

Public Works and Transportation Committee

Council Chambers, City Hall 6911 No. 3 Road

Tuesday, June 22, 2021 4:00 p.m.

PWT-6

MINUTES

Motion to adopt the minutes of the meeting of the Public Works and Transportation Committee held on May 18, 2021.

NEXT COMMITTEE MEETING DATE

July 20, 2021, (tentative date) at 4:00 p.m. in Council Chambers

PLANNING AND DEVELOPMENT DIVISION

1. REPORT BACK ON TRAFFIC BYLAW NO. 5870 AMENDMENTS - ENGINE BRAKES AND CYCLIST CROSSWALK REGULATIONS (File Ref. No. 12-8060-02-01) (REDMS No. 6668527)

PWT-12

See Page PWT-12 for full report

Designated Speaker: Sonali Hingorani

Pg. # ITEM

STAFF RECOMMENDATION

That the staff report titled "Report Back on Traffic Bylaw No. 5870 Amendments - Engine Brakes and Cyclist Crosswalk Regulations" dated April 30, 2021, from the Director, Transportation, be received for information.

2. PROPOSED E-SCOOTER PILOT PROJECT

(File Ref. No. 02-0745-01) (REDMS No. 6161753)

PWT-14

See Page PWT-14 for full report

Designated Speaker: Sonali Hingorani

STAFF RECOMMENDATION

- (1) That the E-Scooter Pilot Project (the Project) as described in the staff report titled "Proposed E-Scooter Pilot Project" dated May 18, 2021 from the Director, Transportation, be endorsed;
- (2) That should the Province of BC approve the Project and designate Richmond as a pilot community within the Electric Kick Scooter Pilot Project Regulations, staff implement the Project;
- (3) That the following Amendment Bylaws to allow the use and enforcement of e-scooters in Richmond during the Project be introduced and given first, second and third reading:
 - (a) Traffic Bylaw No. 5870, Amendment Bylaw No. 10272,
 - (b) Public Parks and School Grounds Regulation Bylaw No. 8771, Amendment Bylaw No. 10274,
 - (c) Municipal Ticket Information Authorization Bylaw No. 7321, Amendment Bylaw No. 10275; and
 - (d) Notice of Bylaw Violation Dispute Adjudication Bylaw No. 8122, Amendment Bylaw No. 10276.

3.	UPDATE	\mathbf{ON}	GEORGE	MASSEY	CROSSING	PROJECT
	(File Ref. No. 1	0-6350-06	-03) (REDMS No.	6682130)		

PWT-28

See Page **PWT-28** for full report

Designated Speaker: Donna Chan

Pg. # ITEM

STAFF RECOMMENDATION

That the report titled "Update on George Massey Crossing Project" dated June 7, 2021 from the Director, Transportation be received for information.

ENGINEERING AND PUBLIC WORKS DIVISION

4. ANNUAL REPORT 2020: RECYCLING AND SOLID WASTE MANAGEMENT – SAFE AND SEAMLESS SERVICE DELIVERY (File Ref. No. 10-6370-01) (REDMS No. 6653817)

PWT-38

See Page PWT-38 for full report

Designated Speaker: Suzanne Bycraft

STAFF RECOMMENDATION

That the annual report titled, "Annual Report 2020: Recycling and Solid Waste Management – Safe and Seamless Service Delivery" dated June 7, 2021, from the Interim Director, Public Works Operations, be endorsed and be made available to the community on the City's website and through various communication tools including social media channels and as part of community outreach initiatives.

5. ELECTRIC VEHICLE ADOPTION - YOUTH OUTREACH INITIATIVE

(File Ref. No. 02-0780-01) (REDMS No. 6652879)

PWT-108

See Page PWT-108 for full report

Designated Speaker: Suzanne Bycraft

STAFF RECOMMENDATION

That the report titled 'Electric Vehicle Adoption - Youth Outreach Initiative', from the Interim Director, Public Works Operations, dated June 7, 2021, be received for information.

Pg. # ITEM

6. HELP CITIES LEAD INITIATIVE

(File Ref. No. 10-6125-07-02) (REDMS No. 6664795)

PWT-114

See Page PWT-114 for full report

Designated Speaker: Norm Connolly

STAFF RECOMMENDATION

That, as described in the report titled 'Help Cities Lead Initiative' from the Director, Sustainability & District Energy, letters be sent to Metro Vancouver; the Ministry of Environment and Climate Change Strategy; the Ministry of Municipal Affairs; the Attorney General's Office; the Ministry Responsible for Housing; the Ministry of Energy, Mines and Low-Carbon Innovation; and the Ministry of Finance, asking them to expand regulatory and program tools that local governments can adopt to facilitate greenhouse gas emission reductions.

7. HABITAT ENHANCEMENT OPPORTUNITIES FOR DIKE IMPROVEMENT PROJECTS

(File Ref. No. 10-6150-00) (REDMS No. 6397282)

PWT-144

See Page **PWT-144** for full report

Designated Speaker: Chad Paulin

STAFF RECOMMENDATION

- (1) That, as described in the staff report titled 'Habitat Enhancement Opportunities for Dike Improvement Projects', dated May 19, 2021, from the Director, Sustainability and District Energy and Director, Engineering:
 - (a) An agreement with the Department of Fisheries and Oceans Canada to establish a Fish Habitat Bank be endorsed;
 - (b) A public communication plan and stakeholder consultation program be developed; and
 - (c) The impacts to service levels and the capacity of existing resources to absorb these activities be monitored and should there be a need for additional staffing resources, staff submit the request for consideration in the annual budget process.

Publi	Public Works & Transportation Committee Agenda – Tuesday, June 22, 2021				
Pg. #	ITEM				
	8.	DIKE MASTER PLAN PHASE 4 – PUBLIC AND STAKEHOLD ENGAGEMENT (File Ref. No. 10-6060-01) (REDMS No. 6429884)	ER		
PWT-152		See Page PWT-152 for full report			
		Designated Speaker: Jason	Но		
		STAFF RECOMMENDATION			
		That, as outlined in the staff report titled "Dike Master Plan Phase Public and Stakeholder Engagement", dated May 20, 2021, from Director, Engineering, the public and stakeholder engagement program endorsed.	the		
		COUNCILLOR ALEXA LOO			
ADDED	9.	SPECIALTY CROSSWALKS (File Ref. No.) (REDMS No.)			
PWT-267		See Page PWT-267 for background information			
	10.	MANAGER'S REPORT			
		ADJOURNMENT			





Public Works and Transportation Committee

Date:

Tuesday, May 18, 2021

Place:

Council Chambers Richmond City Hall

Present:

Councillor Chak Au, Chair

Councillor Alexa Loo (by teleconference) Councillor Linda McPhail (by teleconference) Councillor Michael Wolfe (by teleconference)

Call to Order:

The Chair called the meeting to order at 4:00 p.m.

MINUTES

It was moved and seconded

That the minutes of the meeting of the Public Works and Transportation

Committee held on April 20, 2021, be adopted as circulated.

CARRIED

NEXT COMMITTEE MEETING DATE

June 22, 2021, (tentative date) at 4:00 p.m. in Council Chambers

AGENDA ADDITIONS & DELETIONS

The Chair noted that Item No. 5 - 2020 Climate Action Revenue Incentive Program and Corporate Carbon Neutral Progress Report, was pulled from the agenda.

It was moved and seconded

That:

- Hamilton Traffic Calming be added to the agenda as item No. 6A;
- Light Fixtures on Roads be added to the agenda as item No. 6B;

- Road Improvements at Shell Road and Williams Road be added to the agenda as item No. 6C; and
- Garbage Pickup Around the City be added to the agenda as item No.
 6D.

CARRIED

PLANNING AND DEVELOPMENT DIVISION

1. CYCLING NETWORK PLAN UPDATE - PROPOSED PHASE 1 ENGAGEMENT

(File Ref. No. 02-0775-50-6708) (REDMS No. 6669210)

In reply to queries from Committee, staff noted that (i) images of new bike path designs can be provided, (ii) a survey will be made available to students in all grades, (iii) the survey captures changes in cycling trends during the pandemic, (iv) bike facility designs include various materials, and (v) the proposed public engagement activities will coincide with Bike Month in June.

It was moved and seconded

- (1) That the proposed Phase 1 engagement activities to support the update of the Cycling Network Plan, as described in the report titled "Cycling Network Plan Update Proposed Phase 1 Engagement," dated April 1, 2021 from the Director, Transportation, be endorsed for implementation; and
- (2) That staff be directed to report back on the results of the Phase 1 engagement.

CARRIED

2. TRANSLINK 2021 COST-SHARE PROGRAMS - SUPPLEMENTAL APPLICATION

(File Ref. No. 01-0154-04) (REDMS No. 6643926)

It was moved and seconded

That as described in the report titled "TransLink 2021 Cost-Share Programs – Supplemental Application" dated April 1, 2021 from the Director, Transportation:

- (a) the cycling-related project recommended for cost-sharing as part of the TransLink 2021 BICCS Recovery Program be endorsed;
- (b) should the above project receive final approval from TransLink, the Chief Administrative Officer and General Manager, Planning and Development be authorized to execute the funding agreements and the Consolidated 5 Year Financial Plan (2021-2025) be updated accordingly; and

staff be directed to implement the project approved by TransLink and (c)report back as part of the City's proposed applications to TransLink's 2022 Cost-Share Programs.

CARRIED

SIDEWALK WIDTH STANDARDS FOR MAJOR AND MINOR 3. ARTERIAL ROADS

(File Ref. No. 10-6360-03-01) (REDMS No. 6641372)

In reply to queries from Committee, staff noted that (i) various treatments, depending on site conditions are used when completing sidewalks, (ii) the City's proposed recommendations are in range of other municipal requirements, (iii) the development industry will be informed of changes pending Council approval, and (iv) public consultation is not recommended.

It was moved and seconded

That staff be directed to update the City of Richmond's Engineering Design Specifications to increase the sidewalk width from 1.5m to 2.0m on arterial roadways, as described in the report titled "Sidewalk Width Standards for Major and Minor Arterial Roads" dated April 6, 2021 from the Director, Transportation.

CARRIED

ENGINEERING AND PUBLIC WORKS DIVISION

MULTI-FAMILY WATER METER PROGRAM AND WATER 4. CONSERVATION **INITIATIVES** UPDATE

(File Ref. No. 10-6060-02-01) (REDMS No. 6664046)

In reply to queries from Committee, staff noted that (i) statistics on leak detection is tracked and communicated to property owners in a timely manner, (ii) there is no trend in strata complexes that have not saved money, and (iii) there is no noticeable difference between strata complexes with pools versus without.

It was moved and seconded

That staff bring forward options and recommendations for a mandatory Multi-Family Water Meter Program for consideration as part of the 2022 Utility Budgets and Rates report.

CARRIED

2020 CLIMATE ACTION REVENUE INCENTIVE PROGRAM AND 5. CORPORATE CARBON NEUTRAL **PROGRESS** REPORT

(File Ref. No. 10-6125-05-01) (REDMS No. 6657682)

Please see page 1 for action on this item.

6A HAMILTON TRAFFIC CALMING

(File Ref. No.)

In reply to queries from Committee, staff noted that information on past traffic calming surveys conducted in the area can be provided.

6B LIGHT FIXTURES ON ROADS

(File Ref. No.)

In reply to queries from Committee, staff noted that (i) discussions are taking place with BC Hydro regarding options for less bright lights, (ii) back shades can be installed on lights to prevent light trespassing, (iii) the City follows standards set by the Illuminating Engineering Society and American Medical Association, (iv) generally lights on power poles are BC Hydro owned and aluminum lamp posts are City-owned, and (v) a memo will be provided to Council outlining more detailed lighting options.

6C ROAD IMPROVEMENTS AT SHELL ROAD AND WILLIAMS ROAD (File Ref. No.)

In reply to queries from Committee, staff noted that the construction of traffic signals is expected to begin in summer 2021, with an expected completion date of March 2022.

6D GARBAGE PICKUP AROUND THE CITY

(File Ref. No.)

In reply to queries from Committee, staff noted that (i) there has been an increase in park use and litter creation in the past year, (ii) the City has taken measures to adjust to the increased litter volume, and (iii) the City is adapting its service and standards to keep up with increase in park use due to the pandemic.

6. MANAGER'S REPORT

(i) Peak Freshet Season

Staff noted that (i) snow pack levels in the Fraser Basin as of May 1, 2021 were at 109% of normal for this time of year, (ii) current stream flows are normal, (iii) current peak flow forecast is 9000 cubic metres per second, and (iv) staff will continue to monitor and provide committee with a summary report at the end of the freshet season.

In response to queries from Committee, staff noted that the City's flood protection systems handled the May 17, 2021 heavy rainfall event well, with no known significant issues arising.

(ii) Closure of George Massey Tunnel

Staff noted that the Province plans to close the George Massey Tunnel in both directions for two nights from 10:00 p.m. to 4:00 a.m. on Friday, May 28, 2021, and Saturday, May 29, 2021 for scheduled maintenance. Staff advised that signage will be set up in advance to notify drivers of the closure.

In response to queries from Committee, staff noted that the purpose of the closure is to test the tunnel's fire suppression system and overhead lane control signals.

In response to further queries from Committee, staff noted that (i) there is no update on the George Massey Tunnel replacement project, and (ii) regular updates have not been provided by the Ministry of Transportation.

Discussion ensued with regard to an update on the status of the tunnel replacement project, and as a result of the discussion, the following **referral motion** was introduced:

It was moved and seconded

That staff provide an update on the George Massey Tunnel replacement project at the June 22, 2021 Public Works and Transportation Committee meeting.

CARRIED

(iii) Intersection Cameras Update

Staff highlighted that as of May 18, 2021, the City has activated all 110 traffic intersection cameras as part of the approved phase 1 and 2 of the Intersection Traffic Camera Program.

ADJOURNMENT

It was moved and seconded *That the meeting adjourn (4:46 p.m.).*

CARRIED

	Certified a true and correct copy of the Minutes of the meeting of the Public Works and Transportation Committee of the Council of the City of Richmond held on Tuesday, May 18, 2021.
Councillor Chak Au Chair	Shannon Unrau Legislative Services Associate



Report to Committee

To:

Public Works and Transportation Committee

Date:

April 30, 2021

From:

Lloyd Bie, P.Eng.

Director, Transportation

File:

12-8060-02-01/2021-

Vol 01

Re:

Report Back on Traffic Bylaw No. 5870 Amendments - Engine Brakes and

Cyclist Crosswalk Regulations

Staff Recommendation

That the staff report titled "Report Back on Traffic Bylaw No. 5870 Amendments - Engine Brakes and Cyclist Crosswalk Regulations" dated April 30, 2021, from the Director, Transportation, be received for information.

Lloyd Bie, P.Eng.

Director, Transportation

(604-276-4131)

REPORT CONCURRENCE				
ROUTED TO: CONCUR		RENCE	CONCURRENCE OF GENERAL MANAGER	
RCMP Community Bylaws	<u>v</u>		pe Erceg	
SENIOR STAFF REPORT REVIEW	1h	NITIALS:	APPROVED BY SAO	

Staff Report

Origin

At the June 22, 2020 Council meeting, the following resolution was adopted on consent:

(4) That Traffic Bylaw No. 5870, Amendment Bylaw No. 10184 and Municipal Ticket Information Authorization No. 7321, Amendment Bylaw No. 10185 be reviewed in 12 months' time.

This report provides the requested review.

This report supports Council's Strategic Plan 2018-2022 Strategy #1 A Safe and Resilient City:

Enhance and protect the safety and well-being of Richmond.

1.4 Foster a safe, caring and resilient environment.

Analysis

Review of Bylaw Amendments

Traffic Bylaw No. 5870, Amendment Bylaw No. 10184, to prohibit the use of engine brakes on municipal roads in Richmond and permit cyclists to ride in crosswalks with elephant's feet markings received final adoption on July 13, 2020. At the same time, Municipal Ticket Information Authorization No. 7321, Amendment Bylaw No. 10185, to assign a fine for the prohibited use of engine brakes on municipal roads in Richmond, also received final adoption.

Over the past year, Richmond RCMP did not undertake any joint enforcement with City Bylaws specifically for engine brakes. The RCMP has been prioritizing safety enforcement of the provincial health orders and traffic safety over noise-related complaints during the COVID pandemic. During this time, neither staff nor Richmond RCMP recorded any engine brake noise complaints. However, one complaint regarding the use of engine brakes was received by a Councillor. Staff are also not aware of any concerns with respect to permitting cyclists to ride in crosswalks with elephant's feet without the need to post signage at those locations.

Financial Impact

None.

Conclusion

Staff will continue to monitor any concerns related to the use of engine brakes or permitting cyclists to ride in crosswalks with elephant's feet and, should any be received, will respond appropriately.

Sonali Hingorani, P.Eng. Transportation Engineer

(604**-**276-4049)

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Ed Warzel

E. Wazel

Manager, RCMP Administration (604-207-4767)

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Report to Committee

To:

Public Works and Transportation Committee

Date:

May 18, 2021

From:

Lloyd Bie, P.Eng.

Director, Transportation

File:

02-0745-01/2021-Vol

01

Re:

Proposed E-Scooter Pilot Project

Staff Recommendation

- 1. That the E-Scooter Pilot Project (the Project) as described in the staff report titled "Proposed E-Scooter Pilot Project" dated May 18, 2021 from the Director, Transportation, be endorsed;
- 2. That should the Province of BC approve the Project and designate Richmond as a pilot community within the Electric Kick Scooter Pilot Project Regulations, staff implement the Project;
- 3. That the following Amendment Bylaws to allow the use and enforcement of e-scooters in Richmond during the Project be introduced and given first, second and third reading:
 - (a) Traffic Bylaw No. 5870, Amendment Bylaw No. 10272,
 - (b) Public Parks and School Grounds Regulation Bylaw No. 8771, Amendment Bylaw No. 10274,
 - (c) Municipal Ticket Information Authorization Bylaw No. 7321, Amendment Bylaw No. 10275; and
 - (d) Notice of Bylaw Violation Dispute Adjudication Bylaw No. 8122, Amendment Bylaw No. 10276.

Lloyd Bie, P.Eng.

Director, Transportation

(604-276-4131)

REPORT CONCURRENCE				
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER		
Parks Services Community Bylaws RCMP Law Sustainability and District Energy	Image: control of the control of th	pe Erceg		
SENIOR STAFF REPORT REVIEW	Initials:	APPROVED BY CAO		

Staff Report

Origin

In October 2019, amendments to the provincial Motor Vehicle Act were enacted that gave the Province the ability to establish a regulatory framework to support the use of increasingly diverse modes of personal transportation. The framework allows for pilot projects in communities to test motorized personal mobility technologies such as electric kick scooters, also known as escooters.

At the November 20, 2019 Public Works and Transportation Committee, staff were directed to:

"study the regulation of electric scooter sharing and parking and any related regulatory amendments that may be necessary to facilitate the introduction of dockless electric scooters sharing in Richmond (pending provincial regulatory approvals) and report back at the same time as the forthcoming March 2020 bike-sharing pilot."

Since late 2019, staff have been working with the Province to create the pilot e-scooter program and to have Richmond included as a pilot community within the provincial framework. On March 22, 2021, the Province announced the Active Transportation Electric Kick Scooter Pilot Project Regulations that allow the provincial government to partner with communities to assess e-scooters. To be considered for the pilot program, Council's endorsement of participation and enactment of required bylaw amendments are required. This report seeks to fulfil these requirements and responds to the above referral.

This report supports Council's Strategic Plan 2018-2022 Strategy #2 A Sustainable and Environmentally Conscious City:

Environmentally conscious decision-making that demonstrates leadership in implementing innovative, sustainable practices and supports the City's unique biodiversity and island ecology.

2.2 Policies and practices support Richmond's sustainability goals.

This report supports Council's Strategic Plan 2018-2022 Strategy #4 An Active and Thriving Richmond:

An active and thriving community characterized by diverse social and wellness programs, services and spaces that foster health and well-being for all.

4.1 Robust, affordable, and accessible sport, recreation, wellness and social programs for people of all ages and abilities.

This report supports Council's Strategic Plan 2018-2022 Strategy #6 Strategic and Well-Planned Growth:

Leadership in effective and sustainable growth that supports Richmond's physical and social needs.

6.3 Build on transportation and active mobility networks.

Analysis

Motor Vehicle Act Micromobility Pilot Projects

In January 2020, the Ministry of Transportation and Infrastructure (the Ministry) released its Pilot Project Proposal Package for communities interested in establishing pilot projects to test motorized personal mobility technologies such as electric kick scooters, known as e-scooters (Figure 1). Pilot projects can have a maximum term of three years.

In accordance with the provincial process, staff submitted an Expression of Intent (EOI) on January 31, 2020 followed by the submission of a more detailed Pilot Project Proposal on March 6, 2020 to permit the operation of e-scooters in Richmond.



Figure 1: E-Scooter User

This report addresses the Provincial Cabinet requirements for implementation of the Project:

- Council consent to participate in the Province of BC's Motor Vehicle Act Micromobility Pilot Projects Program in partnership with the Ministry; and
- The City's proposed Project including the required bylaw amendments being approved by Provincial Cabinet.

Generally, the regulations for e-scooters are similar to those for bicycles and e-bicycles; a notable exception is the maximum speed of 24 km/h for e-scooters versus 32 km/h for e-bicycles (Table 1). Municipalities have the ability to further regulate how and where e-scooters can travel on municipal roadways via bylaw, such as setting speed restrictions and establishing rules on e-scooter use on different types of facilities.

Table 1: Summary of Provincial E-Scooter Pilot Project Regulations

Category	Description
Device Specifications	 Powered solely by one or more electric batteries Up to four wheels (1-2 wheels in front, 1-2 wheels at rear) with platform for standing Maximum speed of 24 km/h Continuous power output rating that in total does not exceed 500 W Equipped with bell or horn Front white or amber light and rear red light when operated between ½ hour after sunset and ½ hour before sunrise No seating
Area of Operation	 Designated roads and off-street pathways in a pilot community, in accordance with the provincial regulation and bylaws of the pilot community On streets with speed limit of 50 km/h or less: in a designated cycling lane or as near as possible to the right side of the street On streets with speed limit greater than 50 km/h: only in a designated cycling lane Not permitted on sidewalks unless allowed by pilot community's bylaw

Category	Description	
User	Must be 16 years of age or older	
Requirements	Must wear a helmet	
	Do not need to hold a driver's licence	
	Must not carry passengers or ride abreast	

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Overview of Richmond Proposed E-Scooter Pilot Project

The Project supports a new low carbon mobility option for Richmond residents, employees and visitors, and encourages transit use with a solution for the first and last mile trip. The goal is to provide a safe, convenient and fun personal mobility option for residents that reduces private automobile use, promotes active transportation and transit use, enhances connectivity, and allows multi-modal access to employment, recreation areas and services. With a potential shared escooter system, the devices can be integrated in future mobility hubs to enhance user access. Through monitoring and evaluation, the Project is an opportunity to understand the safety of escooters, impacts on the public realm, potential for travel mode shift, and community perceptions that in turn will help inform future micromobility and active transportation initiatives.

Staff propose that e-scooters be permitted to operate on selected roadways and off-street pathways. The following Project operational parameters beyond those of the provincial regulations are based on research to date on e-scooter operations in cities in Canada and around the world, discussion with e-scooter share operators, and consultation with Richmond RCMP, Vancouver Coastal Health, and the Richmond Active Transportation Committee.

Operating Conditions

While e-scooters may be viewed as similar to bicycles or e-bicycles, these are new devices and a restrained approach of permitting where the devices can operate on public roadways is appropriate for a pilot project employing new technology. Staff therefore propose that e-scooters be permitted to operate on:

- streets with designated cycling facilities,
- local streets defined as a street without lane lines or a directional dividing line with a speed limit of 50 km/h or less,
- streets with a directional dividing line and a maximum speed of 30 km/h, and
- off-street paved pathways next to the roadway or in parks that are signed or marked for shared use.

At the time of writing this report, the recommended operating areas are similar to those being considered in other Metro Vancouver municipalities participating in the provincial pilot program that intend to permit the operation of privately-owned e-scooters. Consistent with the provincial regulations, e-scooters will not be permitted on sidewalks. Staff further recommend that escooters not be permitted on unpaved trails due to safety concerns regarding the stability of the devices on uneven surfaces.

