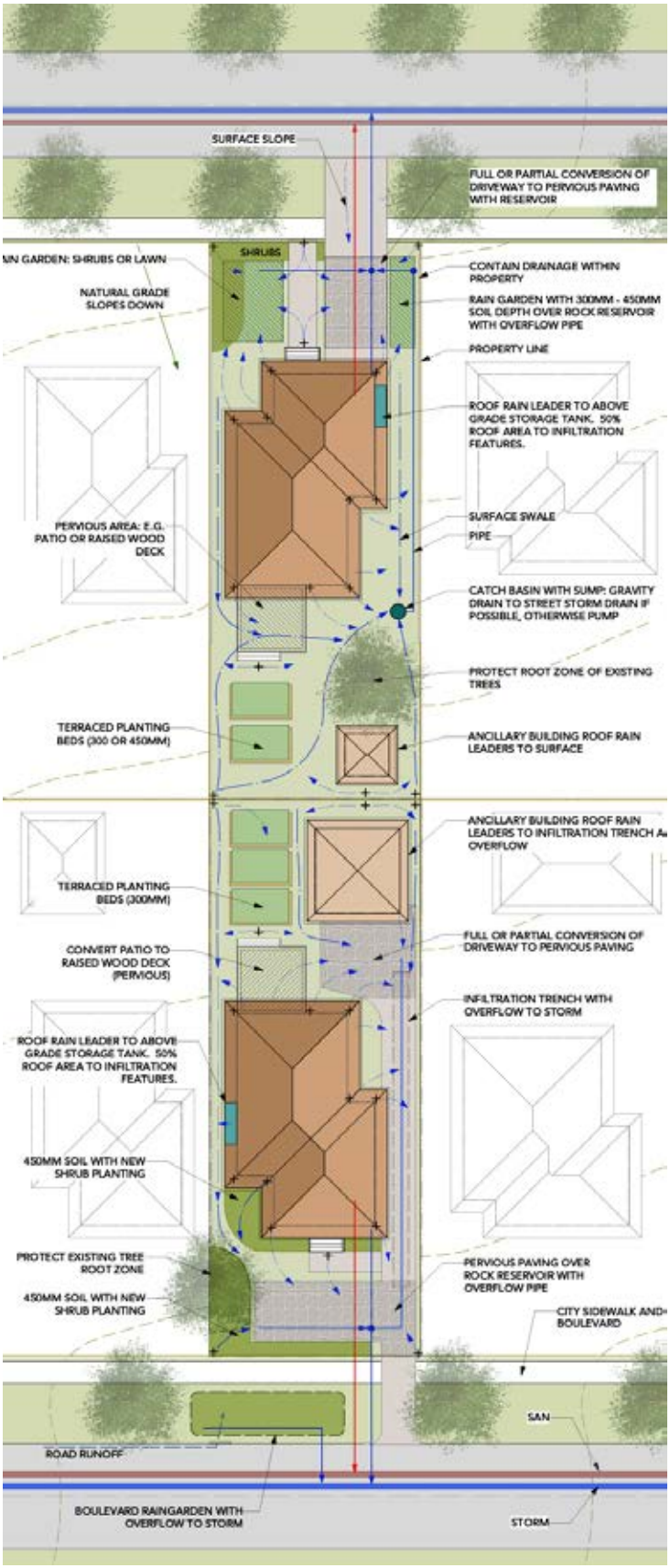

COMMUNITY RAINGARDEN OR WETLAND
PIPED FLOW
SURFACE FLOW (E.G. SWALE, CONSTRUCTED WATERCOURSE)
SURFACE FLOW WITH SUBSURFACE OVERFLOW PIPE
SUBSURFACE DETENTION FACILITY
STREET INFILTRATION FACILITY WITH PIPE
ADJUSTED DRAINAGE CATCHMENT
GENERAL TOPOGRAPHICAL SURFACE FLOW DIRECTION
CONTOUR (2M INTERVAL)
INDEX CONTOUR (10M INTERVAL)
CANADA GAMES SITE REDEVELOPMENT, ROOFS AND PARKING AREAS TO INFILTRATION GALLERIES, DETENTION, WITH CONTROLLED RELEASE TO SIMULATE BASE FLOWS TO GLENMORE RAVINE SURFACE CREEK.
DAYLIGHT PIPE TO SURFACE FLOWS TO RAINGARDENS/ WETLANDS
INFILTRATION SWALE WITH OVERFLOW. INFILTRATION ON HIGH SIDE OF PARK.
NEW CONSTRUCTED WATERCOURSE FOLLOWING EXISTING SURFACE FLOWS
GLENBROOK RAVINE POND: CREEK TERMINUS, PIPE TO FRASER RIVER
INVESTIGATE POTENTIAL TO RE-USE EXISTING (1908) DECOMMISSIONED WATER RESERVOIR FOR STORMWATER DETENTION/RETENTION PURPOSES AT TIME OF SITE REDEVELOPMENT.
FIRST STREET
PATTULLO BRIDGE REPLACEMENT PROJECT MAY OFFER STORMWATER/ECOLOGICAL RAINGARDEN OPPORTUNITIES.

Plan view of typical single family lots with and without examples of stormwater best management practices.

WITHOUT BMPs



WITH BMPs



BRUNETTE RIVER SPECIAL AREA

Sapperton Green Redevelopment

- this major redevelopment will remove existing paved area, and is likley to include demonstration of infiltration swales, infiltration bulges, pervious paving, absorbent landscape and possible rainwater harvesting.

UPTOWN / BROW OF THE HILL / QUEENS PARK / WEST END SPECIAL AREA

City Hall Precinct

- opportunities may exist in the grounds of City Hall, as well as adjacent boulevards and parks, to demonstrate green infrastructure best practices like rain gardens and pervious paving.

City Recreation Parks and Boulevards

- localized areas with city parks (e.g. Mundy Park) and wider street boulevards are candidates to showcase absorbent landscape and rain gardens.

QUEENSBOROUGH SPECIAL AREA

Casino and Commercial Area parking

- select parking areas in Queensborough already incorporate infiltration swales in parking areas. These could be upgraded and expanded as demonstration projects.

Surface swales and wetlands

- Queensborough aslo includes constructed wetlands and swales systems as a part of the highway and greenway corridors.

CITYWIDE AREA

Boulevards and medians

- infiltration buldges and rain gardens may be incorporated into city boulevards and medians as sewer separation continues (e.g. Keary Street in 2018).

Private Mixed Use redevelopment

- major projects like the 22nd Street Station Area redevelopment at Connaught Heights may incorporate infiltration swales, infiltration bulges, absorbent landscape, pervious paving and possible rainwater harvesting.

Private Single Familiy and Duplex/Triplex redevelopment

- As private homes are redeveloped or undergo major renovation, an opportunity exists to incorporate absorbent landscape, rain gardens, select areas of pervious paving, and potentially rainwater harvesting, all with provision of an overflow to the street drainage system (see diagrams on facing page)

Everyone Plays a Role – Public and Private

Meeting the goals and targets to protect New Westminster's river receiving waters and biodiversity requires cooperation from all land uses and land managers in the City. Even single family and low density land uses, and local streets, need to play a role, as they represent over 40% of the land area in our watersheds.

Refer to the BMP Toolkit (Volume II) for a listing of common practices and their suitability to various land use types. Strategies to meet targets in typical land uses include:

Low Density One/Two Family & Lane Housing

- Eliminate sanitary sewer cross connections into storm sewer.
- Design for zero runoff leaving the site for normal to heavy rainfall in new homes. Convey runoff from large and extreme storms to the major drainage path (street or lane).
- In new homes, direct roof stormwater to infiltration (subject to an approval process) rather than to piped sewers.
- Provide incentive programs for roof stormwater harvesting and reuse (existing and new homes).
- Separate on-site combined sewer services in existing lots.