The facilities where e-scooters may operate will be defined by amendments to Traffic Bylaw No. 5870 and Public Parks and School Ground Regulations Bylaw No. 8771 as described in further detail below.

Research indicates that a common risk factor for e-scooter injuries is speed. Staff recommend that the maximum speed limit for on-street facilities be 20 km/h, which is the average speed of a typical cyclist. To minimize conflicts between motorized e-scooters and other users of off-street facilities due to higher differential speeds, the maximum speed limit will be reduced to 15 km/h on off-street pathways that may be shared with pedestrians (e.g., Railway Greenway). When on shared pathways where pedestrians are present, the provincial regulations require users to operate the e-scooter at a speed that does not exceed pedestrian traffic except when passing.

Safety and Enforcement

Research shared by Vancouver Coastal Health identifies the following key safety factors for escooter users:

- lack of helmet use.
- illegal sidewalk riding,
- higher operating speed, and
- riding while under the influence of alcohol or drugs.

The areas of operation and the lower operating speeds are additional mitigative measures designed to address potential safety concerns beyond the provincial regulations. Similar to bicycle regulations, the enforcement of e-scooter regulations when riding will be provided by Richmond RCMP.

Staff are also exploring a partnership with Preventable for a safety education campaign regarding the use of e-scooters. Preventable is a nation-wide, multi-partner non-profit organization that undertakes social marketing campaigns focused on raising awareness of preventable injuries and changing attitudes and actions that directly lead to those injuries.

Monitoring and Evaluation

Following provincial approval of a municipality's pilot program, the Ministry requires that municipalities provide an annual report related to the use and operation of e-scooters. At the one-year anniversary of the launch of the Project, staff will report back to Council with a status update for endorsement prior to submission to the Province to fulfill its monitoring and evaluation reporting requirements including:

- the extent to which e-scooter use promotes active transportation,
- the safety of e-scooter users and other road users,
- compliance with and enforcement of the provincial regulations and the bylaws of the pilot community, and
- the provision and use of e-scooter rental services and their regulation by the pilot community.

Data from various sources will be collected and analyzed to enable a data-led decision-making process to address any concerns that arise and inform any modifications to the Project (Table 2). The Let's Talk Richmond platform will be used to seek broad community input and feedback. Transportation will be the main point of contact for public comments or concerns.

Source Data **Purpose** Ridership Number of people are using e-scooters Where and when people are travelling Destinations Length of trip City, shared service Trip routing operator Why and how people are using e-scooters User & Public Surveys Public's opinion of e-scooters Number, why and when people are injured Shared service operator, Safety Monitoring Types of injuries Vancouver Coastal Health

Table 2: Data Sources to Support Monitoring and Evaluation

Proposed Bylaw Amendments

The following bylaw amendments are required to permit the operation of e-scooters on City roadways and property as a pilot within the framework of the provincial regulations. Collectively, the proposed bylaw amendments bring into force the new provincial regulations relating to e-scooters and enable enforcement in Richmond.

Traffic Bylaw No. 5870

The proposed amendments will allow e-scooters on roads with bike lanes, local roads, roads with a 30 km/h speed limit, and shared pathways within the City road right-of-way. The proposed amendments also regulate maximum speeds on different facilities and allow e-scooters users to ride in a crosswalk marked with elephant's feet similar to cyclists.

An additional amendment is proposed to address concerns the City has received regarding the speed of pedal bicycles and electric motor-assisted cycles (e-bikes) on pathways within the City road right-of-way that are shared with pedestrians. The speed differential with pedestrians can generate conflicts. Staff therefore propose that pedal bikes and e-bikes be limited to a maximum speed of 15 km/h on shared pathways.

While the Motor Vehicle Act already restricts riding on sidewalks, at the request of Richmond RCMP, a further bylaw amendment is proposed to explicitly prohibit bicycles, e-bikes and e-scooters from riding on the sidewalk unless otherwise signed.

Public Parks and School Grounds Regulation Bylaw No. 8771

Motorized e-scooters are currently prohibited from operating on trails and paths within City parks or school grounds. The proposed amendments will permit the use of motorized e-scooters on paved greenways and pathways in City parks that are signed as shared use facilities. These pathways include the Railway Greenway, the Middle Arm Greenway, and Imperial Landing Park. E-scooters will not be permitted on pathways within school grounds as these facilities are typically not wide enough to safely accommodate shared uses. Staff will work with the School District to address any concerns that may arise. If adopted, the proposed amendment will require modification of existing signage on pathways to reflect that e-scooters are now permitted, and new signage on pathways that are currently not signed for shared use.

Similar to the Traffic Bylaw amendment, an additional amendment is proposed to govern the speed of pedal bicycles and electric motor-assisted cycles (e-bikes) on park pathways and trails

shared with pedestrians. Pedal bikes and e-bikes will be limited to a maximum speed of 15 km/h on shared pathways and trails.

Municipal Ticket Information Authorization Bylaw No. 7321 and Notice of Bylaw Violation Dispute Adjudication Bylaw No. 8122

The proposed amendments will allow enforcement of the Traffic Bylaw and Public Parks and School Grounds Regulation Bylaw amendments with associated fine amounts. The proposed fine amounts for the Municipal Ticket Information Authorization Bylaw No. 7321 are consistent with those for similar violations by cyclists as defined in the regulations of the provincial Offence Act. The proposed fine amounts for the Notice of Bylaw Violation Dispute Adjudication Bylaw No. 8122 are consistent with those for similar violations of regulations within the Public Parks and School Grounds Regulation Bylaw.

Request for Proposals (RFP) to Operate Shared E-Scooter System

An RFP for the development and operation of a pilot public e-scooter share program by a third party was issued by the City on April 29, 2021 with a closing date of May 26, 2021. Following evaluation of the proposals received, a staff report will be presented in September 2021 with a recommendation for next steps.

Financial Impact

The cost to revise existing signage and install new signage on paved greenways and pathways to allow the operation of e-scooters on these facilities can be accommodated within an existing approved capital account.

Conclusion

Participation in the Province's Active Transportation Electric Kick Scooter Pilot Project will support the City's mobility targets and GHG emission and carbon reduction goals consistent with the Official Community Plan and the Community Energy and Emission Plan 2020-2050 Directions. Staff recommend that e-scooters be permitted to operate in Richmond on selected roadways and off-street paved pathways. Overall, the pilot project provides an opportunity for the City and the Province to research, test and evaluate the safety and efficiency of e-scooters to support cleaner and more sustainable transportation.

Joan Caravan Transportation Planner (604-276-4035)

J Caravan

Sonali Hingorani, P.Eng. Transportation Engineer (604-276-4049)

Loui Amin

JC:lce



Traffic Bylaw No. 5870 Amendment Bylaw No. 10272

The Council of the City of Richmond enacts as follows:

1. **Traffic Bylaw No. 5870**, as amended, is further amended at Section 1.2 by adding the following definitions in their appropriate place:

Bicycle Lane means a lane reserved for cyclists by signage, pavement

markings or both, and includes a paved shoulder separated

from the travel lane by a white edge line.

Designated Shared Pathway means a two-way off-street paved pathway designated by

signage, pavement markings or both for shared use by

cyclists and pedestrians.

E-Scooter means an electric kick scooter as set out in the *Electric*

Kick Scooter Pilot Project Regulation, as amended or

replaced from time to time.

Local Street means the roadway, but not the sidewalk or boulevard

portion, of a street that does not have lane lines or

directional dividing lines.

Motor Assisted Cycle has the meaning set out in the *Motor Vehicle Act*, as

amended or replaced from time to time.

2. **Traffic Bylaw No. 5870**, as amended, is further amended by deleting Section 29.5 and replacing it with the following:

- 29.5 No person shall ride a bicycle or **e-scooter** in a marked crosswalk, unless it is also marked by two lines of intermittent squares (elephant's feet) on one or both sides of the crosswalk, or it is otherwise signed to permit cycling.
- 3. **Traffic Bylaw No. 5870**, as amended, is further amended by deleting Section 29.6 and replacing it with the following:
 - 29.6 Any person riding a bicycle or **e-scooter** in a marked crosswalk also marked by two lines of intermittent squares (elephant's feet) on one or both sides of the crosswalk, or otherwise signed to permit cycling, must yield the right-of-way to any pedestrians in the marked crosswalk.

- 4. **Traffic Bylaw No. 5870**, as amended, is further amended by adding a new Section 29.7 as follows:
 - 29.7 A person may not operate a bicycle, **motor assisted cycle** or **e-scooter** on a sidewalk unless otherwise directed by a sign.
- 5. **Traffic Bylaw No. 5870**, as amended, is further amended by adding a new Section 29.7 as follows:
 - 29.8 A person may not operate a bicycle or **motor assisted cycle** on a **designated** shared pathway at a speed exceeding 15 km/h.
- 6. **Traffic Bylaw No. 5870**, as amended, is further amended by adding a new Section 29.8 as follows:
 - 29.9 A person may operate an e-scooter:
 - (a) on any bicycle lane, local street and the roadways shown in Schedule B, which is attached and forms part of this Bylaw, at a speed not to exceed 20 km/h; and
 - (b) on a designated shared pathway at a speed not to exceed 15 km/h.
- 7. This Bylaw is cited as "Traffic Bylaw No. 5870, Amendment Bylaw No. 10272."

FIRST READING		CITY OF RICHMOND
SECOND READING		APPROVED for content by originating dept.
THIRD READING		US
ADOPTED		APPROVED for legality by Solicitor
MAYOR	CORPORATE OFFICER	



Public Parks and School Grounds Regulation No. 8771 Amendment Bylaw No. 10274

The Council of the City of Richmond enacts as follows:

- 1. Public Parks and School Grounds Regulation No. 8771 is amended at Section 2.3.1 by adding a new Section 2.3.1 (d) as follows:
 - (d) operate a bicycle or **motor assisted cycle** at a speed exceeding 15 km/h in any **public park** or **school ground**.
- 2. **Public Parks and School Grounds Regulation No. 8771** is amended by adding a new Section 2.3.3 as follows:
 - 2.3.3 A person must not operate an e-scooter in any public park or school ground:
 - (a) except for a designated shared pathway in a public park; and
 - (b) at a speed exceeding 15 km/h.
- 3. Public Parks and School Grounds Regulation No. 8771 is amended at Section 8.1 by adding the following definitions in their appropriate place:

E-Scooter	means an electric kick scooter as set out in the <i>Electric</i>

Kick Scooter Pilot Project Regulation, as amended or

replaced from time to time.

Motor Assisted Cycle has the meaning set out in the *Motor Vehicle Act*, as

amended or replaced from time to time.

Designated Shared Pathway means a two-way off-street paved pathway designated by

signage, pavement markings or both for shared use by

cyclists and pedestrians.

FIRST READING	- A London Control of the Control of	CITY OF RICHMOND
SECOND READING		APPROVED for content by originating dept.
THIRD READING		APPROVED
ADOPTED		for legality by Solicitor
		<u> </u>
MAYOR	CORPORATE OFFICER	

4. This Bylaw is cited as "Public Parks and School Grounds Regulation No. 8771, Amendment Bylaw No. 10274."



Municipal Ticket Information Authorization Bylaw No. 7321 Amendment Bylaw No. 10275

The Council of the City of Richmond enacts as follows:

1. Municipal Ticket Information Authorization Bylaw No. 7321, as amended, is further amended at SCHEDULE B 12A by adding the following in the appropriate numbered order of Column 2:

SCHEDULE B 12A

TRAFFIC BYLAW NO. 5870

Column 1	Column 2	Column 3
Offence	Bylaw Section	Fine
Operation of bicycle, motor assisted cycle or escooter on sidewalk	29.7	\$95
Operation of bicycle or motor assisted cycle on shared pathway at speed exceeding 15 km/h	29.8	\$95
Operation of e-scooter on highway outside of designated locations	29.9(a)	\$95
Operation of e-scooter on highway in designated locations at speed exceeding 20 km/h	29.9(a)	\$95
Operation of e-scooter on shared pathway in designated locations at speed exceeding 15 km/h	29.9(b)	\$95

2. This Bylaw is cited as "Municipal Ticket Information Authorization Bylaw No. 7321, Amendment Bylaw No. 10274."

FIRST READING		CITY OF RICHMOND
SECOND READING		APPROVED for content by originating dept.
THIRD READING		US
ADOPTED		APPROVED for legality by Solicitor
MAYOR	CORPORATE OFFICER	



Notice of Bylaw Violation Dispute Adjudication No. 8122 Amendment Bylaw No. 10276

The Council of the City of Richmond enacts as follows:

1. Notice of Bylaw Violation Dispute Adjudication No. 8122, as amended, is further amended in Schedule A at Schedule - Public Parks and School Grounds Regulation Bylaw No. 8771 by adding the following in the appropriate numbered order of Column A3 Section:

Schedule – Public Parks and School Grounds Regulation Bylaw No. 8771 Designated Bylaw Contraventions and Corresponding Penalties								
A1 Bylaw	A2 Description of Contravention	A3 Section	A4 Compliance Agreement Available	A5 Penalty	A6 Early Payment Option	A7 Late Payment Amount	A8 Compliance Agreement Discount	
Public Parks and School Grounds Regulation Bylaw No. 8771	Period of Time from Receipt (inclusive)		n/a	29 to 60 days	1 to 28 days	61 days or more	n/a	
	Operating a bicycle or motor assisted cycle at a speed exceeding 15 km/h	2.3.1(d)	No	\$ 150.00	\$ 125.00	\$ 175.00	n/a	
	Operating an e- scooter in an unauthorized area	2.3.3(a)	No	\$ 150.00	\$ 125.00	\$ 175.00	n/a	
	Operating an e- scooter at a speed exceeding 15 km/h	2.3.3(b)	No	\$ 150.00	\$ 125.00	\$ 175.00	n/a	

FIRST READING		CITY OF RICHMOND
SECOND READING		APPROVED for content by originating dept.
THIRD READING		UB
ADOPTED		APPROVED for legality by Sollcitor
MAYOR	CORPORATE OFFICER	

2. This Bylaw is cited as "Notice of Bylaw Violation Dispute Adjudication No. 8122, Amendment Bylaw No. 10276."



Report to Committee

To: Public Works and Transportation Committee **Date:** June 7, 2021

From: Lloyd Bie, P.Eng. File: 10-6350-06-03/2021-

Director, Transportation Vol 01

Re: Update on George Massey Crossing Project

Staff Recommendation

That the report titled "Update on George Massey Crossing Project" dated June 7, 2021 from the Director, Transportation be received for information.

Lloyd Bie, P.Eng.

Director, Transportation

(604-276-4131)

Att. 2

REPORT CONCURRENCE					
ROUTED To: Communications Intergovernmental Relations & Protocol U	CONCURRENCE ☑ Jnit ☑	CONCURRENCE OF GENERAL MANAGER			
Parks Services Engineering Sustainability & District Energy	7 7 9				
SENIOR STAFF REPORT REVIEW	INITIALS:	APPROVED BY CAO			

Staff Report

Origin

At the May 18, 2021 meeting of the Public Works and Transportation Committee, the following resolution was carried:

That staff provide an update on the George Massey Tunnel replacement project at the June 22, 2021 Public Works and Transportation Committee meeting.

This report responds to the referral. A chronology of major milestones is provided in Attachment 1.

This report supports Council's Strategic Plan 2018-2022 Strategy #5 Sound Financial Management:

Accountable, transparent, and responsible financial management that supports the needs of the community into the future.

5.4 Work cooperatively and respectfully with all levels of government and stakeholders while advocating for the best interests of Richmond.

This report supports Council's Strategic Plan 2018-2022 Strategy #6 Strategic and Well-Planned Growth:

Leadership in effective and sustainable growth that supports Richmond's physical and social needs.

6.3 Build on transportation and active mobility networks.

Analysis

Long-Term Crossing Solution

The Province announced the replacement of the George Massey Tunnel in September 2012. In February 2017, the Ministry of Transportation and Infrastructure (the Ministry) was issued an Environmental Assessment Certificate to permit the construction and operation of a 10-lane bridge to replace the George Massey Tunnel, and to construct other highway and interchange improvements on Highway 99 in Richmond and Delta. During that time, the previous George Massey Tunnel Replacement Project and the scope of the proposed changes to the Steveston Interchange delayed the City's design and construction of the Gardens Agricultural Park.

In October 2017, the Ministry announced an independent technical review of the Tunnel corridor (the Review) and cancellation of the procurement process for construction of the 10-lane bridge. Following release of the Review in December 2018, the Ministry undertook consultation with regional municipalities and First Nations to identify new criteria and goals for a crossing that better aligns with regional plans. Two public information sessions were held in February 2020 as an update on the George Massey Crossing Project. Two options were presented: a new immersed eight-lane tunnel and a new eight-lane long-span bridge (Attachment 2).

The Ministry submitted business cases for the tunnel and bridge options to the Minister of Transportation and Infrastructure (the Minister) in December 2020 for a decision on the preferred technology for the long-term crossing solution. After five months, the business cases are still being reviewed by both the Minister and the Minister of State for Infrastructure. Despite repeated requests by staff, the the Ministry Project Team has not provided any update on the process or a scheduled date for the decision on the preferred technology.

The Province's Budget 2021 released in April 2021 identifies \$7.5 billion in transportation investments over the next three years that includes notional funding for "a final decision on the scope, budget, delivery and schedule for the George Massey Crossing and interim works projects." However, there is no comprehensive item in the current provincial budget. Media reports at the time indicated that the Province made a funding request to the federal government.

Since the release of the Review in December 2018, the Ministry has undertaken safety improvements to the existing tunnel and initiated scoping work on proposed interim improvements to address traffic congestion and safety issues along Highway 99, and improve transit and cycling connections. The status of these safety-related and interim projects is described below.

Safety and Reliability Improvements

In December 2018, the Ministry announced the following suite of safety improvements at the existing crossing to be undertaken from 2019 through 2020 at an estimated cost of \$40 million. Periodic partial and complete tunnel closures have been required during night-time hours to accommodate the work.

- Resurfacing and line painting on Highway 99 between Steveston Highway and the Highway 17 Interchange, which was completed in November 2019.
- The following safety improvements were initiated in mid-May 2020 and are now substantially complete with the contractor working on deficiency list items:
 - o Improving tunnel drainage to reduce the risk to drivers from pooling water and ice on the road at tunnel entrances.
 - o Converting tunnel and roadway lighting to the LED standard to increase visibility.
 - o Upgrading the fire alarm, fire door, ventilation, and electrical systems to ensure reliability and ongoing safety within the tunnel.

Interim Improvements

The Ministry also announced in December 2018 the initiation of scoping work for four interim improvements as preliminary solutions to help alleviate congestion on Highway 99 while planning for a long-term solution for the George Massey Crossing continues. Over the past two and a half years, staff have participated in discussions with the Ministry Project Team regarding the interim improvements located in Richmond. An overview of each interim improvement is provided below.

While scoping work and preparation of the tender documents are progressing on the interim improvements, funding for construction of the four projects has not been approved by the provincial Treasury Board. The Ministry Project Team cannot share any information on the timing of Treasury Board's review of the projects as Treasury Board dates and agendas are Cabinet confidential. The Ministry Project Team have indicated that the next opportunity for funding

approval is by the end of spring 2021. Should funding be approved, the Ministry Project Team intends to provide an overview of the projects to Richmond and Delta Councils and proceed with the procurement process, mobilization and construction.

Richmond: Steveston Highway-Highway 99 Interchange Improvements

This project will twin the existing Steveston Highway overpass. The new structure is anticipated to be located north of the existing overpass and the resulting five lane cross-section will comprise two eastbound lanes and three westbound lanes including a dedicated westbound to southbound left-turn lane (Figure 1). Additional improvements include:

- Northbound Off-ramp: dual left-turn lanes from northbound to westbound.
- Southbound Off-ramp: dual right-turn lanes from southbound to westbound.
- Active Transportation: enhanced pedestrian access to bus stops on the twinned overpass and on southbound Highway 99, and a multi-use pathway on each side of the twinned overpass.

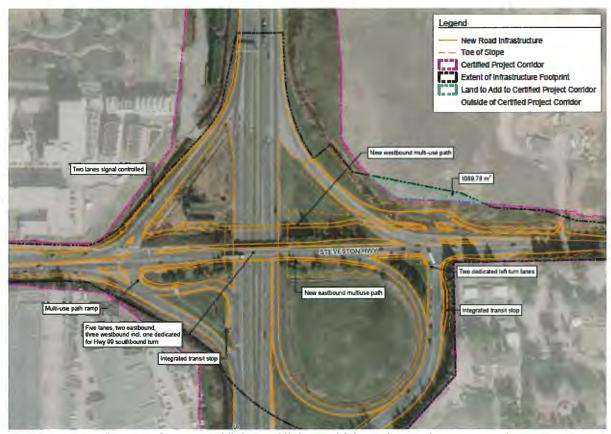


Figure 2: Steveston Highway-Highway 99 Interchange Improvements

It has been 2.5 years since the Ministry's December 2018 announcement that scoping work would begin immediately. While the work appears to be complete, funding for design and construction of the project has not been approved as of the time this report was written. The Ministry Project Team has indicated that the next opportunity for securing funding for the Steveston Interchange will be before the end of spring (June 20, 2021) and the project could be completed by summer 2025 if funding is approved at that time. If funding is not approved this spring it is likely the project will be

further delayed. As such, staff recommend that Council urge the Province to fund and implement this important project as quickly as possible if funding is not approved on or before June 20, 2021.

Richmond: Bridgeport Road Southbound Bus-Only On-Ramp to Highway 99

This project will improve bus speed and reliability by providing a new transit-only southbound connection from eastbound Bridgeport Road to the Sea Island Way on-ramp to southbound Highway 99 (Figure 2). Regional bus routes operating from Bridgeport Canada Line Station to south of the Fraser River will be redirected from Sea Island Way to Bridgeport Road thereby shortening the trip length and time spent in mixed traffic.

The project includes realignment and widening of the existing on-ramp, a new transit priority signal where the bus lane crosses Sea Island Way and active transportation improvements comprising new multi-use pathways. The improvements are wholly within Ministry right-of-way. Should provincial funding approval be granted in spring 2021, the Ministry Project Team estimates that the Bridgeport Road project will be completed in summer 2022.

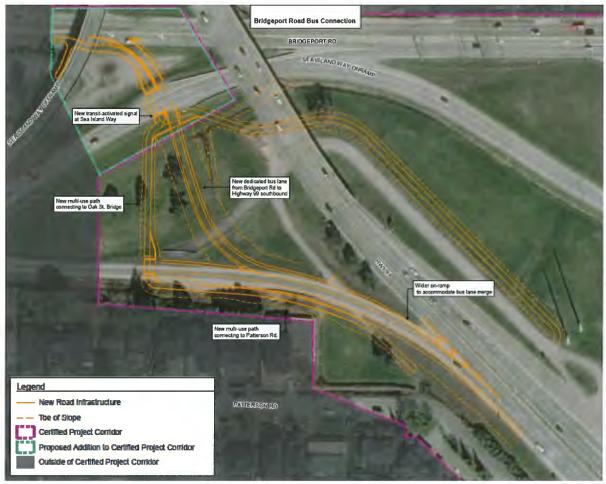


Figure 1: Bridgeport Road Southbound Bus-Only On-Ramp to Highway 99

Delta: Highway 17A-Highway 99 Interchange Improvements

The improvements will add lanes to improve transit connections and bicycle infrastructure upgrades (Figure 3). The project components include:

- Highway 99 northbound off-ramp widening for approximately 400 m to add a second lane for transit priority;
- Highway 99 northbound on-ramp widening for approximately 130 m to add a second lane for transit/HOV priority;
- Highway 17A widening and lane reconfiguration for approximately 550 m to support reconfiguration of the eastbound lanes for transit/HOV priority;
- Improvements to the Ministry's bicycle shuttle pullout on Highway 17A; and
- Improvements to cycling facilities along Highway 17A.