Medium / High Density: Multi-family, Industrial Commercial Institutional

- Meet water quality, volume reduction and detention targets. Allow flexibility to use all Green Infrastructure tools.

Lanes

- Design new homes for no runoff from private parcel to lane except in large or extreme rainfall events.
- Implement regular lane vacuum sweeping and catch basin cleaning in sewer-separated areas, .
- When resurfacing, meet water quality (but not necessarily water volume) targets by installing Green Infrastructure associated with resurfacing.

Local Streets

- Meet water quality and volume reduction targets, but not detention targets.
- Provide flexibility to use several Green Infrastructure tools or combinations.
- Undertake neighbourhood consultation and involvement in design, as well as in operations and maintenance.

Collector / Arterial Streets

- Meet water quality targets, but not water volume reduction or detention targets. Due to space constraints, it may be necessary to consider grey infrastructure such as manhole or vault-based oil-water-grit interceptors and related membrane and/or mechanical filtration systems, for limited water quality treatment..

PRIORITIES AND BENEFITS

The priority in the above actions is reduction of water quality risks to receiving waters, by phasing-in conformance to the Metro Vancouver Monitoring and Adaptive Management Framework (yellow or green standards) that sets out water quality requirements that would apply to the piped drainage in New Westminster.

The actions should also provide stormwater volume reduction at time of redevelopment through specified practices on local streets, reducing effective impervious area at the site level of one/two family & lane housing, and requiring volume reduction and detention at large High Density Multi Family and Industrial/Commercial/Institutional (MF/ICI) developments.

The volume reduction target should provide additional space (approximately 15-30%) in storm sewer pipes to accommodate flows that may increase due to more intense rainfall events and climate change.

Until sewer separation is completed, the increased available volume in existing combined sewers would mitigate the tendency towards more frequent or higher volume Combined Sewer Overflows (CSOs) and reduce the requirement to upsize the combined sewers with capacity constraints. This will allow financial resources to be allocated towards advancing the sewer separation program.

The Action Plan in Section 5.0 of this ISMP introduces the Actions and Priorities to get started on effective implementation.

Some Actions are ongoing, and can continue with renewed commitment and focus of City staff. Other actions are new, and will benefit from on-going community engagement, including stewardship groups, the real estate and development community, homeowners and tenants.

Public awareness and outreach programs should be a perennial part of implementation of the ISMP.

Key Implementation Principles for Action

Working with Stakeholders, Key Principles have been noted to guide implementation of the Citywide ISMP.

MULTIPLE BENEFITS AND CONTINUOUS IMPROVEMENT

- Pursue stormwater management solutions that have multiple benefits—that meet many cross-discipline and cross departmental aspirations.
- Ensure that constructed stormwater management solutions are evaluated, and lessons-learned are shared, for continuous improvement.
- Reduce reliance on drinking water supplies to meet non-potable use demands by supporting roof water harvesting and water-conserving absorbent landscape.

CONTEXT SENSITIVE DESIGN & ADMINISTRATION

- Recognize that there may be variation in stormwater management solutions among different land use types.
- Identify areas of the city that have natural hazards or conditions that would restrict the type of stormwater management technique used (e.g. reduced reliance on infiltration in areas of slope instability, contaminated soils, high water table).
- Where poassible, integrate Green Insfrastructure approaches into updated regulations and requirements, rather than creating new programs or bylaws.

SHARED RESPONSIBILITY

- Balance the responsibility to implement stormwater management solutions among private and public sectors, and support community stewardship.
- Continue to show leadership by example, with the City and private sector showcasing projects that demonstrate success in stormwater management.
- Ensure solutions balance capital, operations and maintenance considerations, and anticipate needs for maintenance funds and the role of private property owners in maintenance.

INCREMENTAL ADAPTATION

- Meet water quality, volume reduction and detention targets incidental to construction or major renovation projects.
- Provide flexibility to use several Green Infrastructure tools or combinations.
- Undertake neighbourhood and stewardship group consultation and involvement in design, as well as in operations and maintenance.
- Implement stormwater source controls into the program of transitioning the combined sewer system into a separated system to reduce CSOs, and the existing sewer bylaw requirements to separate on-site combined laterals with each new building permit, all acting to reach ISMP goals in the long-term.
- Use redevelopment of streets, parks or private lands as opportunities for incremental stormwater management improvements over time.
- Provide on-going monitoring and periodic implementation refinement to support the Adaptive Management Framework and objectives of Metro Vancouver's Integrated Liquid Waste and Resource Management Plan.













Stormwater Management (New Westminster)

5.0 HOW DO WE START?

Implementing the Citywide ISMP will require a sustained effort among a wide variety of partners in City administration and among stakeholder and groups outside the City staff.

Actions will be incorporated into the City's budgeting processes for capital, operating/maintenance and staffing. Investment and priorities may change from year to year.

Overview of Action Programs

'Action Programs' are recommended to organize the implementation – these are presented as:

I. On-going Existing Actions

II. New Short Term Actions

III. New Sustained Actions

IV. New Longer Term Actions

Absorbent landscapes under construction in Glenbrook South (New Westminster).



On-Going Existing Actions

A fundamental issue in pollution abatement is on-going management of the amount of nutrients and bacteria that flow from the stormwater system to receiving waters - as well as sediment, oil and heavy metals that can flow with runoff from surface parking areas.

To minimize these risks, City programs for catch-basin / sump cleaning and sewer cross connection control would be combined to support:

STREET CLEANING

The ongoing program of street sweeping and sidewalk maintenance should continue and be enhanced, to remove sediments and litter such as gum and cigarettes from public spaces. A renewed focus should be placed on fall leaf and water quality cleanup, including citizen programs to encourage timely removal of leaf litter from boulevards, and avoiding the placement of tree or lawn leaf litter on street surfaces where it blocks catch basins and adds excess nutrients to runoff.

CATCH BASIN CLEANING

Catch basin sumps on streets function to remove coarse sediment from runoff before water enters the storm drain pipe. However, when leaves or organic debris and soil accumulate in the catch basins, bacteria can grow and can contribute to the closure of public swimming beaches.

The City should continue and increase regular catch basin cleaning by vacuum truck. It should also continue to remove sediment and oils from 'structural' best practices, like oil/water separators or detention tanks, and require this maintenance on private property.

OIL AND GRIT SEPARATORS

Oil and grit separators should continue to be incorporated in new developments with paved parking areas.

Oils, sediment, and organics in CBs can generate beach-closing bacteria.



SEWER SEPARATION PROGRAM

The City is well advanced on a major capital investment to replace combined sewers with separate systems of sanitary sewer (human contact water) and storm water (roof and pavement drainage).

The sewer separation program is scheduled to be complete by Year 2075. As it is implemented the size and frequency of combined sewer overflows into New Westminster's rivers should be reduced.

SEWER CROSS-CONNECTION ELIMINATION PROGRAM

Even after sewer separation in the public street, there are cases on private property where sanitary sewage is running undetected into storm sewers.

This is against City regulations and health best practice. The City should cooperate with private landowners on an on-going investigation and elimination of cross-connections between storm and sanitary systems within buildings or on private land.

MAJOR DEVELOPMENTS STORMWATER MANAGEMENT

The City has an established policy where major rezoning applications are required to meet detention and water quality criteria established by the City. This policy should be maintained, and reviewed to ensure that it meets the requirements of the Citywide Integrated Stormwater Management Plan.