Figure 3: Highway 17A-Highway 99 Interchange Improvements

Delta: Extension of Highway 99 Shoulder Bus Lanes

This project extends the bus-on-shoulder facilities on Highway 99 between Highway 17A and Highway 10 (Figure 4):

- Northbound: from north of Highway 10 to current start of HOV lane on Highway 99 (2.5 km)
- Southbound: from Highway 17A to Highway 17 (3.5 km)
- Southbound: from Highway 17 to Highway 10 (3.5 km)

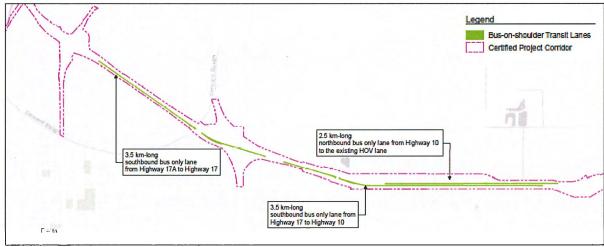


Figure 4: Extension of Highway 99 Shoulder Bus Lanes

Proposed Amendments to Approved Environmental Assessment Certificate

To enable construction of the interim improvements, the Ministry is seeking amendments to the approved Environmental Assessment Certificate (EAC) issued under the BC Environmental Assessment Act in February 2017 as part of the George Massey Tunnel Replacement Project. The proposed amendments have two key purposes as summarized in Table 1.

Purpose	Scope
Make Minor Alterations to Certified Project Corridor	 Add lands required for the Bridgeport Road-Highway 99 improvements: approximately 4,500 m² of existing highway right-of-way. Add lands required for the Steveston Interchange improvements: 1,000 m² of private land in the Agricultural Land Reserve on the north side. In association with this addition, there is 12,000 m² of land on the same property that is no longer required for the project.
Change Scope of what can be Included in Site Preparation in Advance of Construction	Add the following language to the definition of activities that may proceed ahead of full completion of all pre-construction requirements in the EAC: "It also includes roadway and structure construction and utility works in four priority areas of the Certified Project Corridor: Steveston and Highway 17A interchanges, Bridgeport on-ramp, and bus priority lanes between highways 17 and 10. Site Preparation and Advance Construction does not include works to initiate or construct the Fraser River crossing."

The application process included a month-long public consultation period that closed on April 24, 2021. The Ministry will use the comments to develop its amendment application to the Environmental Assessment Office. Once submitted, the review process is anticipated to take four to six months.

Financial Impact

None.

Conclusion

The process to replace the George Massey Tunnel extends back to September 2012 under the previous provincial government. The new provincial government elected in October 2017 restarted the process and now, nearly four years later, there is still no decision regarding the technology of the new crossing. The business cases regarding the preferred option has been with the Minister for five months without any update to the City or other stakeholders. In the interim, staff continue to engage with the Ministry Project Team and advocate for the City's interests regarding the Richmond-based components of the Phase 1 improvements of the Massey Crossing Project and the long-term Phase 2 solution.

Donna Chan, P.Eng., PTOE Manager, Transportation Planning (604-276-4126) Joan Caravan Transportation Planner (604-276-4035)

JC:jc

Att. 1: Recent Activities for George Massey Crossing Project

2: Phase 2: Options for Long-Term Solution

Major Milestones for George Massey Crossing Project

Date	Activity
Sep 2012	Premier announces George Massey Tunnel (the Tunnel) to be replaced
Sep 2013	Premier announces the Tunnel to be replaced with bridge in the same corridor
	Ministry of Transportation and Infrastructure (the Ministry) releases Project Definition Report with detailed Project scope: 10-lane bridge
Dec 2015	 new Steveston Hwy and Hwy 17A interchanges median HOV/transit lanes decommission Tunnel
Feb 2017	EA certificate issued for Project and ALC application approved
Sep 2017	Ministry announces independent technical review (the Review) of the Tunnel corridor and cancellation of procurement process for construction of 10-lane bridge
Sep 2018	Review delivered to the Minister of Transportation and Infrastructure (the Minister)
Dec 2018	Minister releases Review of the George Massey Tunnel Replacement
Oct 15, 2019 General Purposes Committee	 Ministry's project team presents concepts of crossing options: Deep Bored Tunnel Immersed Tube Tunnel Long Span Bridge Committee endorses a new 8-lane immersed-tube tunnel including two dedicated transit lanes with a multi-use path as the preferred option for purposes of public engagement. Committee also supports a request to the Province to develop further plans to improve transit along the entire Highway 99 corridor to enhance
Nov 2019	transit speed, reliability and capacity. Immersed tube tunnel unanimously endorsed by Metro Vancouver Board as the preferred option
Feb 2020	Ministry's project team conducts public engagement on two short-listed options: 8-lane bridge 8-lane immersed tube tunnel
Sept 15, 2020 UBCM	City discussion with then Minister Claire Trevena requesting confirmation of an immersed tube tunnel as the preferred option and to expedite the work to ensure all construction for the new crossing completed by 2025-2026
Dec 2020	Business case completed and received by new Minister Rob Fleming following provincial election
Feb 5, 2021	Metro Vancouver George Massey Crossing Task Force, which reports to the Finance and Inter-government Committee of the Metro Vancouver Board, convenes closed meeting with Ministry staff
Apr 25, 2021	Media reports that a draft funding request and the draft business case were submitted to the federal government
May 25, 2021	Ministry submits application to BC Environmental Assessment Office for administrative amendment to approved Environmental Assessment Certificate for the George Massey Tunnel Replacement Project

Options for Long-Term Solution

Immersed Tube Tunnel Concept

Key Considerations:

- Separated and covered multi-use pathways
- · Similar grade as bridge
- · Low property impact
- Improved connectivity within Deas Island Regional Park
- In-river impacts during construction
- Potential for in-river habitat enhancement
- Ventilation system designed to modern standards
- Emergency systems designed to modern standards, including fire detection, response and communications
- · Shorter crossing, compared to bridge
- · Comparable cost to bridge

Est. Schedule:

- 3 years for environmental review
- 5 years for construction





Long-span Bridge Concept

Key Considerations:

- · Separated multi-use pathways
- · Similar grade as tunnel
- Land-side property impacts, including Deas Island Regional Park
- No piers in the Fraser River; however, piers required in Deas Slough
- Long-term noise, light, visual and shading effects
- · Local construction expertise
- Longer crossing, compared to a tunnel
- Comparable cost to immersed tube tunnel

Est. Schedule:

- 1–2 years for environmental review
- 5 years for construction







Report to Committee

To:

Public Works and Transportation Committee

Date:

June 7, 2021

From:

Suzanne Bycraft

File:

10-6370-01/2021-Vol

Interim Director, Public Works Operations

01

Re:

Annual Report 2020: Recycling and Solid Waste Management - Safe and

Seamless Service Delivery

Staff Recommendation

That the annual report titled, "Annual Report 2020: Recycling and Solid Waste Management – Safe and Seamless Service Delivery" dated June 7, 2021, from the Interim Director, Public Works Operations, be endorsed and be made available to the community on the City's website and through various communication tools including social media channels and as part of community outreach initiatives.

Suzanne Bycraft

Interim Director, Public Works Operations

(604-233-3338)

Att. 1

REPORT CONCURRENCE		
CONCURRENCE OF GENERAL MANAGER		
Jh hing		
SENIOR STAFF REPORT REVIEW	INITIALS:	
SEMONSTALL REPORT REVIEW	Mo	
APPROVED BY CAG		

Staff Report

Origin

This report highlights the City's success in maintaining essential waste management services in spite of challenges stemming from COVID-19 and presents the City's annual progress toward sustainable waste management to support a circular economy as outlined in the attached "Annual Report 2020: Recycling and Solid Waste Management – Safe and Seamless Service Delivery."

This report supports Council's Strategic Plan 2018-2022 Strategy #2 A Sustainable and Environmentally Conscious City:

Environmentally conscious decision-making that demonstrates leadership in implementing innovative, sustainable practices and supports the City's unique biodiversity and island ecology.

- 2.1 Continued leadership in addressing climate change and promoting circular economic principles.
- 2.2 Policies and practices support Richmond's sustainability goals.

This report supports Council's Strategic Plan 2018-2022 Strategy #8 An Engaged and Informed Community:

Ensure that the citizenry of Richmond is well-informed and engaged about City business and decision-making.

8.1 Increased opportunities for public engagement.

Analysis

The City's Sustainability Framework and vision for a circular economy involves maximizing the value of resources by design, through responsible consumption, minimizing waste and reimagining how resources flow in a sustainable, low carbon economy. To support this vision, the City provides a range of reduction, recycling and waste management services to residents, making it easy for materials to be re-used and recycled multiple times into new products. To promote involvement and utilization of these services, the City has an extensive range of communication and outreach initiatives to raise awareness and engage citizens.

In 2020, thanks to seamless service delivery during the pandemic, Richmond residents continued to recycle and reduce waste. "Annual Report 2020: Recycling and Solid Waste Management – Safe and Seamless Service Delivery" (the Report) presents the City's annual progress update (Attachment 1). The Report summarizes Richmond's measures to deliver its full range of services safely and highlights the major renovation of the Recycling Depot. The Report also includes detailed program information, insights into upcoming initiatives and a comprehensive tips and resources section.

2020 Highlights

The Report highlights Richmond's responsible leadership to take quick action to implement measures to help ensure services would continue without interruption while also keeping front-line workers safe. In addition to delivering seamless service, the City completed a major renovation of the Richmond Recycling Depot, increased the number of items accepted, implemented its Food Recovery Network Program, and continued to see increased recycling and waste diversion.

Report 2020 Overview

The 2020 Report contains four sections – the first two sections provide an overview of the past year, including highlights for 2020, details and statistics on the City's waste management programs and services, and key planned initiatives for 2020. The Report's next two sections provide details on the many programs and services that support sustainable waste management, and a comprehensive tips and resources guide that provides more information on where to recycle, dispose or donate various household items.

The following is a summary overview of each section:

Section 1: Annual Outlook provides an overview of the achievements in 2020, including:

- The City completed a major renovation of the Richmond Recycling Depot and expanded the list of accepted items to include baby car seats, automotive batteries and fire extinguishers. The Recycling Depot remained opened and fully operational during the upgrade. It was extremely busy that the volume of materials accepted exceeded last year's volume by about 1,300 tonnes.
- The City provided continuous and uninterrupted recycling and waste management services despite the challenges presented by COVID-19. Key measures taken to ensure service continuity included measures to keep front line workers safe, public communications to promote proper handling of waste hygiene materials, and addressing increased volumes of materials due to work from home trends.
- Richmond's Single Use Plastic and Other Items Bylaw No. 10000 was approved by the provincial government, and staff continued to monitor decisions and actions by the federal and provincial government as well as industry activities as part of assessing and planning for how to support business when the bylaw is implemented in 2021.
- The City completed its Food Recovery Network Pilot Program to bring together local food businesses with charities and farmers into a connected and efficient food system. The pilot results far surpassed expectations.
- In response to health and safety restrictions, the City adjusted its outreach to begin
 implementing online workshops and the development of a virtual video tour of the
 Recycling Depot.

Of note during 2020 was the appreciation expressed by the public toward sanitation front line workers who were continuing to provide essential services during the pandemic. Many thank you notes and chalk drawings were found expressing thanks for continued and consistent delivery of the City's waste management services.

Section 2: Tracking Our Progress provides statistics and data on the broad range of programs and services the City offers residents to responsibly reduce, recycle or dispose of their household items. Highlights for each program show their contribution to residents in single-family homes achieving 79.3% waste diversion.

Through the Green Cart programs, residents diverted 24,280.81 tonnes of food scraps and yard trimmings from the landfill. The residential Blue Box and Blue Cart programs diverted 8,279.35 tonnes of recyclable material, while the Richmond Recycling Depot captured a total of 5,956.29 tonnes of materials. The Large Item Pick Up program completed 13,872 service requests, equating to 933 tonnes of materials collected (19,140 items collected) – 709 tonnes of which were recycled. Through outreach and customer service, staff assisted residents with 16,177 customer service calls, garbage bins were inspected 12,153 times per month and serviced 16,911 times per month, for a combined 348,773 bin visits per year. This timely and consistent collection was especially important due to contaminated items like masks, gloves and tissues being disposed in public bins. The Richmond Recycling app and its Recycling Wizard service continue to provide enhanced service, with 15,396 active collection reminders and 60,664 Recycling Wizard searches.

The Food Recovery Network Pilot exceeded expectations in almost all areas with 59 participating organizations, 414,555 kg of food diverted, 644,800 meals created, \$2.2 million saved and 17,532 kg of food for animal feed.

Section 3: Programs and Services describes the City's comprehensive recycling and waste reduction programs, tips on how to recycle correctly with each service, and how recycling and reducing waste can support a circular economy and the City's sustainability goals. This section also includes information on litter collection, public spaces recycling, event recycling, and community and school engagement programs.

Section 4: Tips and Resources highlights community resources and partnerships that support sustainable waste management, and provides a recycling and disposal directory for details on where to recycle banned and hazardous materials.

Moving Forward

Through partnerships and community engagement, the City will continue to implement new initiatives to make it easier and more convenient for residents to recycle their household waste and support a circular economy. Key focus areas in 2021 will include:

Subject to timing impacts associated with COVID-19, work with businesses and the
community to implement the Single-Use Plastic and Other Items Bylaw No. 10000 and
continue to raise awareness about the issue of single-use plastic and better options that
help reduce waste.

- Continue providing enhanced service at the Richmond Recycling Depot by expanding operational days to seven days a week (in effect January 2, 2021).
- Launch a Recycling Depot 'virtual tour' video on Earth Day (www.richmond.ca/depot).
- Create a virtual Repair Fair to promote repair and reuse in the community.
- Subject to timing impacts associated with COVID-19, complete a detailed review and scope assessment related to enhanced recycling options for the commercial sector.
- Continue annual updates to the Illegal Dumping Overview and Strategy as part of moving towards innovative approaches to mitigate illegal dumping in the City.

Additionally, targeted measures will also be undertaken to address reports from Recycle BC relating to material contamination caused by improper recycling material sorting by residents. Key challenges relate to proper segregation of glass and placement of non-program materials in recycling bins (including butane cylinders, plastic toys, batteries, Styrofoam, etc.). Measures to be undertaken may include a review of barriers to proper sorting of recyclable materials, continued targeted education campaigns, and potentially material audits.

Opportunities to pursue new initiatives relating to plastic waste and circular economy concepts will also be evaluated, with pilot projects undertaken where feasible (e.g. sea bin technology, etc.).

Proposed Communication

Subject to Council's direction, "Annual Report 2020: Recycling and Solid Waste Management – Safe and Seamless Service Delivery" will be made available on the City's website and through various communication tools including social media channels as part of community outreach initiatives.

Financial Impact

None.

Conclusion

Through the "Annual Report 2020: Recycling and Solid Waste Management – Safe and Seamless Service Delivery", the City is providing its residents with an annual progress report on the many recycling and waste management programs and services delivered in the community. By tracking progress and waste diversion, the City is demonstrating Richmond's commitment to responsive services, responsible government and accessible information and communication.

Suzanne Bycraft Interim Director, Public Works Operations (604-233-3338)

SJB:lh

Att. 1: City of Richmond Recycling and Solid Waste Management Report 2020 - Safe and Seamless Service Delivery

City of Richmond Recycling and Solid Waste Management

REPORT 2020

SAFE AND SEAMLESS SERVICE DELIVERY





The globe at popular Larry Berg Flight Path Park reminds us of our place in the world and the broad impact Richmond can achieve through its sustainability efforts.

Charting Our Path Toward a Sustainable Community

Every department and business unit at the City of Richmond is, in some way, involved in our community and the global effort to be more sustainable and reduce environmental impacts. To support this mandate, the City is striving to be a sustainable and healthy island community that meets the needs of the present without compromising the ability of future generations to meet their own needs. It is a place where people live, work, and prosper in a welcoming, connected, accessible and vibrant environment.

In Richmond, the health of the community is sustained through participation in activities that support long-term economic, social and environmental well-being.

Sustainable waste management is integral to achieving this vision and supporting a circular economy, where the materials we buy are used, reused and recycled multiple times into new products to reduce reliance on raw materials.

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Environmental Programs is responsible for residential garbage and recycling services, including collection, drop-off services at the Richmond Recycling Depot, public spaces recycling and litter collection services.

We strive to help create more sustainable waste management through our programs and services to support a circular economy. We believe that it is our responsibility to support our community and preserve our planet for future generations.

Through outreach and engagement, working with our residents and local businesses, and partnering with local agencies, we also strive to meet and exceed all regional waste diversion goals by continuously expanding our programs and service offerings.

SAFE AND SEAMLESS SERVICE DELIVERY



1.0 Annual Outlook

Success stories in 2020 included seamless service delivery, safe front-line workers and a major renovation at the Recycling Depot.

During 2020, the City of Richmond continued to provide uninterrupted services like curbside and centralized collection, large item pick up and litter management, and the Recycling Depot remained fully operational – even while undergoing a major renovation.

This was achieved despite the challenges presented by the COVID-19 pandemic, which required the implementation of measures to keep front-line workers safe to maintain ongoing high quality service for residents. A communications strategy was developed to promote proper preparation of hygiene materials by residents and processes put in place for the handling of increased volumes of waste and recycling generated by the surge in individuals working from home. This was particularly true for the City's Recycling Depot, which experienced more than a 30 percent increase in the volume of materials received.

Since its opening in 1993, the Recycling Depot has consistently expanded the types of items accepted as part of its free drop-off service for Richmond residents. As the list of accepted items continued to increase, it became evident that the site needed to be reorganized and renovated to make room for new materials and provide for efficient collection. This renovation work took place between June and October, and significant improvements were incorporated. (See *Renovating the Recycling Depot* on page 9.) With these improvements, the City has created one of the largest one-stop recycling centres in the region to make it even easier and more convenient for residents to recycle household items.

LET'S RETHINK WASTE

It's time to rethink waste to help shift to a circular economy, where the materials we use stay in circulation to be used, reused and recycled multiple times into new products.

The City also saw great outcomes to support more sustainable food measures through its Food Recovery Network Pilot Program. Over the pilot period from November 2019 to November 2020, the City collaborated with FoodMesh to build a regional Food Recovery Network, bringing together local food businesses with charities and farmers into a connected and efficient food system. Through the network, businesses with surplus food were able to safely and easily divert that food to those who could put it to good use — whether to charities for meals or farmers for animal feed and compost. The pilot program also included community outreach to raise awareness about the program and how to get involved. The phenomenal results of the program far surpassed expectations. (See Food Recovery Network on page 24.)

While the City completed these projects and provided uninterrupted services in many areas, the majority of the regular events and outreach activities like the Richmond Repair Fair, recycling workshops and Recycling Depot tours had to be cancelled when in-person meetings were restricted due to the pandemic. The City adjusted by developing virtual workshops for the community and is exploring how to leverage these tools in the future. As well, the City initiated the creation of a virtual tour video of the newly renovated Recycling Depot.

The City also recognized that businesses were experiencing significant challenges from the restrictions. In response, it postponed two key initiatives – the ban on single-use plastic and a review of commercial recycling – in order to evaluate the impacts of COVID-19 health regulations. In the interim, staff began formulating strategies for ways to set businesses up for success when the initiatives are implemented in 2021.

The Single-Use Plastic and Other Items Bylaw No. 10000 will ban the use of plastic straws, plastic checkout bags and foam food service ware. The extensive first phase of outreach for Bylaw 10000 wrapped up at the end of 2019, with a goal to move forward following approval by the Ministry of Environment and Climate Change Strategy. In March 2020 (announced in September 2020), Richmond was among the first municipalities to receive provincial government approval of its bylaw to ban single-use plastic. However, local businesses were experiencing significant challenges due to COVID-19 at the time, so a decision was made to postpone the adoption and implementation of Bylaw 10000 to 2021. Staff continued to monitor decisions by the federal and provincial governments on the issue to anticipate how these actions could affect Richmond businesses, and what the City could do to support a successful transition to better options. Looking ahead to 2021, Richmond will continue to implement a comprehensive communications and education program to support businesses in the transition to better options and inform the community about how they can positively impact our environment and help reduce reliance on single-use plastics.

A similar assessment was done to determine the viability of completing the commercial recycling services review. Due to the significant decrease in restaurant and retail business activity, any review of current waste and recycling would not be an accurate reflection of the waste generated with regular business levels. As well, most commercial operators were focused on business continuity measures. Instead, the City focused on how to help position this study to move ahead in 2021.

Both the ban on single-use items and the commercial recycling services review are linked to the City's Sustainability Framework and vision for a circular economy that maximizes the value of resources by design, through responsible consumption, minimizing waste and reimagining how resources flow in a sustainable, low carbon economy. To further support this vision, the City will be implementing a range of community engagement and outreach initiatives in 2021 to help raise awareness about the circular economy, the many recycling options available for residents, and the importance of reducing waste overall. Through its "Let's Rethink Waste" campaign, residents are encouraged to select reusable products, repair household items and share or donate materials rather than dispose of them.

While 2020 was a challenging year, the City was able to maintain its service levels and residents continued to recycle and demonstrate their commitment to diverting waste from the landfill. Looking ahead, the City looks forward to seeing progress towards its goals to ban single-use plastics, reduce waste, recycle correctly and consistently, and support measures that create a more sustainable and healthy community.

HOW RESIDENTS CAN HELP SUPPORT A CIRCULAR ECONOMY

1. STOP

Rethink what you're putting in the garbage. Can it be recycled, donated or reused?



2. REDUCE

Reduce waste by choosing reusable options, repairing items and avoiding single-use products such as bottles, film wrap, plastic bags and Polystyrene foam (e.g. Styrofoam) containers.

4. RECYCLE

Keep food scraps and food-soiled paper out of the garbage, and recycle other materials through City collection services, the Recycling Depot and take-back programs (See page 53).

3. REUSE

Donate used items in good condition so they can be reused.

1.1 2020 Top Accomplishments

While focusing on delivering services during the COVID-19 pandemic, the City continued to promote recycling and waste reduction. This report showcases some of the key achievements in 2020, as well as looking back on the City's top accomplishments over the last 30 years.

RECYCLING MILESTONES

Looking back to the 1990s and the past decade, there have been many accomplishments that have helped Richmond reach its goals.

Launched Blue Box program

1990

Launched backyard compost bin distribution program

1992

Launched Blue Cart program

1995

Launched Green Can program

2010

1991

Opened parking lot recycling depot at 5599 Lynas Lane 1993

Launched Blue Cart pilot program for multi-family complexes

Opened Richmond Recycling Depot at 5555 lymas Lane

1996

Launched weekly curbside yard trimmings collection 2011

Launched Food Scraps pilot program for townhomes

1 RECYCLING DEPOT RENOVATION

Completed major upgrades at the Recycling Depot to improve convenience, make it easier to navigate, and provide shelter from the weather under the new canopy and a dedicated classroom for our "Let's Recycle Correctly" workshops and outreach.

2 EXPANDED ITEMS

Added new accepted items at the Recycling Depot, including motor oil and antifreeze, smoke and carbon monoxide alarms, fire extinguishers and lead-acid batteries used in vehicles.

SINGLE-USE BYLAW APPROVED BY PROVINCE

Received provincial approval of the Single-Use Plastic and Other Items Bylaw No. 10000. 4 GREEN AMBASSADOR VIRTUAL PROGRAM

Transitioned to a virtual platform for 7 of 10 symposiums, and supported 4 special events with an estimated 1,135 volunteer hours.

5 COVID-19 SAFETY MEASURES

Undertook measures to protect workers and the public by ensuring social distancing requirements were met while delivering uninterrupted service for the public, including litter collection, solid waste and recycling collection, large item pick up and Recycling Depot services.

6 REDUCED CALENDAR PRINTING

Created an option to allow residents who use the Richmond Recycling app to opt out of mailed collection calendars to reduce printing and postage.

VIRTUAL ZERO HEROES

Launched two virtual Planet Protector Academy Zero Heroes: Home Edition workshops that engaged 98 Richmond youth, with a total of 262 participation hours.

8 YOUTH COMPETITION

Supported the Richmond Youth Foundation 2020 Case Competition on single-use items.

9 INTERACTIVE DEPOT MAP

Added an interactive Recycling
Depot map on the City's website to
make it easy for residents to learn
more about what is accepted and
the location of recycling areas at the
newly renovated facility.

Launched Green Cart program for single-family and townhomes

Launched Large Item Pick Up program

2013

Launched Green Cart program for multi-family complexes

2015

Introduced Single-Use Plastic and Other Items Bylaw

Expanded Large Item Pick Up program

Expanded hours and items accepted at Richmond Recycling Depot

2019

2014

Completed Multi-family Green Cart pilot program 2016

Launched biweekly Garbage Cart program 2020

Renovated Recycling Depot and expanded items accepted

1.2 Setting Goals

Richmond's long-term goal is to support a circular economy through sustainable waste management, and the annual goals listed here are designed to help achieve this target. Each goal is designed to make it easy and convenient to recycle and reduce waste in Richmond, as well as creating and promoting opportunities for innovation, partnership and continuous improvement.