Stormwater Management Pond in New Westminster



New Short Term Actions

WATERSHED PUBLIC AWARENESS OUTREACH PROGRAM (PHASED)

The Watershed Public Awareness and Outreach Program would recognize that urban design and green infrastructure implementation, in each of the city's watersheds, has a direct relationship to the health of the ecosystem of its receiving waters, and on the health of the watershed itself.

The quality of water that is delivered, and to a certain extent its quantity, influence the ability of the watershed and receiving waters to support life and ecosystems—benthic invertebrates (bugs) and insects that are food for aquatic species; support for the life ecosystems of salmon, herring, trout and other fishes, and for heron, eagles and other birds and mammals that prey on the bounty of the shorelines.

The purpose of the Watershed Public Awareness Outreach Program is to:

- Raise awareness among the public, business, agencies and city staff of the relationship of stormwater and watersheds to local ecosystems and life;
- Provide a vehicle for interested stakeholders within each watershed to focus their efforts;
- Support communication and training among watershed stakeholders, and sharing of green infrastructure and other best practices; Undertake communications and outreach, including multi-media and live training and awareness programs. The focus of these communications would be to help the public, landowners and stakeholders understand the relationship of their actions to watershed and salmon health;
- Provide a constituency in support of applications for outside funding for watershed improvements;
- Allow a role for 'citizen-science' in combination with City-funded science and testing, and a focus for monitoring and adaptive management of the watershed;
- Build a bridge between and support for both the Integrated Stormwater Management Plan and the City's Blue Dot, ISCP, OCP, Tree Management, Urban Forest and other environmental programs;
- Share resources among departments and with other local governments to implement adaptive management improvements to improve watershed health.
- Include partnership with other municipalities and Metro Vancouver in the stewardship of the Brunette Creek and Glenbrook South Watersheds.

The City may phase in this 'Watersheds' Program gradually, and expand its depth and breadth in each phase of implementation.

An early priority in selected areas should be to create one or more visible 'water focal points' in each watershed or special area – places where the quality and quantity of water, and the life it supports, can be seen (and monitored / improved). Existing and potential locations for water focal points will be determined on a balance of public land and resources available, potential private sector contributions, community / stakeholder interest, and the potential for the projects to increase community awareness and support.

As well as the environmental benefits, the Watersheds Program is also another means to community and social development in public, school and neighbourhood groups.

DEMONSTRATION PROJECTS AND CAPACITY–BUILDING

Implementation of the Citywide ISMP will require technical knowledge and confidence around design, construction and maintenance of new best practices and technologies. The Capacity-Building Program for Stormwater Management would support:

- Pilot and demonstration projects—these projects provide excellent opportunities to make training and results 'hands-on'. Pilot projects build comfort and confidence among staff and contractors and the skills to implement properly.
- Learn from exsting Hume Park and QCC rain gardens.
- Capacity-building should include a review of implementation and enforcement of existing standards and regulations e.g. construction site erosion and sediment control.

Hume Park Rain Garden (New Westminster).



UPDATED ENGINEERING AND BUILDING STANDARDS

The City should bring regulations and procedures into alignment with the ISMP recommendations. Some older city regulations may require exclusive use of 'grey' infrastructure, and require update. The city should add green infrastructure 'city standards' for typical design, sizing and specifications that are well vetted and accepted. Results of pilot projects should inform these new standards.

UPDATED MAINTENANCE STANDARDS AND ROLES

All infrastructure – whether green or grey – requires on-going maintenance. Some parts of the street (notably landscape boulevards) have been maintained by adjacent landowners.

As green infrastructure is contemplated in city streets, plazas and parks, the City should review its maintenance standards and roles, including the role of adjacent properties and the private sector at larger developments. New standards for maintenance and roles should be developed, and funding allocated for the City portion of maintenance responsibilities.
A review of the potential 'social development' opportunities for green infrastructure maintenance should be a part of the review.

UPDATED DEVELOPMENT APPROVAL AND INSPECTION PROCESSES

Like all infrastructure, green infrastructure should function well if properly designed, installed and maintained, and may fail if poorly implemented. The City's approval and inspection processes should encourage proper design and installation of green infrastructure. Implementing requires a careful allocation of people and process to create an efficient and effective development and implementation approval system. The intent should be to fully incorporate green infrastructure reviews into existing review procedures, rather than inventing new administrative systems.

TECHNICAL TRAINING AND STAFF DEVELOPMENT

Both City staff and external contractors have ongoing needs for technical training on green infrastructure. Related training activities should include:

- Recruiting new staff (engineering, landscape architecture, planning and engagement) into a Green Infrastructure Team.
- Internal technical and training materials and staff development.
- External training materials—aimed at increasing the capacity for proper Green Infrastructure and other BMP design and installation on private lands, aimed at the consulting design community, and in contracting installation and maintenance firms, as well as small property owners and homeowners.
- Implementation should also include training of staff that review applications and that provide referrals or informal guidance to applicants.
- Training should also reinforce enforcement of sediment and erosion control during construction on public and private sites.

ORGANIZATIONAL DEVELOPMENT FOR FUNDING AND IMPLEMENTATION

Many aspects of implementing the ISMP should be accommodated as adjustments to existing budgeting, funding and staffing programs. There are, however, some key changes that would benefit from an organizational development approach, including:

- Creation of a Green Infrastructure Team as a focal point for the program;
- Identification of functions that may be accommodated in existing budgets;
- Identification of new service functions that should require allocations of budget and staffing for effective delivery;
- Clarity on roles of City and Park Board departments, staff and consultants/ contractors in on-going implementation.

AWARDS AND INCENTIVE PROGRAM

The City should integrate Green Infrastructure recognition into Annual Awards programs to recognize noteworthy investments and awareness-building activities that meet the objectives of the ISMP.

New Sustained Actions

Three new programs should be phased in: Absorbent Sites Program; Surface Parking Treatment Program; and Monitoring and Adaptive Management Program.

ABSORBENT SITES PROGRAM

Over 40% of land area in the City of New Westminster is covered by residential land uses and the adjacent local streets. These residential neighbourhoods occur in two widespread types - low density one and two family homes, and high density or mixed use residential/commercial. The quality and volume of water entering the stormwater system and receiving waters is directly related to the design and maintenance of these places that we live.



Pet waste and over-fertilization of landscape areas can lead to bacteria, aquatic weed and algae problems in receiving waters. Proper depth and quality of absorbent landscape soils can mitigate these risks.



Erosion and sediment control during construction is of paramount importance to water quality in receiving waters

The Absorbent Sites Program provides guidance for stormwater-sensitive site development for private residential lands. The local streets and surface parking concerns are addressed below by the Surface Parking Treatment Program.

The issues with at-grade drainage from housing areas are excess nutrients from over-fertilization, nutrients and bacteria from pet waste, petroleum hydrocarbons and heavy metals from driveways or other surface parking areas, and potential erosion and sediment transport to stormwater from gardening activities, and in particular from construction sites.

The Absorbent Sites Program primary objective is that normal rainfall that lands on the at-grade portion of residential landscapes should be absorbed into the underlying subsoils, and heavy rainfall should be filtered through surface soils. It is recognized that large and extreme storms (above the water quality storm) may create some runoff to drain inlets or the fronting street or lane, and provisions for positive drainage for these extreme events should still be made in site and utility planning.

Absorbent Sites can be readily achieved by use of the practices in the BMPs (Vol II). Requirements for Absorbent Sites would be established by design guideline policy or bylaw, and administered at the time of redevelopment through the development or building permit processes.

Single and two-family zones should be encouraged (subject to an approval process) to either harvest roof stormwater for re-use, or disconnect roof stormwater leaders and distribute the roof water to absorbent landscape areas, with an overflow from these absorbent areas for major storm events to the street or piped stormwater system. City exceptions to this requirement should be identified, including areas without foundation drains, or other areas at risk based on hydrogeological investigations. Where landowners otherwise wish an exception to the requirement, approval of the exception should be based on a detailed application form and established criteria.



Absorbent landscape and soils (New Westminster).



On-street parking adjacent to landscaped boulevards is common across New Westminster.

Medium and High Density residential and mixed-use developments are also required to meet the Absorbent Sites Program requirements. It is anticipated that most of these developments would use the performance application process, and that these requirements would be generally complementary to current best practices such as those encouraged by LEED certification. Refer to the following Roof Stormwater Harvesting and Reuse Program for guidance on roof stormwater reuse.

SURFACE PARKING TREATMENT PROGRAM

Surface Parking is one of the major contributors in urban environments to water quality pollution of receiving waters. The parking areas (even recently paved) show visible droppings of petroleum hydrocarbons, which flow with stormwater into pipes and show up as sheen on surface waters. What are not as visible are heavy metals from brake linings, sediments that are carried into the drains by stormwater, bacteria and other pollutants.

In New Westminster, there are two areas of surface parking: on-street, and off-street. All surface parking, whether public or private, contributes to urban water quality issues.

Stormwater infiltration swales can be found in off-street parking in Queensborough Landing.



ON STREET SURFACE PARKING TREATMENT

On-street parking areas are perhaps the largest area of surface parking in the study area. Almost every local street is lined with surface parking, usually on both sides. Implementing treatment of water quality associated with on-street parking is a high priority.

The Surface Parking Treatment Program would support an inter-departmental focus to implement water quality treatment on all on-street parking areas. Priority would be given to streets where drainage is now or soon to be flowing into separated storm sewers and to receiving waters.

All BMP tools should be considered for treating water quality from surface parking. ISMP Volume III: Technical Background Report (internal), has compared the life cycle cost and functionality of combinations of tools in a typical New Westminster residential neighbourhood. Based on that analysis, the program envisions the general allocation of tools to be:

Local Streets:

- Four infiltration bulges per block (approximately 90% of locations – see Figure I - 19 Option LS1);
- Two infiltration bulges at the lower portion of a block, with treatment of the upper half of the block provided by pervious paving under parking (approximately 5% of locations);
- Two infiltration bulges, at the lower portion of a block, with treatment of the upper half of the block provided by pervious paving under parking isolated from travel lanes by a gutter that flows to the infiltration bulges (approximately 5% of locations).

Collector and Arterial Streets:

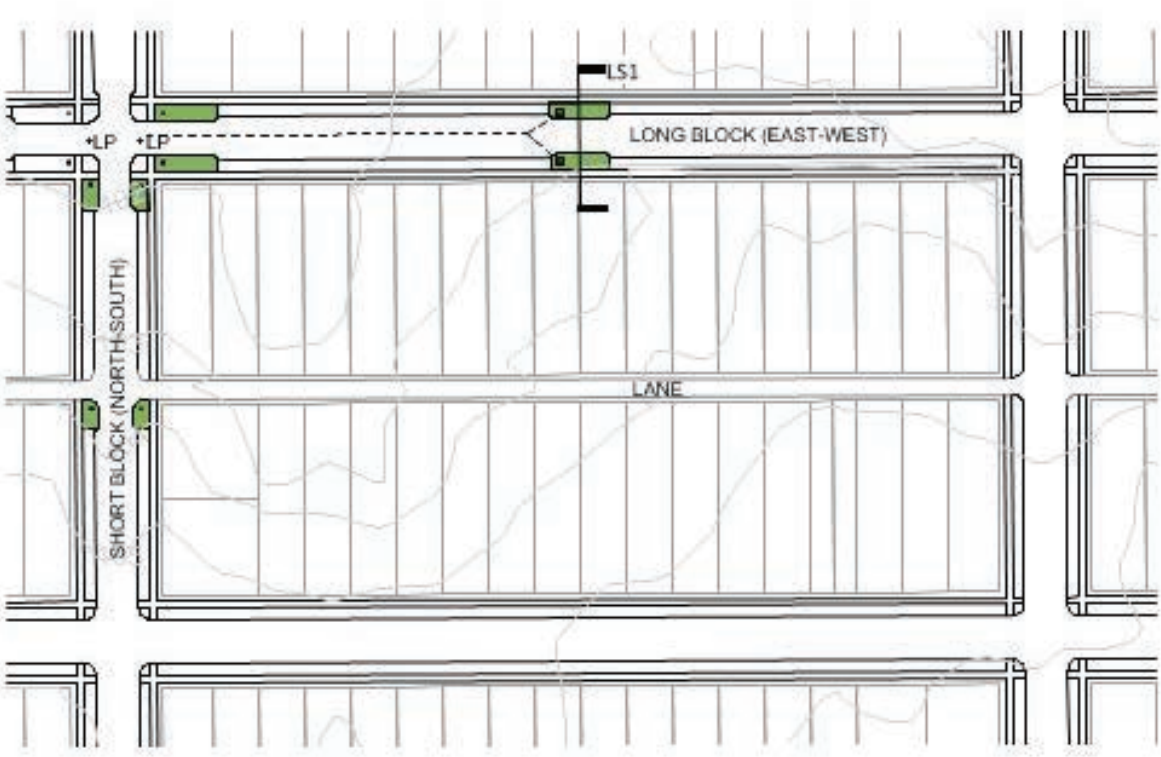
- Membrane-based Water Quality Structures (approximately 90% of locations);
- Localized infiltration bulges or Pervious Paving and Surface Parking (approximately 5% of locations);
- Localized Infiltration into Street Tree Wells (approximately 5% of locations)

Use of water quality structures to treat local streets is discouraged, but may be the only option in certain conditions.

Coordination of technical details with Coastal Health and utility agencies will be required. A review is anticipated of the interface with potable water supply utilities of both natural groundwater and infiltrated runoff.

Guidelines and analysis of these best practices are provided in ISMP Volume II: BMP Toolkit and Volume III: Technical Background Report (internal).

Figure I - 19: Local Street Surface Parking Treatment Option LS1



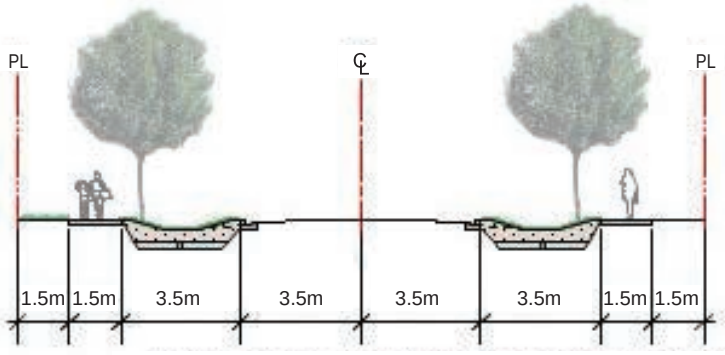
SHORT BLOCK (NORTH-SOUTH)

INFILTRATION BULGE AREA	92 sq.m
PARKING REDUCTION	4 stalls
TREE REMOVAL/REPLACE	4 trees

LONG BLOCK (EAST-WEST)

INFILTRATION BULGE AREA	180 sq.m
PARKING REDUCTION	8 stalls
TREE REMOVAL/REPLACE	8 trees

INFILTRATION BULGE
EX. CB
NEW CB
NEW STORM DRAIN



LOCAL STREET - INFILTRATION BULGES

OFF STREET SURFACE PARKING TREATMENT

Off-street parking areas still exist in the Citywide study area. Although their presence is dwindling in the downtown peninsula, they are still a common element along arterial and collector streets (behind or beside commercial buildings), at shopping centres or warehouse areas, at places of worship, and at schools and institutions.