1 ENHANCE SERVICE AT RICHMOND RECYCLING DEPOT

Expand operational days at the Richmond Recycling Depot to seven days a week.

- 2 CREATE VIRTUAL REPAIR FAIR
 Work to develop COVID-19 compatible
 Repair Fair events to promote repair
 and reuse in the community.
- 3 SUPPORT SINGLE-USE BYLAW IMPLEMENTATION

Develop and undertake business engagement to advise businesses of the provincial approval for the *Single-Use Plastic and Other Items Bylaw No. 10000* and next steps for implementation, once appropriate amidst COVID-19.

4 RAISE AWARENESS ABOUT SINGLE-USE PLASTIC

Continue to raise awareness about the issue of single-use plastic and the new ban, and leverage federal and provincial actions to strengthen the City's implementation of single-use policy to reduce unnecessary waste.

5 INITIATE COMMERCIAL RECYCLING SERVICES REVIEW

Dependent on COVID-19, undertake a detailed review and scoping exercise to establish enhanced recycling for the commercial sector.

6 UPDATE THE ILLEGAL DUMPING STRATEGY

Continue annual updates to the Illegal Dumping Overview and Strategy as part of moving towards innovative approaches to mitigate illegal dumping in the City.

COMPLETE DISASTER DEBRIS PLAN

Prepare a Richmond-specific Disaster Debris Management Plan.





1.3 Renovating the Recycling Depot

When Council approved the major renovation at the Richmond Recycling Depot in January 2019, the team thought remaining open would be the biggest challenge during construction. Then a global pandemic hit.

Suddenly, an already complex project became even more difficult, as social distancing and other health safety measures needed to be factored in. But keeping fully operational remained a priority, and throughout the five months of construction, the Richmond Recycling Depot stayed open and served residents without interruption – in spite of countless challenges.

Every day involved an assessment of resident safety in a construction zone. There were open pits and dug out portions of the road that needed to be covered, as well as tripping hazards and large equipment operating in the area. Barricading off areas to keep people out helped, but it was evident that additional staff would also be needed to monitor the site at all times. With COVID-19 restrictions and the need to maintain physical distance, the City also had to limit the number of vehicles in the Recycling Depot. To manage this and provide safe traffic flow, the City added traffic control crews.

Adapting to safety measures turned out to be one of the more straight-forward challenges. Reconfiguring the Depot layout on a regular basis was a logistical conundrum. Depending on where work was taking place, all of the recycling stations in that area had to be relocated to unaffected areas which also meant fitting everything into a fraction of the usual. One particularly memorable relocation was when staff learned that the entire hazardous waste section had to be moved. Originally, the plan was to do it in stages.

Staff had one day to demolish a structure that could not be moved without extensive damage and relocate several bins. With so many moving parts, everyone involved needed to be flexible and go with an "all hands on deck" approach to make sure the Depot stayed open and operational.

It was also soon obvious that the Recycling Depot was going to be busier than ever during the lockdowns. Described as the year when spring cleaning never ended, residents were evidently taking advantage of extra time at home to clean up and clear out clutter. As a result, the Recycling Depot experienced a record-breaking year — exceeding last year's volume by about 1,300 tonnes.

With the renovations completed, the Recycling Depot is now better organized to allow operational efficiencies, expand accepted items and provide more convenient drop-off areas. The covered centre area provides rain and sun protection, and the new building for hazardous materials is a centralized area for staff to provide assistance while also keeping items like electronics dry. As an added bonus, solar panels on the centre section roof will generate back up power for City operations in the future.

The renovation involved a mix of contractors and City staff from multiple departments to help with construction and project coordination. They stayed even-keeled and focused on good customer service, and residents have expressed their appreciation with kudos like "The staff is very friendly, the Depot is very clean and well organized, and it sounds kind of funny to say, but it's almost a pleasure to go there" and "Just wanted to send you and the team working at the Recycling Depot big kudos. The organization and set-up of the area is awesome, and so much easier to use. I've been using the Depot for the past five years, and it's sometimes been difficult to follow proper procedure, but now the process is seamless and all of the crew working there are really great to deal with."

TOGETHER WE CAN REDUCE WASTE

PWT - 55



2.0 Tracking Our Progress

As part of tracking its progress, the City of Richmond collects data across a broad spectrum of programs, services and activities. This data shows how residents have improved their recycling over the years, and how new programs are contributing to a circular economy.

The mix of data reported reflects the amount of recycling handled through residential collection programs, the usage and types of materials dropped off at the Richmond Recycling Depot and a breakdown of the different types of recyclable materials that are being diverted from the landfill through multiple recycling programs. As well, the City has a number of outreach initiatives that are aimed at increasing awareness and understanding of how to recycle correctly and consistently. This community engagement was limited in 2020 due to COVID-19 health and safety restrictions; however, other data highlights how residents increased recycling while isolating at home.

The City's reporting also highlights how partnerships help reduce food waste and promote a beautiful, litter-free community.

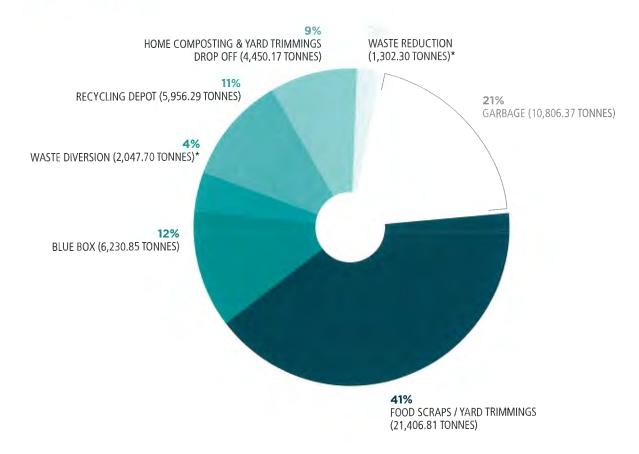
2.1 Diversion Statistics



SINGLE-FAMILY RECYCLING IN 2020



Residents took advantage of a variety of programs to divert 79.3% of their waste from the landfill in 2020.



Residents were able to achieve this through a number of recycling and waste reduction opportunities, including curbside and Richmond Recycling Depot collection, as well as composting programs.

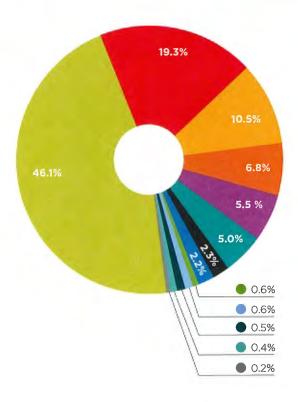
* ESTIMATED

BLUE BOX AND BLUE CART PROGRAMS RECYCLING MIX IN 2020

Through the Blue Box and Blue Cart programs, residents recycled a total of **8,279.35 tonnes** of recyclable materials.



MATERIALS COLLECTED AT THE RICHMOND RECYCLING DEPOT



In 2020, **5,956.29 tonnes** of recyclable materials were collected at the Recycling Depot.

- YARD TRIMMINGS (2,745.19 TONNES)
- SCRAP METAL (1,151.39 TONNES)
- PRODUCT STEWARDSHIP (620.93 TONNES)*
- MIXED PAPER/NEWSPRINT (404.92 TONNES)
- CARDBOARD (327.38 TONNES)
- UPHOLSTERED FURNITURE (294.76 TONNES)
- MATTRESSES (138.61 TONNES)**
- PLASTIC CONTAINERS (132.46 TONNES)
- FLEXIBLE PLASTIC PACKAGING (37.76 TONNES)
- PLASTIC BAGS (37.50 TONNES)
- POLYSTYRENE FOAM (E.G. STYROFOAM) (29.87 TONNES)
- GLASS (24.80 TONNES)
- PROPANE/BUTANE & FIRE EXTINGUISHERS (10.72 TONNES)
- * Includes tires, electronics, paints, solvents, pesticides, lights, small appliances, batteries, cell phones, smoke and carbon monoxide alarms, cooking oil, motor oil, antifreeze and lead acid batteries.
- ** Collected via the Large Item Pick Up Program, not at the Recycling Depot.

8,279.35 tonnes

BLUE BOX AND BLUE CART

+

5,956.29 tonnes

RECYCLING DEPOT

14,235.64 tonnes recycled in 2020





229,824 **EQUIVALENT** LITRES



AEROSOLS 5,600 EQUIVALENT LITRES



PESTICIDES LITRES



12,512 EQUIVALENT



CFLS 653 BOXES



ELECTRONICS 4' - 470 BOXES **251.18 TONNES**



APPLIANCES 141.49 TONNES



TIRES **35.41 TONNES**



MOTOR OIL & ANTIFREEZE **28.96 TONNES**



COOKING OIL **12.53 TONNES**



BATTERIES & CELL PHONES 15.40 TONNES

TUBES

8' - 73 BOXES

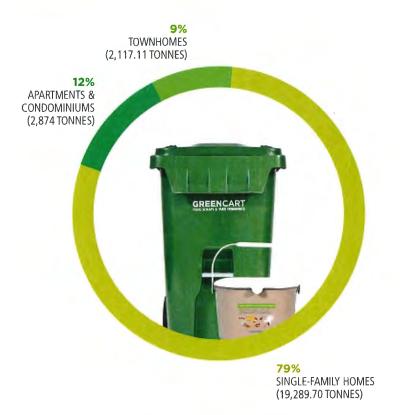


LEAD ACID BATTERIES 1.99 TONNES



SMOKE & CO ALARMS 0.37 TONNES

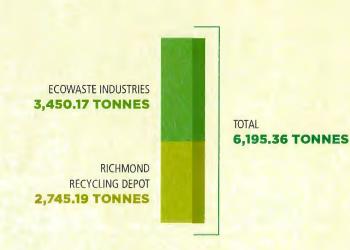
RESIDENTIAL GREEN CART RECYCLING IN 2020



Residents diverted 24,280.81 tonnes of food scraps and yard trimmings from landfill in 2020 to be composted into new resources.

Richmond's Green Cart program is for residents in single-family homes, townhomes, apartments and condominiums.

In 2020, 6,195.36 tonnes of yard trimmings were collected at the Richmond Recycling Depot and the Ecowaste residential and commercial drop-off service.



LARGE ITEM PICK UP IN 2020

13,872
REQUESTS
FOR SERVICE



BOXSPRINGS





933 TONNES WERE COLLECTED

OF 709 TONNES WERE RECYCLED



607 FRIDGES & FREEZERS



434BARBECUES



247 DISHWASHERS



2,336COUCHES & LOVESEATS



1,441 CHAIRS & RECLINERS



336STOVES &
MICROWAVES



6,181

NON-RECYCLABLE HOUSEHOLD

ITEMS COLLECTED FOR SAFE

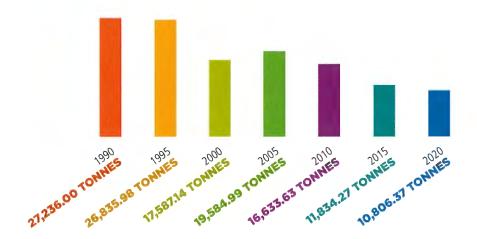
HANDLING AND DISPOSAL



2,417OTHER RECYCLABLE ITEMS

FROM GARBAGE DISPOSAL TO DIVERSION

SINGLE-FAMILY HOMES GARBAGE IN TONNES



SINGLE-FAMILY HOMES DIVERSION OVER TIME

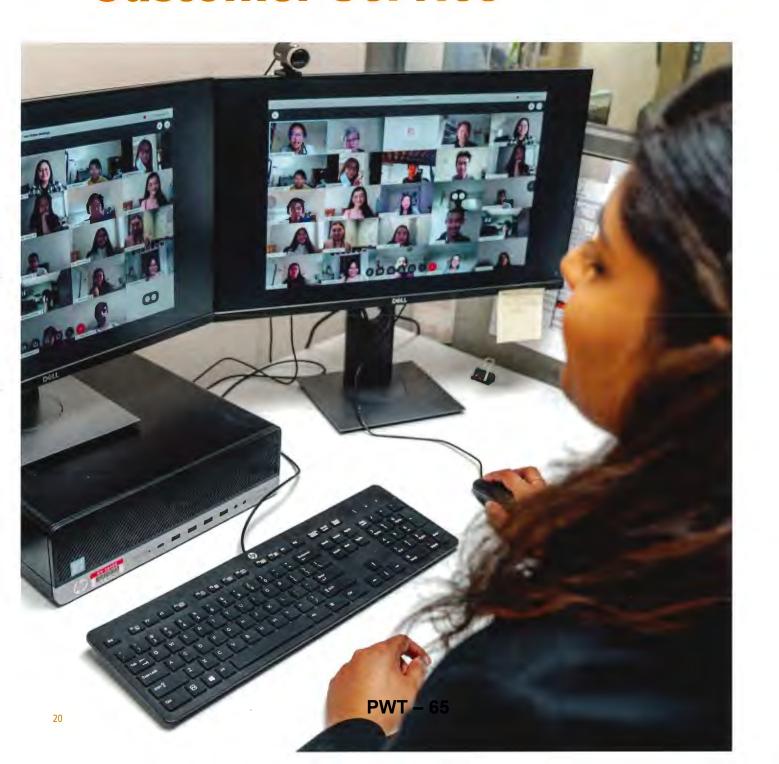


% WASTE GOING TO LANDFILL

% WASTE BEING RECYCLED*

* Includes residential recycling and organics collection and drop-off at Richmond Recycling Depot

2.2 Outreach and Customer Service



Statistics in this section are related to our successful outreach and customer service programs, which are designed to turn education and information into action.



9,635
GARBAGE TAGS SOLD

1,427
GARBAGE DISPOSAL
VOUCHERS SOLD

COMPOST BINS, GARBAGE TAGS SOLD

154
COMPOST BINS
SOLD

GARBAGE, LITTER AND COMMUNITY GARDEN COLLECTION GARBAGE BINS 12,153 TIMES PER INSPECTED 12,153 TIMES PER MONTH AND SERVICED 16,911 TIMES PER MONTH FOR A COMBINED 348,773 BIN VISITS PER YEAR GREEN CARTS SERVICED IN COMMUNITY GARDENS CREWS TRAVEL 3,307 KILOMETRES PER WEEK TO INSPECT AND SERVICE BINS

ONLINE SEARCH AND TIPS TOOLS



RICHMOND RECYCLING APP - ALL-TIME STATS



4,264RECYCLING GAMES PLAYED

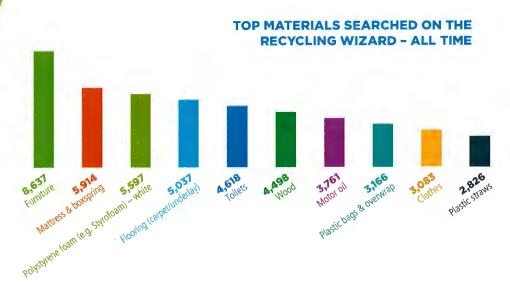


15,396 ACTIVE REMINDERS

7,318PDF CALENDAR DOWNLOADS

69,487
TOTAL ALL-TIME
APP USAGE

60,664
RECYCLING
WIZARD
SEARCHES



SCHOOL AND YOUTH ENGAGEMENT

GREEN AMBASSADOR PROGRAM



In 2020, **154 youth** volunteered in Richmond's Green Ambassador program.



317HOURS

In 2020, Green Ambassadors spent 317 hours preparing for the annual **REaDY Summit**; however, the event could not be held due to COVID-19.

10 symposiums for training and networking with fellow Green Ambassadors were held, for a total of 637 training hours.



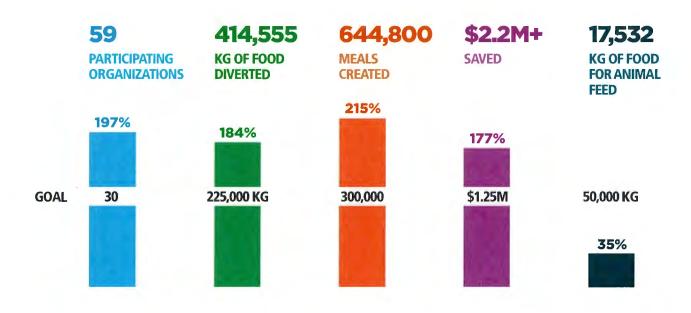
183 HOURS

4 special events were supported by Green Ambassadors, with 183 hours.

FOOD RECOVERY NETWORK

From November 2019 to November 2020, the City of Richmond collaborated with FoodMesh to build a regional Food Recovery Network, bringing together local food businesses with charities and farmers into a collected and efficient food system.

The results from the first year of this program far surpassed the expectations for the project in almost all areas.



Data source: FoodMesh for the City of Richmond Nov 2019-Nov 2020

COMMUNITY ENGAGEMENT

COMMUNITY WORKSHOPS AND TOURS

SESSIONS, WORKSHOPS AND TOURS OFFERED IN 2020

325
PARTICIPANTS

ТҮРЕ	NUMBER	PARTICIPANTS
Virtual Youth Engagement Sessions	2	98
Recycling Workshops	7	207
Richmond Recycling Depot Tours	1	20
Total	10	325

COMMUNITY CLEAN-UP EVENTS

Richmond's Green Ambassadors — youth volunteers — helped clean up public spaces in 2020, including 42.5 volunteer hours for the shoreline clean up and 51 volunteer hours to help remove invasive plants.



MAKING RECYCLING EASY AND CONVENIENT

PWT - 71



3.0Programs and Services

Richmond residents in single-family homes divert most of their waste, and recycling is increasing in townhomes and other multi-family complexes.

To support residents and their commitment to recycling, Richmond continues to expand services to help residents reduce their garbage and create incentives to promote increased recycling. Green Cart and Blue Box/Blue Cart recycling remain core services to help residents recycle. Residents can also drop off a growing list of recyclable items at the Richmond Recycling Depot and other drop-off facilities.

Richmond works with residents, industry partners, product stewardship groups and businesses to achieve its goal to support a circular economy by implementing sustainable waste management. Through partnerships and community engagement, Richmond's commitment to continuous improvement results in enhanced services to benefit residents.

Through its contract with Recycle BC, the City generates revenue to offset recycling costs for residents; however, the City must also adhere to requirements related to the quality of recycling. If banned items are found in the garbage or contamination is found in recycling, the City can be charged fines and other penalties. These requirements are based on the City's *Solid Waste and Recycling Regulation Bylaw No. 6803*, contract requirements with Recycle BC and organics processing facilities, and Metro Vancouver disposal bans for items that must be recycled as they are not permitted in the garbage.

3.1Program and Service Overview

Richmond delivers a wide range of recycling and waste management services for residents to ensure that all waste is managed effectively and efficiently. The following are the key recycling and waste management services offered through the City of Richmond.



BLUE BOX

Weekly curbside collection for paper, newsprint, glass bottles and glass jars, plastic containers, empty aerosol cans, milk cartons, plastic/paper drink cups, spiral wound containers, and tin and aluminium containers. For details, see page 31.



BLUE CART

Weekly recycling collection for paper, newsprint, glass bottles and glass jars, plastic containers, aerosol cans, milk cartons, plastic/paper drink cups, spiral wound containers and tin and aluminium containers. For details, see page 31.



GREEN CART

Weekly collection for foods scraps and yard trimmings. This program is provided to residents in single-family homes, townhomes and multi-family complexes. For details, see page 36.



RICHMOND RECYCLING DEPOT

Drop-off service for products ranging from yard trimmings and household items, to hazardous materials and take-back program products. This service is available to all residents and in limited quantities for commercial operators. The Recycling Depot also sells backyard compost bins, rain barrels, Garbage Tags and Garbage Disposal Vouchers for use at the Vancouver Landfill. For details, see page 42.



GARBAGE CART

Biweekly curbside collection of garbage, not including banned items such as hazardous waste and materials that can be recycled, is available to residents in single-family homes and some townhomes. Garbage Tags and Garbage Disposal Vouchers for the Vancouver Landfill provide options for residents for disposal of additional garbage. For details, see page 40.



LARGE ITEM PICK UP

Residents with the City Blue Box and/or City Garbage Cart program can arrange for collection of large household items. For details, see page 46.



BACKYARD COMPOSTING

Support for residential composting includes the sale of backyard compost bins and a composting demonstration garden. These services are available to all residents. For details, see page 39.



LITTER COLLECTION

Litter Attendants are on the road seven days a week to inspect or service garbage and recycling bins more than 6,700 times each week throughout the city, collecting additional litter along the way. For details, see page 49.



PUBLIC SPACES AND EVENT RECYCLING

Recycling bins in the community make it easy to recycle on the go, such as in parks, at community centres, in the Steveston business district and at the Canada Line stations and Richmond central bus stops. Richmond supports community events by loaning garbage and recycling bins for local events at no charge. For details see Public Spaces Programs on page 48 and Outreach and Customer Service on page 50.



COMMUNITY AND SCHOOL ENGAGEMENT

Through partnerships with students, teachers and the School District, Richmond delivers educational workshops, awareness programs and volunteer opportunities to increase understanding of recycling and the benefits of reducing waste. For details see Outreach and Customer Service on page 50.





Together we can change habits and make better choices that support a circular economy.

LET'S RETHINK WASTE

Changing our habits to think differently about purchases, avoiding unnecessary waste and finding ways to reuse and recycle products and services contributes directly to positive outcomes like reducing reliance on raw materials.

Ultimately, it's about shifting to a circular economy, where the materials we use stay in circulation to be used, reused or repaired, and recycled multiple times into new products.

Top tips to reduce waste:

- Avoid single-use items choose reusable instead
- Choose products with minimal packaging
- Buy, sell, trade or donate household items
- Choose products with recycled content
- Repair products when possible
- Rethink take a moment to assess: do I need this item, will it create unnecessary waste, how can it be reused or recycled?



3.2 Blue Box and Blue Cart Programs

Richmond's Blue Box and Blue Cart recycling programs provide convenient collection of a wide variety of materials including mixed paper, plastic containers, milk cartons, paper and plastic drink cups, empty aerosol cans and spiral wound cans like frozen juice concentrate containers as well as glass bottles and glass jars.

Richmond's Blue Box program for door-to-door curbside collection includes a Blue Box for containers, yellow Mixed Paper Recycling Bag for paper and small, flattened cardboard items and a grey Glass Recycling Bin for glass bottles/jars. The Blue Cart program for centralized collection has separately labeled carts for containers, mixed paper and glass.

It is important to ensure materials are sorted correctly into the proper recycling receptacles. For example, recyclables must be placed individually in bins – not stacked, nestled or in plastic bags. Glass bottles/jars must be placed in the Glass Recycling Bin/Cart – not the Blue Box or Containers Recycling Cart.

Also, some items are not accepted in the Blue Cart/Blue Box program, such as non-packaging plastics like toys, hangers and laundry baskets, as well as non-packaging metal items like scissors and pans. These items are accepted at the Richmond Recycling Depot.

CONTAINER RECYCLING: BLUE BOX/CONTAINERS RECYCLING CART

















- ✓ Empty aerosol cans & caps (food items, air fresheners, shaving cream, deodorant, hairspray)
- Microwavable bowls, cups & lids
- ✓ Paper food containers & cartons (ice-cream, milk, liquid whipping cream)
- ✓ Paper & plastic drink cups with lids
- ✓ Plastic containers, trays & caps (bakery containers) & deli trays)
- ✓ Plastic & paper garden pots & trays
- ✓ Spiral wound paper cans & lids (frozen juice, potato chips, cookie dough, coffee, nuts, baby formula)

- ✓ Aluminium cans & lids
- ✓ Aluminium foil & foil containers (foil wrap, pie plates, food trays)
- ✓ Plastic bottles & caps (food items, condiments such as ketchup, mustard & relish, dish soap, mouthwash, shampoos, conditioners)
- ✓ Plastic jars & lids
- ✓ Plastic tubs & lids (margarine, spreads, dairy products) such as yogurt, cottage cheese, sour cream, ice cream)
- ✓ Tin cans & lids

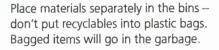
× NOT ACCEPTED

- x Aerosol cans with hazardous materials (spray paint)*
- x Butane cylinders*
- x Ceramic plant pots
- x Compostable/biodegradable plastic bags & containers
- x Containers for motor oil, vehicle lubricant or wax products*
- x Foil-lined cardboard lids from take-out containers
- x Garden hoses
- x Paper takeout containers
- x Plastic bags & overwrap*
- x Plastic string or rope
- x Polystyrene foam (e.g. Styrofoam) materials*
- x Propane tanks*
- * Take to the Richmond Recycling Depot















Avoid stacking or nestling items together, instead place them separately in the bins. For example, don't nestle an aluminium can inside a plastic container.



Empty, rinse and flatten containers. Food or other materials in the containers contaminate the recycling. Remove lids and recycle separately.



Separate glass jars and glass bottles and recycle in the grey Glass Recycling Bin or Glass Recycling Cart.



PAPER PRODUCTS: MIXED PAPER RECYCLING BAG/CART















✓ ACCEPTED

- ✓ Newspapers, inserts & flyers
- ✓ Flattened cardboard boxes
- ✓ Catalogues & magazines
- ✓ Cereal boxes
- ✓ Clean pizza boxes
- Corrugated cardboard (small pieces)
- ✓ Envelopes
- ✓ Junk mail
- Paper bags

- ✓ Paper egg cartons
- ✓ Paper gift wrap & greeting cards
- ✓ Paper takeout containers (including those with a shiny coating)
- ✓ Telephone books
 ✓ Shredded paper (place inside a paper bag to avoid scattering)
- ✓ Writing paper (notepads, loose leaf paper, white or coloured paper, printed paper)

× NOT ACCEPTED

- x Cardboard boxes with wax coating
- x Plastic bags used to cover newspapers/flyers
- x Metallic wrapping paper
- x Ribbons or bows

- x Musical greeting cards with batteries
- x Padded envelopes
- x Plastic or foil candy wrappers



Remove plastic liners/covers and/or any food residue.



Put shredded paper in a paper bag before placing in the Mixed Paper Recycling Bag/Cart to avoid scattering.



Cut cardboard into small pieces and flatten boxes to take up less space in the Mixed Paper Recycling Bag/Cart and in the collection truck.



Oversized/excessive amounts of cardboard can be dropped off at the Richmond Recycling Depot.

GLASS JARS & GLASS BOTTLES: GLASS RECYCLING BIN/CART



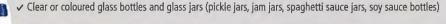








✓ ACCEPTED



× NOT ACCEPTED

- x Glasses, dishes, cookware, window glass and mirrors
- x Ceramic products
- x Lids and caps (remove from the glass bottle/jar and place in Blue Box/Containers Recycling Cart)





Remove plastic and metal lids and recycle separately in the Blue Box/Containers Recycling Cart.



Empty and rinse jars and bottles. Make sure no food is left inside because it contaminates the recycling.





Before 7:30 a.m. every week on collection day.

Note: For centralized Blue Cart service, the collection details are arranged between the City and the Strata Council or Property Manager. Residents do not have to set the Blue Carts out for collection.



Report a Missed Collection

Call 604-276-4010 or email garbageandrecycling@richmond.ca.



How to Get More Free Recycling Supplies

Supplies include:

- Blue Boxes
- Glass Recycling Bins
- Indoor Collection Bags
- Mixed Paper Recycling Bags

Three ways to order supplies:

- Pick up at Richmond Recycling
 Depot
- 2. Call 604-276-4010
- 3. Order online at richmond.ca/recyclesearch

Richmond Recycling Depot 5555 Lynas Lane

Open 7 days a week (Closed on statutory holidays) 9:00 a.m. to 6:15 p.m.

HOW TO RECYCLE CORRECTLY



Non-recyclable plastic items are placed in recycling bins (Straws and plastic cutlery)

These are not recyclable. Please put in the garbage.

Containers with food residue are not rinsed before recycling

Remove food and rinse before placing in Blue Box or Containers Recycling Cart.

Recyclable items that are not accepted in residential collection are placed incorrectly in the Blue Box / Blue Cart, such as:

- · Batteries and cell phones
- Electronics
- Paints and solvents
- Plastic bags
- Polystyrene foam (e.g. Styrofoam)
- · Propane tanks and butane containers
- Non-packaging plastics like toys and coat hangers

Drop off at Richmond Recycling Depot – 5555 Lynas Lane.



Not sure where to recycle an item?
Use the Recycling Wizard on the
free Richmond Recycling app or at
richmond.ca/recyclesearch

You can find drop-off locations and how to recycle a variety of household items using the Recycling Wizard on the free Richmond Recycling app available at the Apple and Android app stores. Plus, you can schedule weekly collection day reminders, order supplies and play the Recycling Challenge game!



3.3 Green Cart Program

Food scraps are banned from the garbage, which means they must be recycled or composted, and the City can be charged fines and other penalties when organics are found in the garbage. With the Green Cart program, all Richmond residents have access to food scraps recycling and when recycling with a Green Cart, residents are helping turn food scraps and yard trimmings into compost for nutrient-rich soil.

Richmond also encourages organics recycling by providing Green Cart service at no charge at the City-sponsored community gardens.

It is important to ensure that only food scraps, food soiled paper, and yard and garden trimmings go in the Green Cart. When items like plastic bags, Polystyrene foam (e.g. Styrofoam) or biodegradable/compostable plastic bags are found in the Green Cart, the load is considered contaminated as these materials are not accepted at processing facilities because they compromise the quality of the compost.

Residents can also create their own compost at home to keep these organic materials out of landfills. Residents can purchase a backyard compost bin at the Richmond Recycling Depot.

GREEN CART FOR FOOD SCRAPS & YARD TRIMMINGS











✓ ACCEPTED

FOOD SCRAPS & FOOD SOILED PAPER

- ✓ Breads, pasta, rice & noodles
- ✓ Coffee grounds & filters
- ✓ Dairy products
- ✓ Fruit
- ✓ Eggshells
- ✓ Meat, poultry, fish, shellfish & bones
- ✓ Paper tea bags
- ✓ Paper towels, napkins & plates
- ✓ Pizza delivery boxes
- ✓ Small amounts of grease/oil absorbed into paper towel
- ✓ Solid grease
- ✓ Table scraps & food scrapings
- ✓ Vegetables

YARD TRIMMINGS

- ✓ Flowers
- ✓ Leaves
- ✓ Grass clippings
- Other organic yard materials
- ✓ Plants (living or dead/dried)
- ✓ Plant trimmings
- ✓ Tree & hedge prunings (branches must be no more than 10 cm (4 in) in diameter and cut short enough to fit in the Green Can with the lid closed)

× NOT ACCEPTED

- x Coffee cups
- x Compostable & biodegradable plastic bags
- x Garden hoses or flower pots
- x Liquid grease
- x Lumber
- x Pet feces or kitty litter
- x Plastic bags & plastic overwrap

- x Plastic mesh tea bags
- x Plastic wraps
- x Polystyrene foam (e.g. Styrofoam) cups, meat trays or takeout containers
- x Prunings over 4 inches (10 cm) in diameter
- x Rocks, dirt or sod





Collect food scraps in your kitchen container. Wrap food scraps in small amounts of newspaper or used paper towel before adding to kitchen container.



Sprinkle kitchen container with baking soda to reduce odours and consider freezing food scraps until you're ready to empty them into the Green Cart.



Keep kitchen container clean by lining it with a few sheets of newspaper, a paper bag liner or used paper towel.



Empty materials from your kitchen container into your Green Cart.



Place vard trimmings into Green Cart along with your food scraps. Extra yard trimmings can go in large paper bags or additional labelled Green Cans.



MULTIPLE GREEN CART SIZES AVAILABLE

Richmond provides Green Carts in multiple sizes to meet resident's recycling needs. Residents can exchange their Green Cart for a different size by contacting the Environmental Programs Information Line at 604-276-4010 or email garbageandrecycling@richmond.ca. There is a \$25 fee for cart exchanges.

SINGLE-FAMILY HOMES CART SIZE SELECTION



Extra Large 360 litres D 34.5 x W 25 x H 44.5 inches Large 240 litres

240 litresD 27.5 x W 24.5 x
H 43 inches

Medium 120 litres D 21 x W 19 x H 37.5 inches

Small 80 litresD 21.5 x W 16 x
H 34.5 inches

TOWNHOMES CART SIZE SELECTION



Small 80 litres D 21.5 x W 16 x H 34.5 inches

Compact 46.5 litres D 12 x W 11 x H 27 inches

YARD TRIMMINGS DROP-OFF

Richmond residents and commercial landscapers can drop off yard trimmings at the following locations.

Ecowaste Industries 15111 Williams Road

Commercial operators can be pre-approved for dropping off materials at no charge when they are servicing residential properties with Richmond Green Cart service.

Visit ecowaste.com or call 604-277-1410 for detailed information.

City Recycling Depot

5555 Lynas Lane Open 7 days a week (Closed on statutory holidays) 9:00 a.m. to 6:15 p.m.

There is no charge for dropping off amounts less than one cubic yard (a car, station wagon or minivan load). Large loads are charged a fee of \$20 per cubic yard. Commercial operators will be charged a fee of \$20 per cubic yard at the Richmond Recycling Depot.



BACKYARD COMPOSTING PROGRAMS

Backyard Compost Bins: Backyard compost bins are available for sale at the Richmond Recycling Depot for \$25 plus tax.

Demonstration Garden: To help residents learn about composting, the City hosts a Compost Demonstration area in the Terra Nova Rural Park at 2631 Westminster Highway just west of No. 1 Road. It is open from dawn to dusk year-round.

Compost Hotline: For tips call 604-736-2250 or email composthotline@telus.net.



Set Out Time

Before 7:30 a.m. every week on collection day.

Note: For centralized Green Cart service, the collection details are arranged between the City and the Strata Council or Property Manager. Residents do not have to set the carts out for pick up.



Report a Missed Collection or Damaged Green Cart

Call 604-276-4010 or email garbageandrecycling@richmond.ca.



How to Exchange your Green Cart

Various cart sizes are on display at the Richmond Recycling Depot. Please note there is a \$25 charge to exchange your cart. To change to an alternative size please contact:

Environmental Programs 604-276-4010

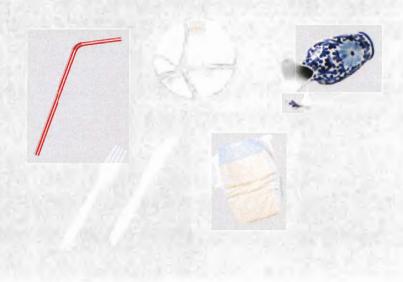


New/Replacement Kitchen Containers

Three ways to get a kitchen container:

- Pick up at Richmond Recycling
 Depot
- 2. Call 604-276-4010
- 3. Order online at richmond.ca/recyclesearch





3.4 Garbage Cart Program

Richmond's curbside Garbage Cart program provides residents with convenient options for waste disposal. Household garbage is collected biweekly. The Garbage Cart program includes City-provided carts with wheels and lids and is designed to lower costs for residents who are reducing their garbage by recycling their household waste.

Most household items are recyclable. Residents are encouraged to think twice before putting items in the garbage to help keep recyclables out of the landfill.

It's important to secure or wrap loose garbage to prevent materials from being scattered by wind or animals. Garbage must be securely packed in plastic bags. This includes ashes, kitty litter, disposable diapers, vacuum cleaner sweepings, disposable masks and gloves, and other loose household garbage.

All garbage must be placed at curbside before 7:30 a.m. on collection day but no earlier than 8:00 p.m. the day before. Do not place receptacles or other items on the road.

Residents are responsible for cleaning up any loose materials that have been scattered over the ground by animals, wind or vandalism.



EXTRA ITEM DISPOSAL OPTIONS

\$2 Garbage Tags

Garbage Tags for curbside collection are available for purchase at all City facilities. One Garbage Tag is good for an additional garbage bag or can.

Garbage Disposal Vouchers

Richmond residents may purchase a Garbage Disposal Voucher for \$5 at all City facilities. These vouchers are good for up to \$25 at the Vancouver Landfill, and are valid anytime. They are limited to one per household.

Visit richmond.ca/garbage for a list of City facilities selling Garbage Tags and Garbage Disposal Vouchers.

GARBAGE CART SIZE OPTIONS

Residents who select smaller cart sizes are generating less garbage and as a result, pay less for their annual garbage collection.

Residents can exchange their cart for a different size, and their garbage collection fees are adjusted according to the size selected. Residents can exchange their Garbage Cart for a different size for \$25 by calling 604-276-4010.



EXTRA LARGE 360 litresD 34.5 x W 25 x H 44.5 in



LARGE 240 litres D 27.5 x W 24.5 x H 43 in Standard size for

single-family homes



MEDIUM 120 litres D 21.5 x W 19 x H 37.5 in Standard size

for townhomes



SMALL 80 litres D 20 x W 16 x H 34.5 in



3.5 Richmond Recycling Depot

The Richmond Recycling Depot is located at 5555 Lynas Lane and is open from 9:00 a.m. – 6:15 p.m., seven days a week for drop off of a broad range of materials.

The Recycling Depot is owned and operated by the City of Richmond, with both full-time staff and additional staff support as needed to manage increased recycling volumes. Staff on site are available to answer questions and provide assistance with unloading awkward or heavy items.

The City continues to increase the number of items accepted at the Recycling Depot to make it a convenient, one-stop drop-off location for multiple items. Richmond residents can drop off a wide range of recyclable materials at no charge.



RECYCLING DEPOT SERVICES

Residents are encouraged to use the curbside recyclables collection for glass bottles and glass jars, rigid plastic containers, newsprint and mixed paper. Businesses are encouraged to subscribe to on-site collection services if a large quantity of recyclables is produced. However, residents and small business operators can drop off one cubic yard of recyclables and three large appliances at the Recycling Depot per day.

This facility accepts a wide range of materials including cardboard, yard and garden trimmings, mixed paper and newspapers, as well as Polystyrene foam (e.g. Styrofoam), used books, cell phones, household batteries, plastic bags and metal items (e.g. bike frames, barbecues, lawn mowers). The facility is also a product stewardship (take back) collection site for large and small appliances, paints, solvents, flammable liquids, pesticides, lights and lighting fixtures, tires, electronics, motor oil, batteries, and smoke and carbon monoxide alarms.



Richmond Recycling Depot 5555 Lynas Lane Open 7 days a week, 9:00 a.m. to 6:15 p.m. (except statutory holidays)



For Sale at the Recycling Depot

- Compost bins \$25 each + tax
- Rain barrels \$30 each + tax
- Extra Garbage Tags \$2 each
- · Garbage Disposal Vouchers \$5 for Richmond residents and value is up to \$25 at the Vancouver Landfill



Free Recycling Supplies Available at the Recycling Depot

- Kitchen Containers
- · Grey Glass Recycling Bins
- Blue Boxes
- Yellow Mixed Paper Recycling Bags
- Indoor College W 88 Green Can Decais

Welcome to the Richmond Recycling Depot!

You'll be amazed by how much you can take – for free – to the Richmond Recycling Depot.

Use the map below to see where to take your items once you arrive at the Recycling Depot. The icons are colour-coded to match the signs at the Depot and help you quickly find your way.

There are always attendants available to help you and to safely handle hazardous recyclable items.



For an interactive version of this map, visit richmond.ca/depot













MATERIALS ACCEPTED

- ✓ Aerosol & spiral wound cans
- ✓ Aluminium materials
- ✓ Appliances
- ✓ Baby car seats/booster seats (pilot program)
 - ✓ Batteries (lead acid car batteries)
 - ✓ Batteries (small household batteries less) than 5 kg)
 - ✓ Books
 - ✓ Butane cylinders
 - ✓ Cell phones (including batteries)
 - ✓ Cooking oil & animal fat
 - ✓ Corrugated cardboard (flattened, clean) corrugated boxes)
 - ✓ Electronics
 - ✓ Exercise & hobby machines



- ✓ Fire extinguishers ✓ Flammable aerosols
- ✓ Flammable liquids
- ✓ Flexible plastic packaging
- ✓ Flower pots (paper & plastic pots/trays)
- ✓ Gasoline (in approved ULC containers)
- ✓ Glass bottles/jars (clear & coloured)
- ✓ Lights
- ✓ Lighting fixtures
- ✓ Magazines
- ✓ Metal items
- ✓ Mixed paper
- ✓ Motor oil & antifreeze
- ✓ Newspaper
- ✓ Paints (household paints)
- ✓ Paint aerosols
- ✓ Pesticides (domestic pesticides)
- ✓ Plastic containers
- ✓ Plastic grocery bags & plastic overwrap
- ✓ Polystyrene foam (e.g. Styrofoam) packaging
- ✓ Power tools
- ✓ Propane tanks
- ✓ Sewing, knitting & textile machines
- ✓ Smoke & carbon monoxide alarms
- ✓ Tin & aluminium cans
- ✓ Tires (passenger & light-duty trucks only)
- ✓ Upholstered furniture
- ✓ Yard & garden trimmings

All materials must be sorted into different containers at the Recycling Depot. Please visit richmond.ca/depot for more information.



3.6 Large Item Pick Up Program

Richmond's Large Item Pick Up program provides a convenient curbside collection service for up to six large household items per year, including mattresses, furniture and appliances. This program is designed to make it more convenient for residents to dispose of large household items and to help reduce illegal dumping. As well, through this program, large household items that can be recycled will be diverted from the landfill.

The Large Item Pick Up program is provided to residents in single-family homes, as well as townhomes and multi-family complexes with the City's Garbage Cart and/or Blue Box program.

This service makes it easier for residents who do not have access to a vehicle to dispose of large items.

HOW THE PROGRAM WORKS

- To schedule collection of up to six items per year, residents can contact the City's service provider, Sierra Waste Services at 604-270-4722 or schedule online at richmond.ca/largeitem.
- Sierra Waste Services will contact you to provide a pick up date and confirmation number.
- On your scheduled pick up date only, place items at the curb or for multi-family complexes, in the area designated by the strata or property manager, before 7:30 a.m. or no earlier than 8:00 p.m. the night before.











LARGE ITEM PICK UP PROGRAM

✓ ACCEPTED

- ✓ Appliances
- ✓ Barbecues (remove propane tank and/or lava rock briquettes)
- ✓ Bed frame
- ✓ Electric lawnmowers
- ✓ Furniture
- ✓ Headboard
- ✓ Outdoor furniture

- ✓ Small household goods, which must be in boxes or bundled and are a reasonable size (one box or bundle is equal to one of the resident's six allotted items)
- ✓ Weight training and exercise equipment
- Mattresses or boxsprings please cover your mattress with a plastic bag
- ✓ Tires (car and light-duty truck)

× NOT ACCEPTED

- x Car bodies or parts
- x Carpets
- x Construction materials
- x Drywall
- x Gas lawnmowers
- x Hazardous waste
- x Lumber, demolition or home renovation materials
- x Mattresses/boxsprings and upholstered furniture that are wet or infested with bed bugs or vermin
- x Pianos
- x Propane tanks*
- x Tree stumps

Note: Items that contain any hazardous liquids such as gas, oil, etc. will not be accepted. See page 56-61 for disposal locations or call Environmental Programs at 604-276-4010.

* Take to Richmond Recycling Depot, 5555 Lynas Lane

PREPARATION - SAFETY REQUIREMENTS

- ✓ Wrap mattresses in plastic and seal with tape to prevent them from getting wet and waterlogged. Cover upholstered furniture and boxsprings with tarps or plastic to keep it dry; tarps will be left behind for reuse.
- Confirm mattresses, boxsprings and upholstered furniture are free of bedbugs to ensure they are accepted for recycling at the facility.
- Remove latch/door from freezers, refrigerators or any other container equipped with a door, latch or locking device.

Note: The item(s) must be able to be safely handled from the curbside in order to qualify for collection.



3.7 Public Spaces Programs

Maintaining a litter-free community and encouraging recycling in parks and other public spaces is an essential part of responsible and sustainable waste management. Not only does this help to keep the City a beautiful place to live and visit, it also helps to reduce the amount of plastic and other garbage going into oceans and other waterways.

The City has three primary services to support recycling and a litter-free community: Public Spaces services, Litter Collection services and Special Event Recycling.

Because building community pride and increasing responsible behaviours involves working together with the community, the City also works with volunteers through the Partners for Beautification program and community clean up events.



PUBLIC SPACES SERVICES

The City of Richmond has recycling and garbage bins located throughout the community in public spaces that include parks and business districts. Recycling and garbage bins are serviced or inspected over 6,700 times each week.

The City's bins include instructional bin labels to help inform people about how to sort items correctly. Many of the recycling bins feature images that complement the surrounding scenery, and others feature custom artwork by local artists. To further improve capacity and operational efficiency, the City also has large in-ground garbage collection bins in high traffic areas.

LITTER COLLECTION SERVICES

Maintaining a litter-free city is a key focus area to ensure residents can enjoy clean parks and public spaces. The City of Richmond has made efforts to ensure that there are garbage bins, and in many cases recycling options, in public spaces throughout the city.

In addition, as essential workers, City crews work seven days a week to collect litter from parks, school grounds, roadsides, sidewalks and boulevards.

They inspect or service garbage and recycling from litter and recycling receptacles in the community 29,064 times every month. Crews also assist with removing graffiti from City garbage bins, and they collect illegally-dumped materials found on City property and provide safe disposal and recycling of these items.

The extensive work to maintain public spaces and collect litter may go unnoticed, particularly because it is done well and regularly. Richmond residents enjoy the benefits, but may not realize the extent of work involved in maintaining a clean and livable city.

SPECIAL EVENT RECYCLING

Recycling stations are recommended for special event bookings taking place in Richmond. For some events, the City hosts recycling stations with assistance from Green Ambassador volunteers. This involves setting up recycling stations and having recycling assistants at the event to advise people on how to recycle.

The City also supports events by providing organizers with recycling bins and garbage carts at no charge, as well as complimentary collection services. This makes it easy for event organizers to keep the venue clean and recyclables out of the landfill.

In addition, the City participates in community clean up events each year.



3.8 Outreach and Customer Service

Richmond's successful outreach and customer service programs are designed to help turn information and education into action. By working with children and youth through school programs and the Green Ambassadors, Richmond creates a learning environment where students gain a better understanding about recycling and sustainable waste management, and then apply their skills as volunteers and through school activities. The City is also offering more virtual outreach opportunities.

Providing outreach, customer support services and information materials also assists residents by increasing their understanding of how to recycle correctly along with new tools and services to promote recycling at home and on the go.

The Environmental Programs Information Line staff assist customers on the phone, via email and at community events to answer questions, assist with requests relating to garbage and recycling, and provide guidance on where to go for additional information and resources. Richmond staff also assist customers directly at the Recycling Depot, and through its outreach programs in the community.

At the Recycling Depot, staff provide assistance with where and how to recycle using its drop-off options, answer questions about City programs and services and sell products such as compost bins and rain barrels as well as Garbage Tags and Garbage Disposal Vouchers. Through outreach, Richmond goes into the community to connect with residents to share information and respond to questions.



SEARCH & TIPS TOOLS

Richmond offers the Recycling Wizard to help residents search for where to recycle household items. The Recycling Wizard is available online at richmond.ca/recyclesearch and in the Richmond Recycling app, free from the Apple and Android app stores.

STUDENT OUTREACH

Richmond sponsors programs, contests and other activities for local students to raise awareness about the importance of reducing waste and how to recycle correctly. These activities inspire them to feel that taking care of the planet is fun.

RICHMOND GREEN AMBASSADORS

Richmond's Green Ambassadors are dedicated high school students who participate in monthly symposiums to learn about environmental sustainability and apply what they have learned as volunteers at City events and activities. These energetic and environmentally conscious individuals also manage green initiatives in their schools, including an annual REaDY Summit (Richmond Earth Day Youth Summit).

COMMUNITY WORKSHOPS

Richmond's free community workshops provide education and tips that support recycling and waste reduction techniques. A summary of workshops is provided below.

For information on the workshops, call the Environmental Programs Information Line at 604-276-4010, email garbageandrecycling@richmond.ca, or visit the Community Outreach section at richmond.ca/recycle.

TYPE OF WORKSHOP	DESCRIPTION
Recycling Workshops	Learn how to reduce reliance on single-use items and sort household recyclables properly to reduce contamination. Understand the recycling process and the importance recycling has on the environment, including the impact of marine plastic and other hot topics in solid waste management.
Richmond Recycling Depot Tours	Interactive tour of the Richmond Recycling Depot designed to teach residents about the drop-off options available and materials accepted for recycling.