Although this section is intended to address staff parking areas at heavy industrial sites, it should not be applied to industrial yards—which should have their own pollution abatement program.

The preference for treatments of off-street surface parking is similar to that for on-street, although the site plan configuration varies. All BMP tools should be considered for treating water quality from surface parking. However, the program envisions the general allocation of tools to be:

Off-Street Surface Parking:

- Infiltration Swales (Figure I - 20 Small Parking Option PS1)
- Pervious Paving to Parking Bays

Guidelines and analysis of these best practices are provided in ISMP Volume II: BMP Toolkit and Volume III: Technical Background Report (internal).

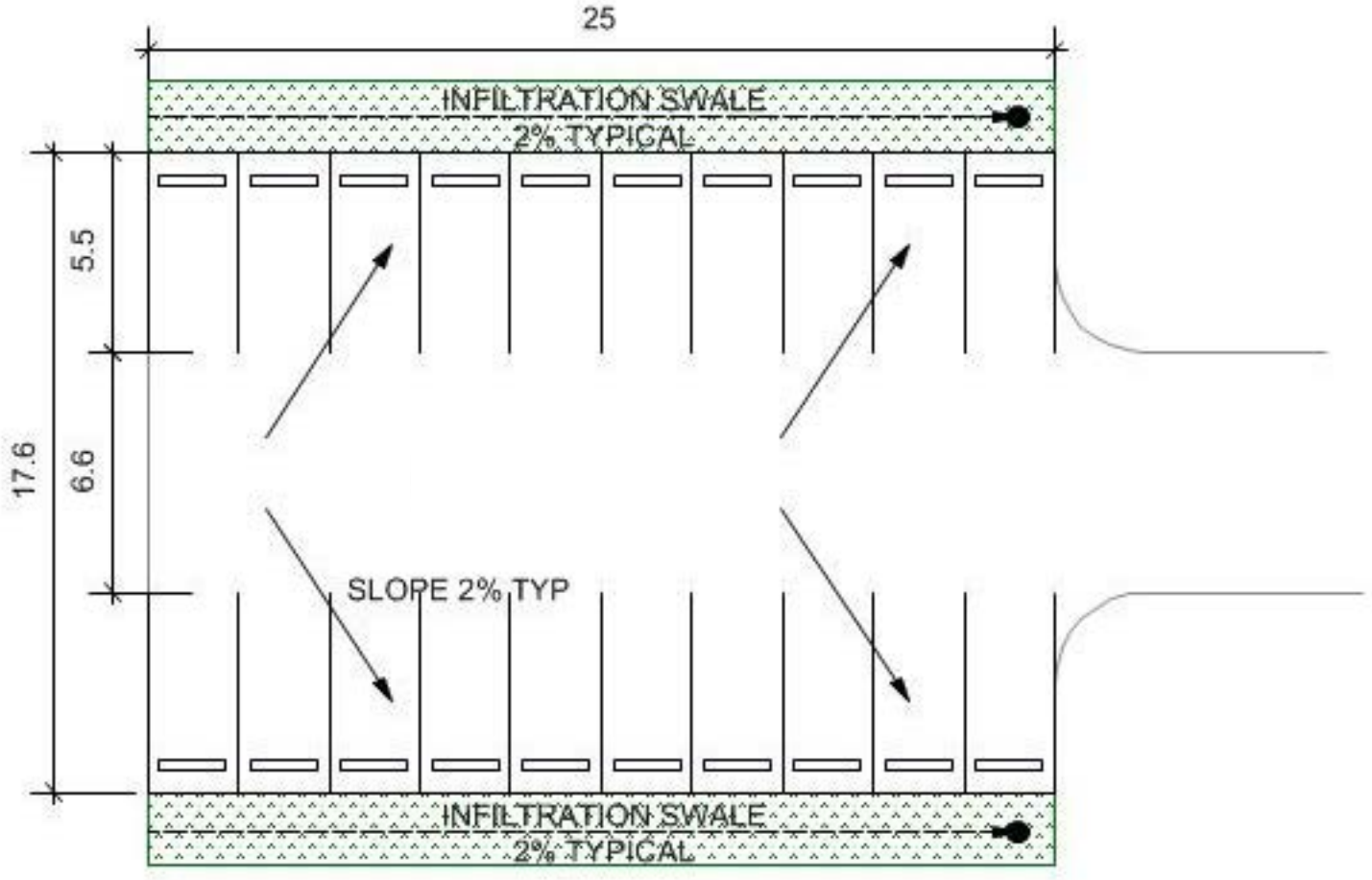
Which of these approaches are chosen for a given off-street parking area is to be determined at the time of development application, or if there is a rezoning application, at the rezoning stage. The development permit process may require landscaped area and tree cover for other purposes, and this requirement, as well as site configuration and space available, should lead to site specific choices.

Use of water quality structures to treat off-street surface parking is discouraged, but may be the only option in certain conditions. Water quality structures (e.g. pretreatment and membrane filtration system) may be appropriate in retrofit surface parking situations where no redevelopment is anticipated for some time, but there is a desire to provide basic water quality treatment.

Where surface parking is an open roof of a parking garage, treatment shall be to a similar performance standard to that provided by the above. Where space is limited, this might be by a water quality structure.

As storm sewer separation progresses, existing off-street parking areas may be connected to new storm sewers that will outfall to sensitive receiving waters. In addition to installed BMPs with new construction, it is therefore important to encourage water quality BMP retrofit of existing off-street surface parking areas prior to final sewer separation. A proposed Surface Parking Treatment Incentive Program could provide a charge on un-treated surface parking areas, with these charges reduced or eliminated as treatment BMPs are installed. A related grants program could provide incentives to early adopters.

Figure I - 20: Small Parking Area Treatment Option PS1



MONITORING AND ADAPTIVE MANAGEMENT PROGRAM

Metro Vancouver's approved Integrated Liquid Waste Resource Management Plan (ILWRMP) requires that municipalities monitor stormwater to assess and report on the effectiveness of ISMP implementation. Metro Vancouver, in consultation with member organizations, has developed a Monitoring and Adaptive Management Framework (MAMF) to monitor watershed health. It is recommended that the City of New Westminster create and maintain a Monitoring and Adaptive Management Program in accordance with the guidelines in the MAMF.

Under the MAMF, there are specific guidelines for piped systems, including monitoring of water quality parameters in every watershed once in every five years, for dissolved oxygen, pH, temperature, conductivity, turbidity, nutrients, E.coli and fecal coliforms, iron, copper, zinc, lead, and cadmium.

As sewer separation starts to create stormwater flows to receiving river waters, the New Westminster Citywide Monitoring and Adaptive Management program implementation will include establishing monitoring sites and baseline data, and reviewing that baseline data in context with the water quality performance targets set out in the MAMF. Subject to baseline results, it is recommended that the City adopt the 'Yellow' MAMF ISMP Performance Targets as a minimum, while striving to meet the 'Green' water quality targets.

Additional detail of the proposed monitoring program are provided in ISMP Volume III Technical Background.

New Longer Term Actions

Two programs that are worthy, but potentially later in the implementation priorities: Absorbent Lanes and Stormwater Harvesting and Reuse.

ABSORBENT LANES PROGRAM

The City of Vancouver has been a leader in showcasing stormwater best practices in its Country Lanes Project.