4.0 Tips and Resources

In Richmond, we care about our community, and we are working together with residents and local organizations to reduce waste and promote a circular economy. These Tips and Resources highlight the City's community partners, and provide a guide for how to deal with hazardous waste and other items not accepted in curbside and centralized recycling programs.

With the help of community resources and partnerships, Richmond residents have access to easy and convenient drop-off services and programs to support recycling, safe disposal, and waste reduction. This section includes contact information and locations for Richmond services and community partners involved in take-back collection through product stewardship programs. Together these Tips and Resources help to support maximum recycling and reduce the amount waste going to the landfill.



4.1 Community Resources and Partnerships

ECOWASTE INDUSTRIES

The City offers residents the option to drop off unlimited quantities of yard and garden trimmings for free at Ecowaste Industries. Proof of Richmond residency is required.

Ecowaste Industries:

15111 Williams Road Hours of operation and instructions: 604-277-1410 ecowaste.com

COMPOST HOTLINE

The Compost Hotline is a community program operated by City Farmer that provides support and tips for best practices in home composting.

Compost Hotline:

604-736-2250 composthotline@telus.net

RICHMOND SHARES

Richmond Shares is a non-profit organization that facilitates the exchange of gently used items.

Richmond Shares: richmondshares.bc.ca

METRO VANCOUVER RECYCLES

Metro Vancouver Recycles helps you find options for recycling products and get helpful links to online services.

Metro Vancouver Recycling Directory: metrovancouverrecycles.org

RECYCLING COUNCIL OF BRITISH COLUMBIA (RCBC)

RCBC provides information and resources to support recycling in the community.

Recycling Hotline

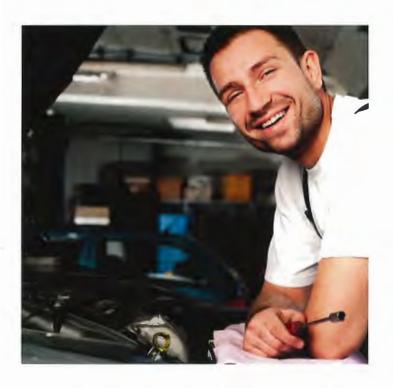
Monday to Friday, 9 a.m. to 4 p.m. 604-RECYCLE (604-732-9253) hotline@rcbc.bc.ca

CITY OF RICHMOND FOOD RECOVERY NETWORK

Partnering with FoodMesh, this program safely and easily diverts surplus food by bringing together local food businesses with charities and farmers.

Richmond Food Recovery Network: foodmesh.ca/services-regional/richmond





4.2 Banned and Hazardous Materials

Careless handling of hazardous products can cause serious injury as well as damage to the environment. Hazardous products that are dumped in sewers or green spaces can injure livestock, wildlife and plant life. Careful and often specialized disposal is essential for these materials.

There are certain materials that Metro Vancouver disposal facilities do not accept, either because there are already disposal programs set up for these items, or because they are hazardous to waste collection workers, the public and the environment.

At disposal sites, garbage loads are inspected for banned and prohibited materials. Loads that arrive at the disposal sites containing prohibited materials are assessed a \$65 minimum surcharge, plus the cost of removal, clean-up or remediation. Loads containing banned materials are assessed a 50% tipping fee surcharge.

For a list of drop-off locations, use the City's Recycling Wizard available on the Richmond Recycling app and at richmond.ca/recyclesearch, or call the RCBC Recycling Hotline at 604-732-9253.

BANNED HAZARDOUS AND OPERATIONAL IMPACT MATERIALS



- x Agricultural waste
- x Asbestos
- X Automobile parts and bodies
- x Barrels, drums, pails or large (205 litre or greater) liquid containers, full or empty
- x Biomedical waste
- x Dead animals
- x Gypsum
- x Hazardous waste
- x Inert fill material including soil, sod, gravel, concrete and asphalt exceeding 0.5 cubic metres per load
- x Liquids or sludge
- x Refuse that is on fire, smouldering, flammable or explosive
- x Wire and cable exceeding 1% of load

BANNED MATERIALS THAT ARE RECYCLABLE WITH CITY SERVICES



- x Beverage containers
- x Containers made of glass, metal or banned recycled plastic ASAS
- x Corrugated cardboard
- x Electronics
- x Expanded polystyrene packaging
- x Food waste
- x Green waste
- x Mattresses
- x Motor oil & antifreeze
- x Propane tanks
- x Recyclable paper
- x Tires (passenger & light-duty truck only)

For a complete list of banned materials, please visit metrovancouver.org/services/solid-waste/recycling-programs/disposal-ban

4.3

Recycling and Disposal Directory

Many common hazardous household and automotive products must be recycled or disposed through special depots. Disposal sites and take-back collection options for hazardous, banned and other materials are listed on the following pages.

Please note that this information is provided as a reference for your convenience; however, it is not guaranteed. Please call first to confirm that the site is still open to accept these take-back products and to check hours of operation.

Watch for the **BLUE** listings for items recyclable through the City of Richmond

Disposal Ban – Banned from the landfill and recyclable through retailers, stewardship or take-back programs

Disposal Ban – Banned from the landfill and recyclable through the City and other services

Not Banned – Recyclable through the City and other services

Not Banned – Recycling options are available

A fee is charged

See Programs and Services starting on page 27 to find out what is accepted through the City's collection and drop-off services.



ANTIFREEZE AND EMPTY CONTAINERS	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Jiffy Lube 10991 No. 4 Road	604-448-0142
List of accented items: bcusedoil	com or 604-732-9253



APPLIANCES – SMALL	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Best Buy 700-5300 No. 3 Road	604-273-7335
Ironwood Bottle & Return-It Depot 110 - 11020 Horseshoe Way	604-275-0585
OK Bottle Depot 145-5751 Cedarbridge Way	604-244-0008
Regional Recycling 13300 Vulcan Way	1-855-701-7171
List of accepted items: electrorecycle	e.ca or

List of accepted items: electrorecycle.ca or 604-732-9253.



BABY CAR SEATS	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot (pilot program) 5555 Lynas Lane	604-276-4010
S City of Vancouver Landfill 5400 72nd Street, Delta	604-873-7000
Pacific Mobile Depots (third Saturday of every month) Britannia Community Centre, 1661 Napier Street, Vancouver	604-718-5800
Queensborough Landing Return-it Depot Unit A - 409 Boyne Road, New Westminster	604-540-4467



BATTERIES – AUTOMOTIVE		
DROP-OFF LOCATION	PHONE	
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010	
Canadian Tire 3500 No. 3 Road 11388 Steveston Highway	604-273-2939 604-271-6651	
Costco 9151 Bridgeport Road	604-270-3647	
Kal Tire 2633 No. 5 Road	604-278-9181	
Regional Recycling 13300 Vulcan Way	1-855-701-7171	

Note: All retailers accept a used battery for each one purchased. Collection sites: recyclemybattery.ca



CARBON MONOXIDE (CO), SMOKE AND COMBINATION SMOKE & CO ALARMS		
DROP-OFF LOCATION	PHONE	
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010	
Regional Recycling 13300 Vulcan Way	1-855-701-7171	
Complete list of alarms accepted: regeneration.ca or		

604-732-9253.



ELECTRONICS: Audio visual equipment, computers, monitors, televisions, printers, fax machines, scanners, video games and accessories

DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Best Buy 700 - 5300 No. 3 Road	604-273-7335
Ironwood Bottle & Return-It Depot 110 - 11020 Horseshoe Way	604-275-0585
OK Bottle Depot 145 - 5751 Cedarbridge Way	604-244-0008
Regional Recycling 13300 Vulcan Way	1-855-701-7171
Staples 8171 Ackroyd Road 110 - 2780 Sweden Way	604-270-9599 604-303-7850
Complete list of materials accepted:	

EXERCISE AND HOBBY MACHINES DROP-OFF LOCATION PHONE 604-276-4010 Richmond Recycling Depot 5555 Lynas Lane Regional Recycling 1-855-701-7171 13300 Vulcan Way

Complete list of materials accepted: return-it.ca/electronics or 604-473-2400.

return-it.ca/electronics or 604-473-2400.



BATTERIES – HOUSEHOLD AND MOBILE PHONES

Batteries weighing 5kg or less		
DROP-OFF LOCATION	PHONE	
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010	
Best Buy 700-5300 No. 3 Road	604-273-7335	
Home Depot 2700 Sweden Way	604-303-9882	
London Drugs 5971 No. 3 Road 3080 - 11666 Steveston Highway	604-448-4811 604-448-4852	
Regional Recycling 13300 Vulcan Way	1-855-701-7171	
Rona (batteries only) 7111 Elmbridge Way	604-273-4606	
Staples 8171 Ackroyd Road 110 - 2780 Sweden Way	604-270-9599 604-303-7850	

Batteries accepted: call2recycle.ca or 1-888-224-9764.

Mobile phone drop-off sites: call2recycle.ca/locator.

All cellular/mobile phone stores accept used cellular/ mobile phones for refurbishing or recycling.

To erase data from your device, use the free Cell Phone Data Erasers at recyclemycell.ca/recycling-your-device.



EYEGLASSES DROP-OFF LOCATION

Drop off at any local optometrist or eye care professional.



BUTANE CYLINDERS	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010



FIRE EXTINGUISHERS	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
S Vancouver Fire 22131 Fraserwood Way	604-232-3473



FLAMMABLE LIQUIDS, PESTICIDES, SOLVENTS AND GASOLINE		
DROP-OFF LOCATION	PHONE	
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010	
Regional Recycling 13300 Vulcan Way	1-855-701-7171	
Complete list of accepted items: regeneration calor		

Complete list of accepted items: regeneration.ca or 604-732-9253.

GENERAL HAZARDOUS MATERIALS		
DROP-OFF LOCATION	PHONE	
S Tervita 160 -13511 Vulcan Way	604-214-7000	



GYPSUM DRYWALL No other materials attached to or on drywall	
DROP-OFF LOCATION	PHONE
S City of Vancouver Landfill 5400 72nd Street, Delta	604-873-7000
New West Gypsum Recycling 11871 Horseshoe Way	604-534-9925
Vancouver Transfer Station (maximum 1/2 sheet with a paid load of garbage) 377 W. Kent Avenue N., Vancouver	604-873-7000





Not Banned – Recyclable through the City and other services

Not Banned – Recycling options are available

A fee is charged



HYPODERMIC NEEDLES DROP-OFF LOCATION

Purchase a "Sharps Container" from a pharmacy and return the container to same pharmacy when full. Complete list of drop-off locations: healthsteward.ca/returning-medical-sharps.



LIGHTS AND LIGHTING FIXTURES	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Canadian Tire 11288 Steveston Highway	604-271-6651
Regional Recycling 13300 Vulcan Way	1-855-701-7171
Rona 7111 Elmbridge Way	604-273-4606

Accepted items: regeneration.ca or 604-732-9253.



LUBRICATING OIL (USED), OIL FILTERS AND PLASTIC OIL CONTAINERS	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010

Accepted items: bcusedoil.com or 604-732-9253.



MATTRESSES AND BOXSPRINGS	
DROP-OFF LOCATION	PHONE
S Canadian Mattress Recycling 1210 Cliveden Avenue, Delta	604-777-0324
S City of Vancouver Landfill 5400 72nd Street, Delta	604-873-7000
S Vancouver Transfer Station 377 W. Kent Ave. N., Vancouver	604-873-7000
Richmond's Large Item Pick Up Program: Contact	

Richmond's Large Item Pick Up Program: Contact Sierra Waste at 604-270-4722. Some restrictions apply. Program details: richmond.ca/largeitem.



MEDICAL DEVICES AND EQUIPMENT	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
OK Bottle Depot 145 - 5751 Cedarbridge Way	604-244-0008
Regional Recycling 13300 Vulcan Way	1-855-701-7171



MUSICAL INSTRUMENTS (ELECTRONIC)	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
OK Bottle Depot 145 - 5751 Cedarbridge Way	604-244-0008
Regional Recycling 13300 Vulcan Way	1-855-701-7171



PAINT AND PAINT AEROSOL CONTAINERS	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Ironwood Bottle & Return-It Depot 110 - 11020 Horseshoe Way	604-275-0585
Regional Recycling 13300 Vulcan Way	1-855-701-7171
Complete Bartha and a second all and a	.*

Complete list items accepted: regeneration.ca or 604-732-9253.



PHARMACEUTICAL

DROP-OFF LOCATION

All pharmacies accept leftover or outdated prescription drugs, non-prescription medications, herbal products, mineral supplements, vitamin supplements and throat lozenges for safe disposal.

For a list of pharmacies and/or drugs, medications, herbal products and mineral supplements accepted, visit healthsteward.ca/returns/british-columbia or call 604-732-9253.

Note: Please do not wash these items down the drain or throw them in the garbage.



POLYSTYRENE FOAM (E.G. STYROFOAM) - MOLDED PACKAGING & FOOD

DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Ironwood Bottle & Return-It Depot 110 - 11020 Horseshoe Way	604-275-0585
London Drugs 5971 No. 3 Road 3080 - 11666 Steveston Highway	604-448-4811 604-448-4852
Queensborough Landing Return-it Depot Unit A - 409 Boyne Road, New Westminster	604-540-4467



POLYSTYRENE FOAM (E.G. STYROFOAM) - PEANUTS/CHIPS

DROP-OFF LOCATION	PHONE
Packaging Depot 6360 Kingsway, Burnaby	604-451-1206
5524 Cambie Street, Vancouver	604-325-9966



PROPANE TANKS: Refillable & Disposable DROP-OFF LOCATION PHONE Richmond Recycling Depot 604-276-4010 5555 Lynas Lane

Significant City of Vancouver Landfill 604-873-7000 5400 72nd Street, Delta

Note: Free drop-off of up to four disposable tanks and two refillable tanks.



OUTDOOR POWER EQUIPMENT	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Regional Recycling 13300 Vulcan Way	1-855-701-7171



SEWING, KNITTING & TEXTILE MACHINES	
DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Ironwood Bottle & Return-It Depot 110 - 11020 Horseshoe Way	604-275-0585
OK Bottle Depot 145 - 5751 Cedarbridge Way	604-244-0008
Regional Recycling 13300 Vulcan Way	1-855-701-7171



TELUS EQUIPMENT (RENTAL OR RETAIL)

DROP-OFF LOCATION

All TELUS rental or retail equipment such as cordless/ corded phones, Voice Over IP (VOIP) phones, Global Positioning System (GPS) equipment and video/ telephone conference equipment can be returned via Canada Post. Call 604-310-2255 for more information.



THERMOSTATS	
DROP-OFF LOCATION	PHONE
Andrew Sheret Ltd. 4500 Vanguard Road	604-278-3766
Vancouver Zero Waste Centre (maximum 2) 8588 Yukon Street, Vancouver	604-873-7000

Drop-off locations: hrai.ca/public-drop-off-locations or 1-800-267-2231 ext 224.



TIRES AND TUBES – BICYCLES		
DROP-OFF LOCATION	PHONE	
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010	
Cap's/Krusty's Bicycles 135-8460 Alexandra Road	604-270-2020	
Village Bikes (small amounts) 3891 Moncton Street	604-274-3865	
	4 066 750 0400	

List of locations: tsbc.ca/bike.php or 1-866-759-0488.



TIRES – VEHICLES		
DROP-OFF LOCATION	PHONE	
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010	
sland City Automotive 180 - 5400 Minoru Blvd	604-273-4023	
Canadian Tire (no rims) 3500 No. 3 Road 11388 Steveston Highway	604-273-2939 604-271-6651	
Kal Tire 2633 No. 5 Road	604-278-9181	
Metro Tires Ltd. 16160 River Road	604-321-9004	
OK Tire (only 4 per household) 5831 Minoru Boulevard	604-278-5171	
Redline Automotive Ltd. 1 - 11711 No. 5 Road	604-277-4269	
Vancouver Landfill (Passenger/light truck, with/without rims, limit of 10) 5400 72nd Street, Delta	604-873-7000	

Richmond's Large Item Pick Up Program: Contact Sierra Waste at 604-270-4722. Some restrictions apply. Program details: richmond.ca/largeitem.

Complete list of locations: tsbc.ca or 1-866-759-0488.

All retail locations accept a used tire for a new one purchased.



TOOLS - POWER (ELECTRONIC & ELECTRICAL)		
DROP-OFF LOCATION	PHONE	
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010	
Ironwood Bottle & Return-It Depot 110 - 11020 Horseshoe Way	604-275-0585	
OK Bottle Depot 145 - 5751 Cedarbridge Way	604-244-0008	
Regional Recycling 13300 Vulcan Way	1-855-701-7171	
Richmond Return-It Depot 135 - 8171 Westminster Hwy	604-232-5555	



TOYS (ELECTRONIC & ELECTRICAL) INCLUDING VIDEO GAMING SYSTEMS & **ACCESSORIES**

DROP-OFF LOCATION	PHONE
Richmond Recycling Depot 5555 Lynas Lane	604-276-4010
Best Buy 700 - 5300 No. 3 Road	604-273-7335
Ironwood Bottle & Return-It Depot 110 - 11020 Horseshoe Way	604-275-0585
OK Bottle Depot 145 - 5751 Cedarbridge Way	604-244-0008
Regional Recycling 13300 Vulcan Way	1-855-701-7171



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Disposal Ban – Banned from the landfill and recyclable
through retailers, stewardship or take-back programs

Disposal Ban - Banned from the landfill and recyclable through the City and other services

Not Banned – Recyclable through the City and other services

Not Banned – Recycling options are available

A fee is charged



UPHOLSTERED FURNITURE (COUCHES, ARMCHAIRS, ETC) **DROP-OFF LOCATION PHONE** Richmond Recycling Depot 604-276-4010 5555 Lynas Lane 604-777-0314 Canadian Mattress Recycling 140 - 715 Eaton Way, Delta City of Vancouver Landfill 604-873-7000 5400 72nd Street, Delta

Richmond's Large Item Pick Up Program: Contact Sierra Waste at 604-270-4722. Some restrictions apply. Program details: richmond.ca/largeitem.





Report to Committee

To:

Public Works and Transportation Committee

Interim Director, Public Works Operations

Date:

June 7, 2021

From:

Suzanne Bycraft

File:

02-0780-01/2021-Vol

01

Re:

Electric Vehicle Adoption - Youth Outreach Initiative

Staff Recommendation

That the report titled 'Electric Vehicle Adoption - Youth Outreach Initiative', from the Interim Director, Public Works Operations, dated June 7, 2021, be received for information.

Suzanne Bycraft

Interim Director, Public Works Operations

Att. 1

REPORT CONCURRENCE				
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER		
Communications Community Social Development Sustainability and District Energy	☑ ☑ ☑	- Glin hung		
SENIOR STAFF REPORT REVIEW	Initials:	APPROVED BY CAO		

Staff Report

Origin

This report presents information on a community outreach initiative designed to promote electric vehicle awareness among youth. During 2020, the City applied and was awarded funding in the amount of \$10,000 from Emotive's Community Outreach Incentive Program. The purpose of this program is to create awareness and alignment with the provincial Zero-Emissions Vehicle (ZEV) Act, which requires that automakers sell or lease only 100% ZEVs by 2040. By helping to promote awareness among youth, the City is not only furthering its own Green Fleet Action and Community Energy and Emissions (CEEP) plan objectives, but is also helping to lead broader community ZEV adoption.

This report supports Council's Strategic Plan 2018-2022 Strategy #2 A Sustainable and Environmentally Conscious City:

Environmentally conscious decision-making that demonstrates leadership in implementing innovative, sustainable practices and supports the City's unique biodiversity and island ecology.

2.1 Continued leadership in addressing climate change and promoting circular economic principles.

This report supports Council's Strategic Plan 2018-2022 Strategy #8 An Engaged and Informed Community:

Ensure that the citizenry of Richmond is well-informed and engaged about City business and decision-making.

8.1 Increased opportunities for public engagement.

Analysis

In 2019, the Province of British Columbia passed the Zero-Emission Vehicles Act (ZEV Act). The ZEV Act requires automakers to meet an escalating percentage of new light-duty ZEV sales and leases, reaching:

- 10% of light-duty vehicle sales by 2025;
- 30% by 2030; and
- 100% by 2040.

The City's Green Fleet Action plan guides corporate actions to ensure alignment with these regulations, including the acquisition of ZEVs to reduce fleet-related emissions. Electric vehicle charging stations continue to be installed to encourage broader community electric vehicle adoption. Council endorsed the CEEP Strategic Directions in January 2020; the Directions will guide the development of more specific actions in the revised 2020-2050 CEEP. Strategic Direction 3 - Transition to Zero Emission Vehicles aims to foster electric mobility, with expanded options for charging personal electric vehicles, electric car share vehicles, e-bicycles,

and e-scooters at home, at work and on-the-go. As part of the early stages in the CEEP public engagement program, staff aimed to reach youth and families throughout the community to raise awareness and obtain feedback by participating in community events through the summer of 2019. Youth engagement is an opportunity to create awareness and demonstrate leadership to position the community for further advancing ZEV adoption.

Community Outreach Initiative

Emotive Community Outreach Incentive Program

The Emotive Community Outreach Initiative (COIP) is a component of the provincial CleanBC Go Electric Program and is managed by Plug-In BC. This is the second time the City has received funding through this program. The first was \$8,000 in 2018, which was used to promote electric vehicles and charging infrastructure through outreach programs. The campaign consisted of information booths at a variety of local public events, including the Richmond World Festival as well as free public workshops. With the \$10,000 received in 2020 and an increased focus on raising awareness among youth, staff undertook development of this initiative with the involvement of the City Green Ambassadors with a keen interest in electric vehicles and who had previously been involved with City EV outreach events. Plug-In BC, Plug-In Richmond and the Richmond School District were also partners in the development of this outreach initiative.

COIP Program Overview

The concept of designing a youth awareness initiative with youth involvement helped to frame a unique and engaging approach. The involvement of Plug-In BC helped to ensure the messaging remained on target with broader provincial ZEV regulations and, most importantly, the Richmond School District's involvement helped to design a program that would be aligned with standard school curriculum approaches. The outreach program, known as the "Richmond EVie Lesson Toolkit", includes the following components:

- 1. A uniquely City-designed mascot appropriately named "EVie", including EVie emojis.
- 2. An engaging 60 second video to introduce the concept of EVs and how they may be connected in future. (Video link: https://vimeo.com/536454214 and password: COR)
- 3. For younger students, a lesson plan for kindergarten to grade 7 which includes colouring and activity pages.
- 4. For older students, a lesson plan designed for grades 8 to 12 including a presentation slide deck.
- 5. Creative components, including a design challenge or short video challenge, where students can design their own views of what transportation may look like in 2050. Winning entries will be featured on Emotive's social media platforms.

Teachers can use the Richmond EVie Lesson Toolkit in their classrooms in whole or in part, as best suited to their teaching agendas.

A story-board image of the different EVie Lesson Toolkit components is included as Attachment 1 for reference.

Due to COVID-19, this program was created entirely through virtual meetings between November 2020 and April 2021 involving more than 11 planning sessions and numerous virtual meetings with teachers and internal City staff. The Green Ambassador volunteers donated 350 hours during this period to help design the program.

COIP Program Roll Out

Staff are working with the Richmond School District to launch the EVie Lesson Toolkit starting in June 2021 in preparation for program roll out starting in September 2021. The roll out will involve letters being sent to the Richmond School District teachers inviting them to teach all or portions of the program. Staff and the Green Ambassadors involved in the program will be available for virtual presentations to guide teachers through all the program elements. The toolkit will be available for teachers in Richmond to access through Plug-In BC's website. Teachers will be invited to complete evaluations of the program through Let's Talk Richmond and feedback can be used to revise and improve the toolkit.

The involvement of the various partners described in this initiative has led to considerable interest in the uniqueness of the approach. The program was designed with the following in mind:

- Execute a youth-led design;
- Design with Richmond School District involvement to follow standard school curriculum;
- Design with provincial involvement via Plug-In BC; and
- Deliver an easily replicable program for other school districts throughout the province and nationally.

The intent is to first offer the program in a beta-testing platform to Richmond School District teachers. Their experiences and feedback will help guide any future program delivery and expansion. Representatives of Emotive COIP and the Provincial Ministry of Energy, Mines and Low Carbon Innovation have expressed an interest to expand this initiative, and these opportunities will be explored at a later date pending the outcome of beta-testing.