The use of concrete wheel strips to support heavy waste vehicles, with surrounding absorbent landscape of pervious paving, is an exemplary design. This installation also represents a healthy relationship in involving the neighbourhood and adjacent landowners in pre-design engagement and in on-going maintenance.

However, lanes in New Westminster generally do not support much surface parking, and it is runoff from surface parking that is a priority for treatment to provide acceptable water quality for receiving waters. For this reason, investment in Country Lanes projects in New Westminster would be a lower priority than investing in solutions which treat water from surface parking areas (on-street or off-street).

The Absorbent Lanes approach is important in reducing volume flows, and would reduce CSOs in the combined sewer system in the short term, and provide additional capacity in separate storm sewers in the long term. When other priority projects have been funded, attention could turn to investment in Absorbent Lane projects, with a determination of what parts of New Westminster would be most beneficial at that time.

In the meantime, it is important that the amount and quality of runoff from lanes does not deteriorate. The Absorbent Sites program (above) should encourage no runoff during normal up to heavy rainfall from private lands. Other than in large or extreme storms, there should therefore be no runoff from private lands to lanes or streets.



Paved lane in New Westminster.

The City of Vancouver has been a leader in showcasing stormwater best practices in its Country Lanes Project.



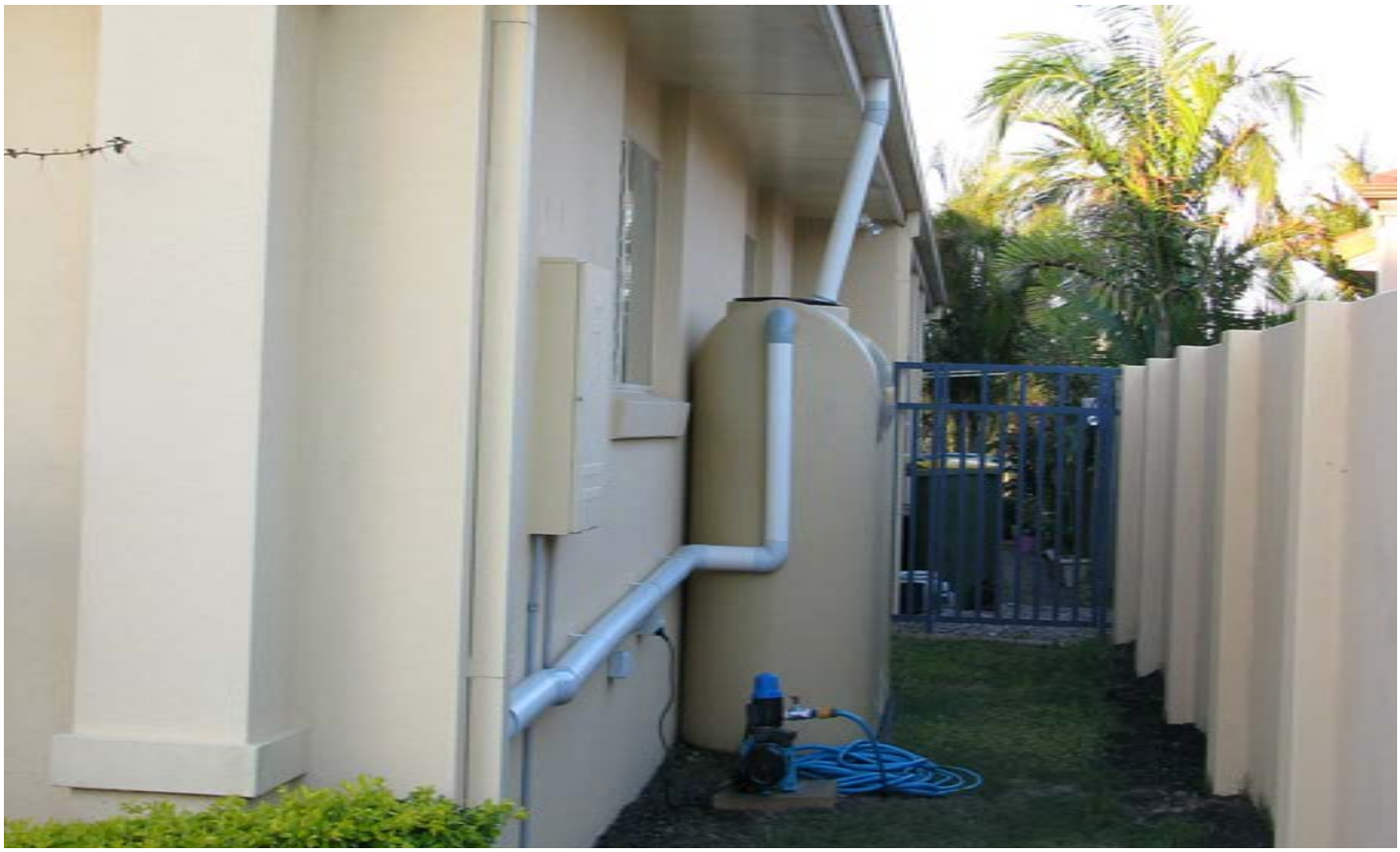
ROOF STORMWATER HARVESTING AND REUSE PROGRAM

Rooftop drainage from residential development, is less polluted than at-grade drainage, and should be treated as a resource for reuse where possible.

There are areas of BC (Gulf Islands, Vancouver Island) where use of roof stormwater harvesting and reuse technology is established and growing. There are also several examples of institutional and mixed use buildings in Metro Vancouver that use stormwater harvesting and reuse technology, and in some cases wastewater treatment and reuse (Convention Centre, Olympic Village, UBC, private developments). For general introduction to Stormwater Capture and Reuse, refer to the ISMP Volume II: BMP Toolkit.

There are water conservation advantages in use of roof stormwater harvesting, both in reducing potable water consumption in summer outdoor water use and indoor toilet flushing. Use of the collected stormwater for toilet flushing is also important for a winter 'draw-down' of the water level in the tank in order to provide room for stormwater storage during periods of heavy rain.

Stormwater harvesting system in a private residential home (Australia).



Approvals systems for stormwater harvesting and reuse are evolving quickly in Canada and BC, with some concerns remaining in approval authorities about quality control in system installation and operations.

In this context, we recommend a program that encourages, but does not require, roof stormwater harvesting and reuse in the City. Elements would include:

- Motivational information to explain the benefits of stormwater harvesting (videos, pamphlets).
- Technical materials on the issues and guidelines for proper installation and maintenance.
- A focus on design, development and cost optimization for low-cost treatment techniques to reduce health risks and improve aesthetic acceptance of roof stormwater harvesting, in particular for toilet flushing but also as spray irrigation water where human contact may be possible.
- Work on expedited approval procedures between City Building and Plumbing Inspection, as well as with Coastal Health and BC Environment. These approval issues are common to many local governments, and therefore cooperative measures may be appropriate.
- Leadership on pilot installations and monitoring / public familiarization.

6.0 HOW DO WE ORGANIZE LONG-TERM FUNDING AND IMPLEMENTATION?

A Gradual and Sustained Effort

Meeting the targets for water quality long term, and reducing combined sewer overflows (CSOs) in the short term will take both community effort and financial effort.

The effort should be tied to infrastructure renewal. Although the City is built-out, it is constantly undergoing gradual re-construction as buildings, streets and infrastructure reach the end of their design-life.

At the current rate of redevelopment, a significant portion of New Westminster's single family buildings will be reconstructed by mid-century. The City's sewer separation program will also to or past mid-century before it is complete.
The timeline of implementing the Citywide ISMP is in the same scale – it will require a sustained effort in the range of 50 – 70 years before its recommendations are fully implemented in concert with building and infrastructure renewal.