Financial Impact

The City received a \$10,000 grant from Emotive's Community Outreach Incentive Program. The project was developed within this funding allocation, along with City staff time, Green Ambassador volunteer hours and in-kind professional advice from teaching professionals, Plug-In BC and Plug-In Richmond.

Conclusion

This report provides an overview of the EVie Lesson Toolkit, a multi-pronged curriculum-based teaching initiative designed to raise awareness of electric vehicles among youth. The toolkit is being offered to teachers in the Richmond School District to beta-test and provide feedback for review and refinement. Early indications are that this unique approach to youth outreach could result in this made-in-Richmond teaching toolkit being shared with others in the regional district, and potentially expand provincially and beyond.

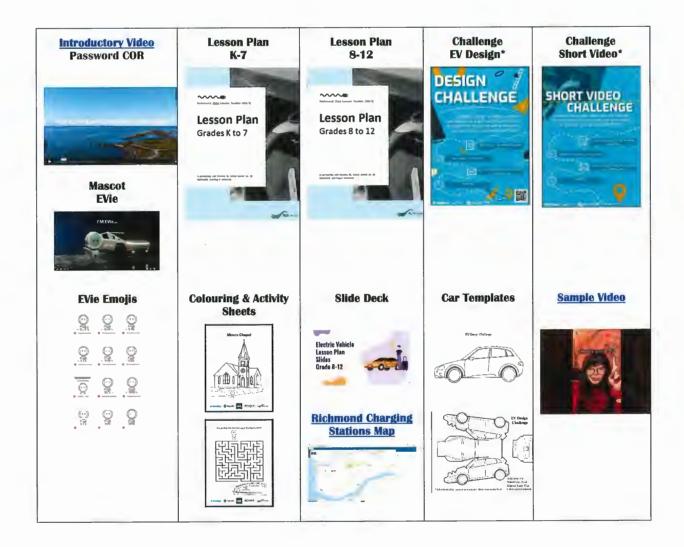
Suzanne Bycraft

Interim Director, Public Works Operations (604-233-3338)

SB:jk

Att. 1: EVie Lesson Toolkit – Story Board Image

EVie Lesson Toolkit – Story Board Image Proposed Website: www.pluginbc.ca/RELT





Report to Committee

To: Public Works and Transportation Committee

Date: May 21, 2021

From: Peter Russell

File: 10-6125-07-02/2021-

Vol 01

Director, Sustainability and District Energy

Re: Help Cities Lead Initiative

Staff Recommendations

That, as described in the report titled 'Help Cities Lead Initiative' from the Director, Sustainability & District Energy, letters be sent to Metro Vancouver; the Ministry of Environment and Climate Change Strategy; the Ministry of Municipal Affairs; the Attorney General's Office; the Ministry Responsible for Housing; the Ministry of Energy, Mines and Low-Carbon Innovation; and the Ministry of Finance, asking them to expand regulatory and program tools that local governments can adopt to facilitate greenhouse gas emission reductions.

Peter Russell

Director, Sustainability and District Energy (604-276-4130)

Att. 5

REPORT CONCURRENCE			
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER	
Building Approvals Development Applications Policy Planning	☑ ☑	- Gla hung	
SENIOR STAFF REPORT REVIEW	Initials:	APPROVED BY CAO	

Staff Report

Origin

This report seeks Council's endorsement of the Help Cities Lead advocacy campaign for greater collaboration between the Province of BC and local governments to support and accelerate energy efficiency and GHG reductions in new and existing buildings.

In 2010, Council adopted targets in Richmond's Official Community Plan to reduce community greenhouse gas (GHG) emissions 33% below 2007 levels by 2020, and 80% below 2007 levels by 2050.

Since 2012, the City's wholly-owned Lulu Island Energy Company (LIEC) has been delivering renewable energy to connected buildings in the Alexandra District Energy Utility (DEU), totalling 2.4M square feet of space to date. LIEC's Oval Village DEU, established in 2013 now services 2.7M square feet of space; these buildings will be receiving renewable energy starting in 2024 from sewer heat recovery technology. The City Centre DEU service area was established in 2018 and already has commitments to service 5M square feet of space; these buildings will be using low-carbon heat pump technology. Finally, staff have direction from Council to bring forward a servicing strategy and financial plan for a City Centre-scale DEU, anticipated in Q3 2021, using renewable energy sources. These investments are expected to deliver meaningful results: the City expects that its district energy utility program will be responsible for a 70% reduction in GHGs from Richmond's total building sector alone by 2050.

In 2014, Richmond adopted its Community Energy and Emissions Plan (CEEP). The CEEP outlines an array of strategies and actions for the City to reduce community energy use and GHG emissions. Actions related to new buildings built on the success of the City's greenhouse gas (GHG) reduction policies and infrastructure investments, including GHG reductions achieved by LIEC.

In January 2020, Council endorsed greenhouse gas emission reduction targets within eight Strategic Directions to guide the completion of an updated CEEP and obtain final public feedback. The updated targets set out in that report align with those set by the International Panel on Climate Change to limit overall global warming to 1.5°C above pre-industrial temperatures. To achieve this, the City of Richmond will need to reduce community greenhouse gas (GHG) emissions 50% below 2007 levels by 2030, and net-zero carbon emissions by 2050.

This report supports Council's Strategic Plan 2018-2022 Strategy #2 A Sustainable and Environmentally Conscious City:

2.1 Continued leadership in addressing climate change and promoting circular economic principles.

Analysis

The objective of Help Cities Lead is to accelerate decarbonisation of the building sector, by means of the Province providing local governments with a specific set of expanded mandates for

climate action. Help Cities Lead is an advocacy campaign initially conceived through the Sustainable Communities Network¹ in 2019. As of April 26, 2021, 29 municipal councils in BC have agreed to request that the Province support the recommended actions and next steps included within the Help Cities Lead initiative.

Alignment with Richmond's Greenhouse Gas Reductions Objectives

With the increased performance and availability of high-efficiency electric heat pumps for space and water heating in buildings, achieving deep GHG reductions within new and existing buildings is more feasible now than it was less than a decade ago. Buildings being constructed in Richmond under the BC Energy Step Code, including buildings connected to the City's wholly-owned LIEC, are already making use of zero-carbon electric heat pumps. Richmond's updated CEEP will identify a portfolio of strategies, programs and policy measures to reduce GHG emissions from new and existing buildings. Some of these measures would benefit from a Provincial mandate allowing local governments to set building GHG emission limits directly, or through a provincial "opt in" standard that local governments could adopt as bylaw requirements. The latter process would be similar to that used by local governments in adopting the BC Energy Step Code performance requirements.

Richmond has actively advancing energy efficiency and GHG reductions in new buildings over the past decade through LIEC's DEU connected buildings and energy efficiency policies that pre-dated the City's adoption of the BC Energy Step Code. The City has consistently advocated for expanded local government mandates in this area, through previous UBCM resolutions and advocacy through the BC Energy Step Code Council. The Help Cities Lead initiative is consistent with these efforts. The City's ability to implement climate action measures targeting new and existing buildings in Richmond's updated CEEP would be greatly assisted if the Province adopted the five key asks of Help Cities Lead, and all five are identified as enabling measures within the draft 2020-2050 CEEP.

Help Cities Lead - Regulatory and Program Actions for the Building Sector

Help Cities Lead identifies five specific areas where some form of delegation of provincial authority to local governments would empower BC municipalities to implement policies and programs that could greatly reduce community-wide GHG emissions over the next decade:

1. Regulating GHG emissions for existing buildings

With the exception of the City of Vancouver, local governments in BC currently do not have the authority to regulate GHG emissions from existing buildings. The Province could delegate powers to local governments enabling them to regulate GHG emissions from existing buildings or enable local governments to opt in to standardized GHG emission limits, analogous to the Energy Step Code. See Attachment 1 for more information.

¹ Sustainable Communities is a collaborative, information-sharing network of local government staff from BC communities (including City of Richmond) that are active on energy and climate.

2. Regulating GHG emissions for new buildings

The City, through LIEC, has directly invested in low carbon district energy systems to reduce GHG emissions in new commercial, institutional and high density residential buildings in the City Centre. For new buildings inside or outside of district energy service areas, the BC Energy Step Code is also an effective tool for energy efficiency. However, the Step Code does not currently regulate GHG emissions. In response to this limitation, the City pioneered the use of providing a two-option Step Code approach, allowing a one Step lower energy efficiency performance if a low carbon energy system is installed. Connecting to a DEU qualifies as a low carbon energy source because buildings are either directly connected to a low carbon energy source, as in the case of the Alexandra DEU, or will be, as in the case for the City Centre DEU and Oval Village DEU (i.e. when the sewer heat recovery energy system is completed in 2024). Provincial delegation of powers to local governments to directly regulate GHG emissions (or to opt in to standardized GHG emission limits in Code) would remove the need for an indirect local government work-around, and would greatly improve the ability of local governments to ensure that new buildings achieve low GHG emissions. Help Cities Lead calls on the Province to establish province-wide limits on building emissions that would steadily decrease each year, culminating in a near zero carbon standard by 2030. See Attachment 2 for more information.

3. Mandatory building energy benchmarking and reporting

Energy benchmarking is the process of collecting and monitoring annual energy and emissions data from large buildings over time, so that the energy performance of any participating building can be compared to that of similar buildings. Widespread implementation of mandatory energy benchmarking and reporting programs in US cities, including Seattle and New York City, has resulted in significant gains in building performance, as increased transparency and disclosure enables property managers to assess the relative performance of their buildings, and motivates users to invest in energy efficiency and emission reduction measures. The City of Richmond has previously requested that the Province enable local governments to implement a mandatory benchmarking requirement in 2014, and again in 2017, with several municipalities supporting this through UBCM Resolution B62. The City is currently participating in Building Benchmarking BC, an initiative where owners of large buildings can voluntarily disclose building energy use and GHG emissions. This program has been successful, with 42 commercial and multi-unit residential buildings in Richmond reporting their results in the first year of this program, indicating clear market acceptance of building benchmarking. See Attachment 3 for more information.

4. Mandatory home energy labelling

Federal and provincial legislation requires energy labelling for a broad range of consumer products including motor vehicles, furnaces, windows, lighting and kitchen appliances. However, there are no energy labeling requirements for homes. Richmond currently collects building energy modelling data through implementation of the Energy Step Code, but, the mandate for local governments to require building energy reporting from existing buildings remains unclear. An explicit local government mandate to implement home energy labelling requirements would address this, enabling interested parties including homeowners, local

governments, industry professionals, and potential home buyers to access information about a given home's energy performance. The 2018 CleanBC Plan notes that home energy labelling would "make it easier for buyers and renters to factor energy costs into their decisions while giving owners another incentive to make their buildings more efficient." See Attachment 4 for more information.

5. Property assessed clean energy financing (PACE)

"Property assessed clean energy" or "PACE" financing programs enable property owners to leverage some of the value of their home to finance the up-front cost of building energy efficiency upgrades (e.g., energy efficient heating systems, high-performance windows, thermal upgrades to walls and roofs), and then pay the costs back over the operational life of the upgrade through a surcharge on their tax assessment. The assessment is attached to the property, not an individual. When the property is sold, financing for the energy efficiency upgrades carries on with the new owner who benefits from the investment until the investment costs have been fully paid. See Attachment 5 for more information.

Financial Impact

None.

Conclusion

Richmond has long been active in implementing building GHG reduction measures to achieve deep community-wide GHG reductions, including activities such as investing extensively in low carbon district energy systems through the City's wholly-owned LIEC and enacting energy efficiency policies such as the BC Energy Step Code. This report identifies five specific changes to current provincial legislation – all of which are consistent with the approved Strategic Directions that will guide a revised CEEP – that would empower Richmond and other BC municipalities with additional tools to implement policies and programs for new and existing buildings, thereby greatly reducing community-wide GHG emissions over the coming decades.

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Att. 1: Help Cities Lead Briefing Note – Regulating GHG Emissions for Existing Buildings

Att. 2: Help Cities Lead Briefing Note – Regulating GHG Emissions for New Buildings

Att. 3: Help Cities Lead Briefing Note - Building Energy Benchmarking

Att. 4: Help Cities Lead Briefing Note – Home Energy Labelling

Att. 5: Help Cities Lead Briefing Note - Property Assessed Clean Energy (PACE) Financing













Briefing Note: Regulating GHG Emissions for Existing Buildings

December 2020

Purpose

This note aims to update the provincial government on the benefits of—and support for—new regulation that would target greenhouse gas (GHG) emissions from existing buildings. As buildings contribute approximately 11 per cent of British Columbia's overall emissions, the province will need new policy in this sector if it is to meet its legislated climate targets to reduce province-wide GHG emissions by 40% from 2007 levels by 2030 and 80% by 2050.

Background

Building space and water heating is the province's third-highest source of climate pollution after road transportation and the oil and gas sector.

- With the exception of the City of Vancouver, British Columbia's local governments presently have few means of effectively limiting building emissions, which represent between 40 and 60 percent of their total GHG inventory.
- CleanBC commits the province to develop new standards for building upgrades by 2024; anticipated updates to the National Energy Code of Canada for Buildings (NECB) would guide the new standard.
- The 2016 Pan Canadian Framework on Clean Growth and Climate Change directs the federal government to develop a new model code for existing buildings by 2022.¹ If implemented and subsequently adopted by British Columbia, this code would help local governments guide energy efficiency improvements at the time of a building's renovation.
- However, the above code would have limited impact on GHG emissions, because it is solely focused on energy efficiency. A more efficient building that uses fossil fuels to heat its space and water will continue to pollute significantly more than one that uses electricity or low-carbon fuel.
- Leading local governments are seeking new legislative changes that will enable them to directly limit allowable emissions from buildings within their jurisdiction.²

¹ Government of Canada. Pan-Canadian Framework on Clean Growth and Climate Change. "New Actions." 2016. p. 17

 $^{^2 \} BC \ Climate \ Leaders. The \ Climate \ Leaders \ Playbook. \ https://bcclimateleaders.ca/playbook/the-big-moves/where-we-live-and-work/$

- Without this kind of measures, modelling done by Integral Group shows that the provincial governmental will not achieve its GHG emissions reductions targets.
- The November 2020 Mandate Letter to the Minister of Environment and Climate Change Strategy includes direction for the Minister to keep BC on track to meet its 2030 greenhouse gas emissions targets.

The Evidence Basis

A recent Pembina Institute report concludes British Columbia could reduce emissions from existing buildings by up to 60 per cent by retrofitting three per cent of the building stock each year, and also by converting half of those retrofitted buildings from fossil fuel heating to low-carbon energy sources, such as electricity.

- British Columbia briefly achieved this level of retrofit activity in the second quarter of 2009, the year homeowners were able to access both the provincial LiveSmart and the federal ecoENERGY retrofit incentive programs. On average, though, those combined programs yielded retrofits of just one per cent of eligible homes.
- This limited uptake aligns with U.S.-based research demonstrating that incentive- and information-based programs alone are insufficient to accomplish climate retrofit upgrades at the needed scope, scale, and speed.
- As most heating equipment is only replaced every 15 to 20 years or, in the case
 of building envelope improvements, every 40 to 50 years, retrofits must
 maximize GHG reductions along with energy savings. Delaying effective
 measures to reduce emissions will ultimately only increase the cost of achieving
 these savings. Delays will also make it more difficult for both the province and
 local governments to achieve their climate targets.
- According to a recent report by the American Council for an Energy-Efficient Economy (ACEEE), it is too early to point to a single best-practice approach for mandatory building performance standards. The ACEEE instead encourages individual jurisdictions to pursue an approach that works best for its communities. The report also points to actions such as building benchmarking and stakeholder consultation as important precursors to a standard.

Jurisdictional Scan

 Multiple jurisdictions already regulate, or are planning to regulate, minimum energy performance requirements for existing buildings; at least two—New York City and Tokyo—directly regulate building emissions.

 New York City's Building Emissions Law, enacted in 2019, established emissions limits beginning in 2024 and increasing in 2030.³ This law requires

³ UrbanGreen. NYC Building Emissions Law Summary: Local Law 97.

owners of buildings larger than 25,000 square feet to report on energy use and make changes if they do not meet the requirements specified for their building type. There are exceptions to this size threshold, particularly in the case of affordable housing.

- In most cases, the jurisdictions require mandatory energy and/or GHG
 performance reporting as well as other measures to encourage and support
 proactive upgrades before they are required.
- The City of Vancouver has required prescriptive energy efficiency retrofit
 upgrades as part of its major building alterations permitting process since 2015.
 It is currently updating its zero-emissions strategy for existing buildings and is
 considering a transition to a regulatory approach based on minimum GHG
 performance.

British Columbia - Current State

The Province of British Columbia does not currently regulate greenhouse gas emissions from existing buildings.

- In 2019 and 2020, the Ministry of Municipal Affairs and Housing's Building Safety and Standards Branch conducted limited consultations on various approaches for a potential new standard for building upgrades.
- This consultation consisted of one-on-one interviews with a small number of key stakeholders; findings are not yet publicly available.
- The City of Vancouver is planning to establish GHG emissions performance requirements for existing buildings starting in 2025 as part of its Climate Emergency Plan that was approved by Vancouver City Council in November 2020.
- The Metro Vancouver Regional District (Metro Vancouver) is currently exploring minimum GHG pollution requirements for existing buildings under the Provincial Environmental Management Act.
- Should Metro Vancouver move forward with a GHG pollution standard for buildings, to ensure fairness and consistency, the provincial government may wish to enable additional local governments to use the tool.
- The set of recommendations advanced by the UBCM Special Committee on Climate Action includes a provision for the province to develop a retrofit code, which sets standards for low carbon building retrofits.

Next Steps

Potential next steps for government include the following actions.

 Release the findings from the first round of the government's recent consultation on a GHG standard for building upgrades.

- Expand and accelerate stakeholder consultation on a standard for building upgrades.
- Ensure that the issues being explored by the province include a GHG
 performance standard as well as the range of supporting measures (e.g.,
 benchmarking, financing) needed to ensure a successful building upgrades
 policy.
- Work closely with leading local governments to ensure they have the skills and capacity required to implement a standard for building upgrades.
- Expand the CleanBC commitment to develop new standards for building upgrades by 2024 to include GHG performance standards, as well as energy performance standards.
- Establish a minimum energy and GHG performance standard for existing public sector buildings.













Briefing Note: Regulating GHG Emissions for New Buildings

December 2020

Purpose

This note aims to update the provincial government on the benefits of, and support for, new regulation that would target greenhouse gas (GHG) emissions from new buildings – a policy measure we are pleased to note was included in the November 2020 Mandate Letter to the the Attorney General and the Minister Responsible for Housing.

Background

Approximately one third of the buildings standing in British Columbia in 2050 will be built in the coming 30 years. Many of these buildings will burn natural gas to supply their occupants with heat and hot water. Other than the City of Vancouver, British Columbia local governments presently have no way to require new buildings to use low-carbon energy systems.

- Many local governments would like the province to set minimum allowable GHG emissions performance requirements for new buildings.
- The set of recommendations advanced by the UBCM Special Committee on Climate Action includes a provision to add a carbon metric to the Energy Step Code.
- As envisioned, these requirements would grow more stringent year over year until 2032, when they would culminate in a near zero GHG emissions standard.
- Recent modelling by Integral Group suggests that the province will not achieve its 2030 climate target unless it directly embeds GHG emissions requirements in the British Columbia Building Code.
- Local governments cannot use the BC Energy Step Code to regulate GHG emissions from new buildings.
- The November 2020 Mandate Letter to the Attorney General and the Minister Responsible for Housing includes direction for the Minister to support local governments to set their own carbon pollution performance standards for new buildings.

Jurisdictional Scan

As noted above, with the exception of the City of Vancouver, British Columbia Local Governments cannot directly limit greenhouse gas emissions from new buildings.

 The City of Toronto's Zero Emission Building Framework requires owners of new buildings to demonstrate compliance with the Framework's minimum greenhouse

- gas intensity performance standard. This requirement is in addition to minimum energy performance standards.
- Toronto's Framework includes a full set of targets and requires increasing levels
 of performance over time. The city developed four performance tiers to take the
 industry from today's construction practices to near-zero emissions performance
 by 2030.
- Toronto's pathway to near-zero emissions building construction is helping the city meet its 2050 GHG targets; it provides the building industry with a clear and transparent picture of upcoming requirements.
- The City of Vancouver currently regulates minimum GHG performance requirements for a wide range of building types, including single family homes, townhomes, low- and high-rise multi-unit residential buildings, commercial buildings, and offices.
- Like its energy performance standards, Vancouver has established a GHG
 performance metric: kilograms of carbon dioxide equivalent emissions per square
 meter per year (kgCO2e/m2/y) for larger buildings and an absolute emissions
 cap for homes. The city easily checks and verifies the GHG requirement using
 the same procedures that it uses to regulate energy performance.
- By 2025, Vancouver intends to impose a zero-emissions building standard for new homes and buildings.
- In July 2019, the City of Berkeley became the first U.S. city to adopt an ordinance to prohibit natural gas service connections in new buildings. One year later, at least 40 cities in California have adopted one form or another of a "no or almost no" gas mandate for new construction.¹²
- A diverse coalition of utilities, industry associations, and NGOs is currently underway in California to include an all-electric requirement in Title 24, the state's updated building code for new homes.

British Columbia - Current State

The British Columbia Building Act does not allow local governments to establish technical building requirements beyond those cited in the British Columbia Building Code unless they are listed as an "unrestricted matter" under Section 5 (4) of the Building Act General Regulation. Examples of unrestricted matters include dedicated parking stalls for persons with disabilities, provisions for fire vehicle access, and district energy systems.

 In 2017, the province created the BC Energy Step Code by adding Article 9.36.6 and 10.2.3 of Division B to the unrestricted matters list. The regulation empowers local governments to establish minimum energy efficiency performance standards in new construction. However, it does not allow them to establish minimum GHG emissions standards.

¹ California Building Decarbonization Coalition. "Active Local Government Efforts." Retrieved from: http://buildingdecarb.org/active-codeefforts. html

² McCoy, C. "The Legal Dynamics of Local Limits on Natural Gas Use in Buildings." Harvard Law School. June 2020. Retrieved from: http://eelp.law.harvard.edu/wp-content/uploads/The-Legal-Dynamics-of-Local-Limits-on-Natural-Gas-Use-in-Buildings.pdf

- In short, local governments may use the British Columbia Building Code to regulate the energy performance of new buildings, but it falls short of helping them reach their community climate objectives.
- A 2019 Integral Group study commissioned by the Ministry of Municipal Affairs and Housing concluded that even a very efficient building built to the Upper Steps of the BC Energy Step Code could emit "significant" emissions over its lifetime.³ The regulation does not, in other words, guarantee the GHG reductions necessary to drive emissions to zero or near-zero levels.
- Recent Integral Group modeling suggests it will be very challenging for the
 province to achieve its climate targets unless it either introduces legislative
 changes permitting local governments to establish their own technical building
 requirements for GHG emissions, or directly embeds such requirements in the
 British Columbia Building Code.
- Without a direct path to regulating GHG emissions attributed to new buildings, a number of British Columbia local governments have begun developing creative "workarounds."
- Some communities now allow developers and builders to build to a lower step of the BC Energy Step Code than the base requirement referenced in their building bylaws so long as proponents commit to using a low carbon energy system, such as a heat pump, in their project.
- At least one other local government is exploring the use of density bonusing to incent the construction of low-carbon buildings; another is using Development Permit Area Guidelines.
- These local governments are working independently and establishing their own definitions of "low-carbon building" and/or "low carbon energy system." In short, the lack of a provincial standard has led to inconsistency in the marketplace.
- The set of recommendations advanced by the UBCM Special Committee on Climate Action includes a provision to add a carbon metric to the Energy Step Code.
- The Attorney General and Minister of Responsible for Housing was issued a Mandate Letter in November 2020 that includes direction for the Minister to support local governments to set their own carbon pollution performance standards for new buildings.

Next Steps

Potential next steps for government include the following actions:

- Work with the Energy Step Code Council to establish a GHG performance standard for new buildings by no later than July 2021.
- Amend the BC Building General Regulation to enable local governments to regulate GHG emissions of new buildings by no later than January 2022.
- Consider establishing GHG standards for new construction under the BC Energy Step Code—a move that would minimize administrative burdens. If choosing this

³ Integral Group. "Implications of the BC Energy Step code on GHG Emissions." June 2019. Retrieved from: http://energystepcode.ca/app/uploads/sites/257/2019/11/BC-Step-Code-GHGI-Report_Nov-2019.pdf

- option, government should establish and support an Energy Step Code Council subcommittee to review options and propose a preferred approach.
- Work closely with leading local governments and other key partners to ensure local building sectors across the province have the skills and capacity required to meet GHG performance standards for new construction.