Funding should vary by year and by the aggressiveness of the program. Based on analysis in ISMP Volume III Technical Background (internal), funding allocation over and above the existing sewer separation program will be required to:

- Support the Capacity-Building Program for staff and stakeholders that design, regulate, approve and deliver stormwater best practices.
- Support pilot projects – design, implementation and monitoring – to act as both training and proof of performance initiatives.
- Fund scientific monitoring as required by the Adaptive Management Framework.
- Provide pooled capital and operating/maintenance funds to allow detail design, construction and targeted maintenance of required stormwater retrofits and best practices on City streets and properties (see ISMP Volume III for maintenance assumptions).
- Fund the detail writing and adoption/phase-in of updated regulatory approaches to promote implementation of stormwater BMPs and enforcement efforts.
- Receive funds, and disburse grants or reductions in fees, related to stormwater incentive programs, both the Surface Parking Treatment program, and a potential Stormwater Reuse program.

Some of this budget might incorporate and enhance existing City funding e.g. catch-basin cleaning and cleaning of other structural best practices, as well as the sewer cross-connection program.



Stormwater catch-basin in New Westminster.

Short Term Organizational Development and Funding

The 'Phasing and Scheduling Strategy' in Figure I - 21 suggests that a 5 year effort may be necessary to 'start-up and phase-in' the implementation of proposed changes.

In reality, the City is already active in stormwater management. The proposed targets will bring new players, new roles, and a need for new understanding and training as a precedent to on-the-ground action. There are likely to be both education and awareness steps, as well as refined or new regulations and financing mechanisms that need to be put in place.

Figure I - 21: Phasing and Scheduling Strategy



Ongoing Stakeholder Consultation & Public Outreach

3

i

PHASE C: Expand Green Infrastructure (GI) into New Non-SF Projects

- Review options for a stormwater utility and for financial incentive programs.
- Require BMP application in new non-single family projects on private land.
- Upscale the amount of GI installations in local streets.
- Continue with public awareness programs and demonstration / capacity building.

ii

PHASE D: Expand Green Infrastructure to New One/Two Family / Lane Housing

- expand GI application to new One/Two Family Housing and Lane Housing, with the familiarity and standards gained in the above three phases now used to expand application or best practices into new construction in low density residential redevelopment.
- Provide SF-specific demonstration and public awareness programs.

iii

PHASE E: Expand Green Infrastructure to Retrofits

- expand application to retrofits, in recognition that implementing water quality improvements will need to address problems in existing surface parking and building sites.
- Incentive programs, financed by fees on untreated impervious area, are to be considered to speed adoption for retrofits.
- Expand public information and homeowner/small contractor training to facilitate implementation.

4

PHASE F: Long Term Aspirations

- Phase F would introduce incentives and programs for Stormwater Harvesting and Reuse, and for Absorbent Lanes.
- Public awareness programs, water quality monitoring and adaptive management programs would continue to allow fine-tuning.

Beyond Phase F, the programs would be fully active. Continuous improvement to the City's stormwater management is envisioned as a permanent objective, in recognition that full implementation will be achieved only over a building/street asset life cycle, which is in the range of 50 to 100 years (average 75 years).

The following Action Priorities table identifies tasks, roles, and implementation timetables, to be updated from time to time.

Table 1-1: New Westminster ISMP Action Priorities

ACTION	FUNDING	PRIORITY	LEAD AGENCY	RESOURCES (City)
PHASE A: IMMEDIATE AND ONGOING (YEARS 1 - 2)				S=small M=medium L=large
Implement Green Infrastructure (GI) team	Operating	Year 1	Inter-departmental	M
Catch basin cleaning action / awareness	Operating	Ongoing	Eng.:Operations	S
Cross connection control action / awareness	Operating	Ongoing	Eng.:Operations	S
Require Green Infrastructure (GI) in large rezonings	Operating	Ongoing	Eng: Services / Planning	S
Integrate GI demonstration/learning in current projects	Capital & Development	Ongoing	Eng: Services. / Parks	M
PHASE B: REMOVE BARRIERS, BUILD CAPACITY (YEARS 3 - 4)				
Green Infrastructure (GI) public awareness (stage one)	Operating	Year 2	Eng: Services (Env Services)	M
Identify priority areas for street GI implementation	Operating	Year 2	Eng: Services	S
Update Engineering standards to include GI	Operating	Year 2	Eng: Services	S
Plan for Water Quality Monitoring Program	Operating	Year 2	Eng: Services (Env Services)	M
City Off-Street Property GI demo / monitoring projects	Capital / Development	Ongoing	Eng: Services / Parks	S
PHASE C: EXPAND GREEN INFRASTRUCTURE INTO NEW NON-SF PROJECTS (YEARS 5 - 6)				
Review surface parking treatment fee / incentives options	Operating	Year 3	Eng: Services / Finance	S
Study stormwater utility admin system - future option	Operating	Year 3	Eng: Services / Finance	S
Street block GI demo / monitoring projects	Capital	Ongoing	Eng: Services	S
Parks site GI and biodiversity demo / monitoring projects	Capital	Ongoing	Parks / Eng: Services	S
Green Infrastructure (GI) public awareness (stage two)	Operating	Year 3	Eng: Services (Env Services)	S
Require GI in new MF ICI projects (update regs/policy)	Operating	Year 3	Eng: Services / Planning / Plumbing & Building	M
On-street surface parking treatment integrated with sewer separation	Capital	Ongoing	Eng: Services	L

Table 1-1: New Westminster ISMP Action Priorities (cont'd)

ACTION	FUNDING	PRIORITY	LEAD AGENCY	RESOURCES (City)
PHASE D: EXPAND GREEN INFRASTRUCTURE TO NEW ONE/TWO FAMILY / LANE HOUSING (YEARS 6 - 7)				S=small M=medium L=large
Green Infrastructure (GI) public awareness (stage three)	Operating	Year 4	Eng: Services (Env Services)	S
Private SF GI demo / monitoring projects	Capital / Development	Ongoing	Eng: Services / Planning / Plumbing & Building	S
Require GI in new Single Detatched/Duplex/Triplexes/ Laneway housing (update regs.)	Operating	Year 4	Eng: Services / Planning / Plumbing & Building	M
Water Quality Monitoring (baseline) at separated outfalls	Operating	Ongoing	Eng: Services (Env Services)	M
On-street surface parking treatment integrated with sewer separation	Capital	Ongoing	Eng: Services	L
PHASE E: EXPAND GREEN INFRASTRUCTURE TO RETROFITS (YEARS 8+)				
Green Infrastructure (GI) public multimedia (stage four)	Operating	Year 5	Eng: Services (Env Services)	S
Private surface parking GI demo / monitoring projects	Capital / Development	Ongoing	Eng: Services / Planning	S
Launch charges/incentives for GI in ex private surface parking	Operating	Year 5	Eng: Services / Finance	M
Water Quality Monitoring / Adapt to meet regulations	Operating	Ongoing	Eng: Services (Env Services)	M
On-street surface parking treatment integrated with sewer separation	Capital	Ongoing	Eng: Services	L
PHASE F: LONG-TERM ASPIRATIONS (YEARS 10+)				
Green Infrastructure (GI) public multimedia (stage five)	Operating	Year 6+	Eng: Services (Env Services)	S
Rainwater capture / reuse demo / monitoring projects	Capital	Ongoing	Eng: Services / Planning / Plumbing & Building	S
Launch incentives for rainwater capture/reuse	Operating	Year 6+	Eng: Services / Finance	M
Start Absorbent Lanes program	Operating	Year 6+	Eng: Services	M
Water Quality Monitoring / Adapt to meet regulations	Operating	Ongoing	Eng: Services (Env Services)	M
On-street surface parking treatment integrated with sewer separation	Capital	Ongoing	Eng: Services	L

Long-term Organizational Development and Funding

It is very important to get started on implementation of the Citywide ISMP Recommendations. Minor Supplements to existing funding can support that beginning.

For a sustained and long-term effort, it is recommended that the following funding strategies be investigated in more detail.

SHIFT TO POLLUTER PAY MODEL

The City is investing heavily in the sewer separation program, and that should support major reductions in the pollution associated with combined sewer overflows.

As stormwater is separated, and as it outfalls directly to river receiving waters, there will be a reduced, but still significant amount of pollution that is carried with the stormwater, if it is untreated.

The source of pollution in stormwater is widely spread – it is the surface parking areas, whether on-street or off-street, the manicured landscapes with excess nutrient runoff, the pet and wildlife feces, and sediment from construction operations.

To be fair to the city taxpayer, the costs of such pollution should be allocated to the source of the pollution. It is possible, with implementation of green infrastructure, to have a highly livable and high density City that has very low levels of pollution. The City should move to the principle of 'polluter pay', with both the public and private sector / homeowners contributing in measure to their pollution.

As a corollary, those who are not sources of pollution should pay significantly less than those who are polluting.

STORMWATER UTILITY

Other local governments (e.g. Halifax, Victoria) have implemented a distinct organization to administer stormwater management and funding – a stormwater utility. Similar to a water, energy, or communications utility, this administration would operate on a 'fee for service' basis. It would charge user fees based on a fair allocation of benefits and costs, with the total fees sufficient to make the utility self-sufficient with little or no subsidy from the property tax base.

In the City of Victoria, a primary reason for establishment of a stormwater utility was to provide a system of incentives for stormwater pollution control, financed by changes on untreated impervious area, similar to the parking area pollutions fees described below.

PARKING AREA POLLUTION FEES

An increasingly common approach by other local governments is to establish a fee that is calculated on the area of un-treated surface parking area on a parcel. The fee is calculated based on a combination of aerial imagery and building permit records. Areas of surface parking that have implemented green infrastructure water quality treatment would be exempt from the fee. Some parts of the revenue generated may be used for incentive funding to assist green infrastructure retrofits.

Taken together, this fee and incentive has the effect of encouraging retrofit of green infrastructure water quality treatment into existing surface parking areas. At the same time, it allows that some parcels may not wish to retrofit (e.g. being too small, or being slated for early redevelopment) and they would prefer to simply pay the fee, which in effect funds the implementation of water quality treatment in another location.

These types of fees utilize market forces to encourage change – and are often targeted at existing development, where the regulatory requirements associated with permitting for new development do not apply.

STORMWATER PARCEL TAX

A second approach to funding infrastructure separate from assessment-based property tax is to implement a function-specific parcel tax. These charge a fixed amount per year per parcel. The fee does not vary based on assessed value of the property. In effect, these fees do not penalize large or high value property owners – such as industry or larger commercial. Commonly a parcel tax is a small amount per property, which adds up to a substantial and sustainable fund for a specific purpose – like implementation of stormwater improvements – as opposed to general revenue. In that way the public is certain of the allocation of the tax. The parcel tax may also have a sunset arrangement – where it is set to expire after a stated time period.

As opposed to a stormwater utility or parking area pollution fees, a stormwater parcel tax does not follow the principle of polluter pay.

INTEGRATION WITH CLIMATE CHANGE AND RISK MANAGEMENT PROGRAMS

Climate Change and Risk Management Programs related to sea level rise, storm and flood risk, and drought risk will all require increasing attention and investment by all levels of government and the private sector.

The City of New Westminster's Citywide ISMP implementation should be watchful of how its funding could be integrated into larger risk management programs and senior government grants and incentives. There is much cross-over among objectives of the ISMP and actions that would make the city more resilient to climate change.

ADAPTIVE MANAGEMENT

Just as the water quality aspects of the ISMP should be subject to ongoing monitoring and adaptive management, we recommend that the funding and implementation action plan take a similar approach.

The lifespan of this program implementation should extend through the lifespan of a typical simple building – about 75 years. There will be much change – in technology, in precedents, in public attitudes, in climate – over those years. A review of priorities and programs is advised, at least once every five years.

7.0 WHAT CONSTITUTES SUCCESS?

New Westminster - one of the oldest cities in British Columbia, is rapidly becoming one of the leaders in livability and innovation. The Integrated Stormwater Management Plan is a key implementation tool for the City's Environment Strategy, Envision 32 Plan and Blue Dot Movement, and through its actions we expect New Westminster to become increasingly noteworthy for:

- Urban rivers that are alive with fish, amphibians, birds and marine mammals;
- Urban streets and developments that are resilient to climate change;
- A leading example of livable and sustainable urban design.

To quantify success, this Integrated Stormwater Management Plan includes specific targets and action programs for water quality improvements and stormwater runoff volume reduction.

The proposed Monitoring and Adaptive Management Strategy should be used to measure results on a regular basis, and the associated data will inform ISMP implementation updates to achieve target performance. Reporting on this performance will be important to senior government agencies overseeing the Metro Vancouver Integrated Waste and Resource Management Plan, and to stakeholders and the public.

Additional indicators may be summarized in a 'How are we doing' Dashboard, e.g.

- Ha or percentage of previous area;
- Percentage of tree canopy;
- Reduction in Combined Sewer Overflow (CSO) events;
- Number of Rain Garden, Infiltration Bulge or other water quality structures installed

The ISMP sets out a long term strategy. It's success will require gradual and sustained effort by both City forces and the private sector. The most effective implementation will be through integration of the ISMP best practices into on-going infrastructure and development projects as assets reach the end of their life cycle.

One of the ISMP's greatest challenges, and its greatest success if achieved, will be an improved cross-discipline and public understanding of the design, construction and maintenance of green infrastructure throughout the city's parks, streets, institutions and private land holdings.

Success will be gained through the entire community taking up a role to protect New Westminster's water and watersheds and the quality of life and urban biodiversity that our abundant and valuable stormwater supports.

Assumptions and Limitations

The analysis and recommended actions in this document are based on review of currently available information, and are in accordance with current planning and engineering practice.

Readers should note the following limitations:

I. Maps and quantities shown are based on 'sample areas' that are representative of the pattern of conditions across the study area. Actual total quantities may vary.

II. Where unit costs or quantities are shown, these are approximate 2014 dollars CDN suitable for comparison of options, and based on little or no site information, and therefore only accurate within a range of plus or minus 30% (Class D). No warranty is implied or given on accuracy of quantities or unit costs for any given project.

III. Mapping is based on data and polygons from a variety of sources, and is schematic in nature. No warranty is made as to accuracy of map information.

IV. Infiltration rates discussed are theoretical based on typical rates in assumed soil conditions, sufficient for general option comparison and policy guidance. Users are advised to gain site-specific hydrotechnical advice as a basis for detail design.

V. Where design detail guidelines are provided, the information is intended as an introduction. Readers are guided to the technical reference documents listed as References in ISMP Volume III: Technical Background (internal) for more information. In all cases, it is required that professional site-specific design and construction management advice be sought to customize application of these best practices to a specific site and land use situation.



Plan view of typical single family lots calculating areas of applied stormwater best management practices.

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Public art in Toronto Place Park (New Westminster).

NEW WESTMINSTER

LANARC