Briefing Note: Building Energy Benchmarking

December 2020

Purpose

This note aims to update government on the benefits of mandatory building energy benchmarking and explain why local governments would like authority to require owners of certain categories of buildings to benchmark their properties and report out the data. British Columbia local governments have been requesting provincial action on benchmarking since 2014.

Background

Energy benchmarking is the process of collecting and monitoring energy data from a large number of buildings over time so that governments and the private sector can compare the performance of any one participating building against similar properties. Energy benchmarking helps:

- Individual building owners and managers track a property's energy performance from one year to the next and identify potential issues for further investigation. It also allows them to easily see how well their building is performing relative to similar properties.
- Governments and utilities target energy and greenhouse gas reduction policies, programs, and regulations to areas of the building sector where they will have the most impact.
- Governments and utilities to more easily and reliably analyse policy impact.

The Evidence Basis

In a 2017 study, Lawrence Berkley National Laboratories researchers found that mandatory benchmarking programs contributed to a three to eight per cent decrease in building energy-use-intensity levels over a two- to four-year period. Though it's impossible to attribute all of these energy savings to benchmarking, the researchers confirmed a causal relationship.

¹ Lawrence Berkeley National Laboratory. "Evaluation of U.S. Building Energy Benchmarking and Transparency Programs: Attributes, Impacts, and Best Practices." 2017. p. 57. Retrieved from: https://emp.lbl.gov/sites/default/files/lbnl_benchmarking_final_050417_0.pdf

With over ten years of applied experience, the benefits of benchmarking are now well understood. The practice:

- Drives positive changes in owner and occupant energy management via increased transparency and awareness of operational energy use.
- Encourages property owners to make targeted investments to reduce energy use.
- Promotes further efficiency through proper building commissioning and maintenance regimens.
- Creates growth for, and competition toward, better energy performance in the building industry.
- Helps inform municipal, regional, and national-scale energy policy.
- Allows jurisdictions to better substantiate GHG targets, and design more efficient programs.
- Identifies top performers and worst offenders of energy performance within neighborhoods and across building archetypes, allowing programs and service providers to more strategically target improvements.
- Allows prospective tenants to compare the overall costs they may face when choosing to lease a particular building.
- Promotes improved envelopes and mechanical systems, which can increase resilience in the face of climatic shocks and stresses.

Jurisdictional Scan

North American jurisdictions have used mandatory energy benchmarking since at least 2009, when New York City first required it of buildings larger than 50,000 square feet. Today, more than 30 jurisdictions have mandatory building energy benchmarking—30 cities, the states of Washington and California, and the Province of Ontario.

- In 2018, Ontario became the first Canadian jurisdiction to require water and energy reporting for privately owned residential, commercial, industrial, and institutional buildings. Owners of all large buildings in the province must now report their energy and water use annually.
- As of July 2019, Ontario required reporting for buildings with floorspace larger than 100,000 square feet; as of July 2020, the province had planned to step down this minimum to 50,000 square feet.
- Ontario's benchmarking program aligns with its current target to reduce emissions 30 per cent below 2005 levels by 2030.²

² Province of Ontario, 2018. "Ontario's Environment Plan: Preserving and Protecting our Environment for Future Generations." Retrieved from: https://prod-environmental-registry.s3.amazonaws.com/2018-11/EnvironmentPlan_1.pdf

- It is also consistent with a directive in the Pan Canadian Framework on Clean Growth and Climate Change that federal, provincial and territorial governments should work together to require labelling of buildings energy use by as early as 2019.
- In Washington DC, owners of all buildings larger than 50,000 square feet must report their energy and water use for public disclosure. This program is run through the Energy Star Portfolio Manager platform and is part of the Clean and Affordable Energy Act of 2008, which has a target of a 50 per cent reduction in GHGs by 2032 for the District of Columbia.
- The City of Portland requires owners of commercial buildings larger than 20,000 square feet to report on their energy use annually. This program covers around 80 per cent of conditioned commercial space in the city.
- Portland has recorded its progress with detailed annual reports. The reports
 reveal that compliance has increased every year, from 82 per cent in 2015 to 93
 per cent in 2018. Not only does Portland's performance beat out most major
 American cities, it has successfully reduced its energy use intensity for offices
 close to five per cent between 2016 and 2018.

British Columbia - Current State

There are currently no mandatory provincial or sub-provincial building energy benchmarking programs in British Columbia. It is also unclear if local governments operating under the Community Charter have the authority to require energy benchmarking within their jurisdiction. The Vancouver Charter enables the City of Vancouver to require benchmarking if it is used to show compliance with a regulation.

- In 2014, the Union of British Columbia Municipalities resolved to ask the
 provincial government to amend the Vancouver Charter, Local Government Act,
 and Community Charter to empower local governments to require energy
 benchmarking and make public non-confidential and non-competitive building
 energy performance results.
- In 2017, a second successful resolution asked the province to develop a
 requirement that buildings above a given size threshold benchmark their energy
 performance and report this information to the province annually, and for this
 information to be made available to local governments.
- In both instances, the province responded that it understands energy efficiency is key to achieving climate targets, and that it is exploring energy benchmarking policy options.
- The legal authority for local governments to regulate benchmarking without amendments to existing legislation is uncertain. A 2017 report by City of Richmond "...BC Ministry of Energy and Mines staff have noted their belief that local governments may enact benchmarking requirements, given that the Community Charter specifies 'a council may, by law, regulate, prohibit and

- impose requirements in relations to...buildings and other structures (Section 8(3)(1)).'"³
- This interpretation has not been knowingly confirmed nor rejected by either provincial or local government legal counsel. Until it is explicitly understood by both the province and local governments, it is unlikely that any local government operating under the Community Charter will move ahead with mandatory benchmarking.
- The City of Vancouver is planning to require benchmarking for large retail and commercial buildings starting in 2023 as part of its Climate Emergency Plan that was approved by Vancouver City Council in November 2020.
- The Metro Vancouver Regional District (Metro Vancouver) is currently reviewing whether it has authority under the Provincial Environmental Management Act to require energy benchmarking as a means to show compliance with a buildingscale greenhouse gas air pollutants regulation.
- Should Metro Vancouver conclude it has this authority, that jurisdiction may
 proceed with mandatory benchmarking. Should that occur, to ensure fairness
 and consistency, the provincial government may wish to enable additional local
 governments to use the tool.
- Building Benchmark BC is a recent initiative funded by Natural Resources
 Canada and BC Hydro to provide the reporting framework and encourage
 voluntary building benchmarking in the province. In its first year it registered
 over 600 privately owned buildings and includes the participation of nine leading
 local governments. Its reporting framework can be easily converted to support
 the broad rollout of mandatory benchmarking by local governments or the
 provincial government.

Disclosure Concerns

- The Building Owners and Managers Association of British Columbia has historically opposed mandatory energy benchmarking programs, citing concern with public disclosure of benchmarking results.
- However, mandatory benchmarking programs need not include disclosure. They
 can instead require certain buildings within a jurisdiction to track and then report
 their energy benchmarking results to the jurisdiction overseeing a mandatory
 program.
- In many jurisdictions, mandatory benchmarking programs are introduced with only reporting requirements, providing valuable information to both building owners and the jurisdiction receiving the reports. Disclosure of this information could follow, and sometimes does follow, but is not a default design requirement.

³ City of Richmond. February 2017. "Climate Action – Building Energy Benchmarking Policy Advocacy." February 2017. File 10-6125-07-02/2015-Vol01. P6. Retrieved from: https://richmond.ca/_shared/assets/Building_Energy_Benchmarking_CNCL_03271746780.pdf

Cost Concerns

- The largest cost for building owners is the time needed to set up a building's profile in a benchmarking program. To help offset some of this time, utilities, such as BC Hydro, currently cover the cost for some commercial customers to set up a building's initial benchmarking account.
- Once a building is set up, most of the additional inputs for an account are ongoing monthly utility use data for that building. In British Columbia, the downloading of utility data into Energy Star Portfolio Manager has been automated thanks to cooperation between the provincial government and the province's major gas and electric utilities.
- To help address potential government concerns with administration costs, Vancouver's Open Green Building Society has designed a backend benchmarking web-based program called the Grid. The software pulls data from a building's Energy Star Portfolio Manager file and reports it to the level of government administering a benchmarking program. The tool also provides aggregated building data in a format that allows the administrator to carry out careful market analysis and policy analysis. Grid is the software platform used to support the Building Benchmark BC initiative.
- In addition to the two costs discussed above and the existing initiatives being undertaken to address them, other considerations associated with mandatory benchmarking are training and data quality. Other jurisdictions that already require energy benchmarking, have demonstrated that program design can address these costs.

Next Steps

Potential next steps for government include the following actions.

- As per Union of British Columbia Municipalities resolutions in 2014 and 2017, the province could enable local governments to require building benchmarking reporting and disclosure on an opt-in basis.
- The province could further support the adoption of building benchmarking by local governments by developing and funding on an ongoing basis a central platform for data reporting, storage, and disclosure.
- The province could ensure that provincial and utility incentive programs support mandatory municipal benchmarking programs, as these programs will provide support to achieve utility demand side management objectives and its CleanBC targets.













Briefing Note: Home Energy Labelling

December 2020

Purpose

This note aims to update government on the benefits of a home energy labeling program – a measure we are pleased to note is included in the November 2020 Mandate Letter to the BC Minister of Finance - as one component of a potential new Building Energy and Greenhouse Gas Reduction Framework. A mandatory energy labeling program for new and existing homes would equip British Columbia consumers and other stakeholders with valuable information about a given home's energy performance, helping inform both purchase decisions and local-government energy efficiency programs, and ultimately helping local governments and the province meet their legislated climate targets.

Background

As early as 1994, researchers have regarded incomplete information on household energy consumption patterns as a market failure. Mandatory home energy labelling would address this failure by allowing information about a given home's energy performance to be shared with interested parties including homeowners, local governments, industry professionals, and potential home buyers.

- The Province of British Columbia does not currently have any requirements for home energy labelling; however, local government leaders have been discussing the opportunity with their provincial counterparts for at least six years.
- British Columbia local governments are unable to require either the reporting or disclosure of home energy labelling scores for existing homes.
- In 2014, the Union of British Columbia Municipalities resolved that the province consider adding energy assessment and EnerGuide label to the requirements for new Part 9 residential buildings. The government of the day declined the request, stating that the BC Building Code effectively specifies minimum emissions requirements.
- In 2016, the Pan-Canadian Framework on Clean Growth and Climate Change committed federal, provincial, and territorial governments to collaborate on building energy labeling that would in turn provide consumers and business with transparent information on energy performance.
- The 2018 CleanBC Plan committed the province to exploring a building energy rating requirement at the point of sales or lease. The Plan states that such a

¹Levine, Mark D. et al. Energy Efficiency, Market Failures, and Government Policy. 1994. Retrieved from https://eta-publications.lbl.gov/sites/default/files/energy-efficiency-market-failures-and-government-policy.pdf

- rating system would "make it easier for buyers and renters to factor energy costs into their decisions while giving owners another incentive to make their buildings more efficient."
- The November 2020 Mandate Letter to the Minister of Finance includes direction for the Minister to work with the Minister of Energy, Mines, and Low Carbon Innovation to require realtors to provide energy efficiency information on listed homes.

Key Considerations

About Energy Labels

In Canada and British Columbia, legislation requires energy labelling for a broad range of consumer products including motor vehicles, furnaces, windows, lightbulbs, and kitchen appliances. However, there are no labeling requirements for the single largest purchase a given Canadian is likely to make—their home.

- Disclosure and labelling programs can help encourage energy efficiency and are an important part of many market-transformation strategies².
- For buildings in Canada, Natural Resources Canada (NRCan) administers the EnerGuide home energy label programs. The EnerGuide program can be used for both new and existing homes.
- The City of Vancouver is currently exploring a "virtual" home energy score that it plans to pilot in 2021.
- For new homes, there are also a number of industry-led voluntary labelling programs, including the Canadian Home Builders Association's Net Zero Energy Labelling Program, Built Green, the Passive House Institute's Passive House certification, and the Canada Green Building Association's Leadership in Energy and Environmental Design (LEED) program.

Benefits of Mandatory Home Energy Labels

Mandatory home energy labels benefit a wide range of parties.

- They benefit home shoppers, so that they can better understand the operational costs of a given property, and more readily identify efficiency improvements that will lower energy costs over the long term. This information increases transparency for home shoppers, improves their ability to differentiate between properties, and ultimatley provides an additional level of consumer protection.
- They help home sellers convey the value of their energy efficiency improvements, adding a selling point to their home.
- They give real estate agents insights into a home's efficiency and any onsite renewable energy features, so that they can more effectively market and value a property.
- Mandatory building energy labelling also supports workforce development, by increasing demand for home energy audits and home performance upgrades, potentially spurring job creation.

² Dunsky Energy Consulting. Home Energy Performance Labelling: Pilot Program Manual." May 2017

- Labels help all levels of government meet energy reduction targets by motivating homeowners and potential buyers to invest in energy-efficiency measures.
- In cases where regulations require reporting of home energy scores to a central green building database, policymakers and utilities will be better equipped to gain insights into where energy is being used in their residential sector.
- Regulators can also tie home energy labeling requirements to existing building GHG performance requirements and require or support upgrades to homes that fall short of a specified level.
- Research on home energy labeling for the City of Edmonton found that the benefits to homeowners of taking part in mandatory energy labeling are greater than the costs and identified a positive correlation between energy efficiency features and selling price in the city's residential market.³
- More generally, a home energy label—and the assessment summary that usually accompanies it—can provide valuable information to homeowners and potential buyers about the steps they can take to improve a home's energy performance and lower its greenhouse gas emissions.

Jurisdictional Scan

In numerous other jurisdictions throughout the world, policy makers use mandatory home energy labelling to improve consumer awareness and building energy performance—helping jurisdictions meet their climate goals.

- Since 2006, all 28 European Union member states have required energy performance labels for all buildings. Labels must provide details to prospective buyers/tenants at time of construction, rental, or sale. Home energy labelling disclosure is required throughout the European Union.
- In the United States, some form of home energy disclosure is required in at least five states (Alaska, Connecticut, Hawaii, Kansas, Massachusetts, and South Dakota) as well as cities such as Austin TX, Berkley CA, Chicago IL, Minneapolis MN, Montgomery Country MD, and Portland OR.
- Assessments for home energy labels can vary in how detailed they are and how, where, and to whom they are reported.
- Well-designed and successful home energy efficiency policies depend on the existing infrastructure involved in home construction, sales, and performance analysis. In North America, the Multiple Listing Service® real estate industry database can include energy-use data, home energy ratings, and information on a property's energy efficiency characteristics. Potential home buyers—especially those interested in low energy costs and other benefits of energy-efficient homes—can use this data to inform their purchase decisions.⁴

³ City of Edmonton, "A Community Energy Transition Strategy Policy Brief: Mandatory Energy Labelling & Disclosure" 2019. Retrieved from https://www.edmonton.ca/city_government/documents/PDF/MandatoryEnergyLabellingAndDisclosure.pdf

⁴ ACEEE. Policy Brief: Home Energy Efficiency Policies: Ratings, Assessments, Laels, and Disclsoure, 2018. Retrieved from https://aceee.org/sites/default/files/pdf/topic-home-energy-assessment.pdf

British Columbia-Current State

The Province of British Columbia does not currently require home energy labelling. However, municipal and provincial policy makers have been discussing the idea for at least six years.

- In 2014, the Union of British Columbia Municipalities resolved that the province consider adding energy assessment and EnerGuide label to the requirements for new Part 9 residential buildings. The government of the day declined the request, stating that the *BC Building Code* effectively specifies minimum emissions requirements.
- The 2018 CleanBC Plan committed the province to exploring a building energy rating requirement at the point of sales or lease. The Plan states that such a rating system would "make it easier for buyers and renters to factor energy costs into their decisions while giving owners another incentive to make their buildings more efficient." The November 2020 Minister of Finance Mandate Letter includes direction for the Minister to work with the Minister of Energy, Mines, and Low Carbon Innovation to require realtors to provide energy efficiency information on listed homes.
- For new construction, in jurisdictions referencing the BC Energy Step Code, local
 governments can require builders to submit to the jurisdiction having authority a
 home energy score as part of its permitting administrative requirements and for
 the label to be displayed within the home at time of occupancy (e.g., on the
 electric panel). However, this authority ceases as soon as the occupancy permit
 is issued.
- British Columbia local governments currently lack the authority to require home energy labelling. Local governments would like the ability to opt into a mandatory home energy labelling reporting and disclosure program to help them achieve their community energy and climate targets. Without this authority, the market failure created by the lack of information about home energy performance will persist.
- The Minister of Finance was issued a Mandate Letter in November 2020 that included direction for the Minister to work with the Minister of Energy, Mines, and Low Carbon Innovation on a measure that will require realtors to provide energy efficiency information on listed homes.

Next Steps

Potential next steps for government include the following actions.

- The province could share with local governments and other stakeholders the findings of its exploration to date into an energy rating requirement for homes and buildings, as per the 2018 CleanBC Plan.
- Government could enter into discussions with local government leaders and other stakeholders on options for enabling home energy labelling and/or energy efficiency information on listed homes within the next two years.

- In consultation with local government representatives and other stakeholders, the
 province could establish a workplan for launching a home energy labelling
 program within the next year. Such a plan would at a minimum, allow local
 governments to opt into a mandatory home energy labelling program within their
 jurisdiction.
- The province could further support the adoption of home energy labels by local governments by developing and funding on an ongoing basis a central platform for data reporting, storage, and disclosure.

Case Studies

Portland, OR

The City of Portland passed the Residential Energy Performance Rating and Disclosure code in December 2016 and the program officially kicked off in early 2018. The program applies to homes within the City of Portland boundaries that are either single-detached, or a side-by-side rowhouse style complexes. Due to the nature of how the energy use measurements are conducted, apartments or stacked homes are not able to be included in the program yet.

Homeowners are required to obtain a home energy score prior to listing any applicable property to be sold. The onus of procuring the home energy assessment is on the owner and must be advertised with the home's for sale listing. In addition to disclosure on the listing, the owner must then also register the home on the US Green Building Registry.⁵ This program works in alignment with the city's 2050 goal of reducing carbon emissions by 80%.⁶

As of May 2019, 10,000 homes have participated in the home energy score program. There is a \$500 fine for non-compliance, which the city has indicated is significantly more than the cost of assessment and posting the label for the home. Initially the realtor community was reluctant to get on board with the program, however after implementation the city worked with the realtor community to address some of their common concerns (i.e. requiring the score to be completed prior to time of listing and not at time of closing.)

Austin, TX

The City of Austin passed the Energy Conservation Audit and Disclosure (ECAD) ordinance in 2008, which requires assessments and disclosures for all homes and

⁵ City of Portland. Home Energy Score. "Determine if you need a home energy score."

⁶ City of Portland. Home Energy Score. "Home Energy Score Program."

⁷ City of Portland. Home Energy Score. "Sellers start receiving fines this month for missing Home Energy Score."

⁸ ACEEE Policy Brief. Home Energy Efficiency Policies: Ratings, Assessments, Labels, and Disclosure."

buildings served by Austin Energy. ECAD has been built into the city code and requires all homes 10 years or older to be audited prior to listing them for sale.⁹

This measure is helping the city reach its Austin Climate Protection Plan goals to reduce CO2 emissions by more than 365,000 metric tonnes by 2020 and offset 900 megawatts of peak energy demand by 2025. The state also offers loan programs for energy efficiency upgrades to help homeowners reduce energy use in their homes through a program called LoanSTAR and PACE financing.¹⁰

Over half of the houses sold in Austin between 2009 and 2012 were in compliance. Since the program was introduced city staff report that the energy use performance in the housing stock has improved. There are fines for non-compliance, which range from \$500 to \$2,000 depending on the building type.

Initially realtors in the community were concerned about the impact of the program, however after city staff worked with them to hear their concerns (i.e. requiring audit at time of sale and not listing, which doesn't give home buyers any leverage or homeowners any incentive to improve performance). The city also used the American Recession Recovery Act funding to expand the number of energy auditors available in the city.¹¹

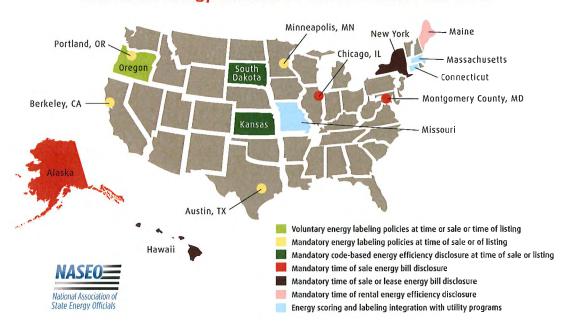
⁹ <u>Austin Energy. Energy Conservation Audit and Disclosure Ordinance.</u>

¹⁰ ACEEE Policy Brief. Home Energy Efficiency Policies: Ratings, Assessments, Labels, and Disclosure."

¹¹ Ibid.

Other Resources

Residential Energy Disclosure Policies in States and Cities



Map Source: https://www.naseo.org/issues/buildings/home-energy-labeling













Briefing Note: Property Assessed Clean Energy Financing

December 2020

<u>Purpose</u>

This note aims to update government on the benefits of, and support for, new measures that would enable local governments to offer Property Assessed Clean Energy (PACE) financing programs for residential and commercial properties - a policy measure we are pleased to note was included in the November 2020 Mandate Letter to the to the Minister of Energy, Mines, and Low Carbon Innovation and the Minister of Municipal Affairs. Such programs lower barriers for home and business owners to access energy-efficiency retrofit financing.

Background

PACE programs allow property owners to finance the up-front cost of building energy efficiency upgrades—such as more efficient heating systems, or windows—by paying the costs back over time via a voluntary property tax assessment. The assessment is attached to the property, not an individual; if, and when, the property is sold, the financing carries on with the new owner.

- Though British Columbia governments have been requesting PACE-enabling legislation since 2014, no programs are operating in the province.
- Alberta, Ontario, and Nova Scotia have all implemented PACE legislation, but programs remain limited in scope and sophistication.
- PACE programs are commonplace south of the border. In the United States, private PACE program administrators partner with either individual local governments or multiple localities working through joint-powers authorities. Some local jurisdictions operate their own programs independently.
- Administration costs are modest for local governments, provided their role is limited to collection through property taxes and a third party, such as a utility or public agency, handles implementation.
- PACE programs generally fall into two categories: Commercial PACE (C-PACE) and Residential PACE (R-PACE).
- Local governments offer C-PACE programs to property owners who generate income from lease payments or revenue from business tenants. Administrators generally require owners to demonstrate that the investments will save them money. Owners must also demonstrate that they can repay the assessment. Local governments also offer R-PACE programs to owners of small residential properties.

- PACE financing is an important tool that local governments could use to encourage building owners to make upgrades that they might not otherwise have made—either because they lack access to capital from other channels or they have concerns about long payback periods.
- The September 2020 BC Economic Recovery Plan included \$2 million for the province to support the development of a PACE financing tool
- The November 2020 Mandate Letters to the Minister of Energy, Mines, and Low Carbon Innovation and the Minister of Municipal Affairs include direction for the ministers to enhance energy efficiency programs and incentives for residential and commercial buildings, including PACE financing.

The Evidence Basis

- Studies demonstrate that U.S. PACE-financed projects have saved nearly 2.974 billion kilowatt hours (kWh) of energy while averting the release of 7.44 million metric tonnes of CO₂ equivalent greenhouse gas emissions.¹
- In the United States, 20 states plus the District of Columbia run commercialproperty PACE programs. These programs have financed more than USD\$1.5 billion in capital project upgrades across more than 2,400 properties. They've also created more than 17,000 jobs.
- On the residential side, U.S. homeowner PACE programs have yielded USD\$6.2 billion in capital project upgrades for more than 280,000 homes. These residential PACE projects have created more than 108,000 jobs while slashing climate pollution.

Jurisdictional Scan

Commercial PACE (C-PACE)

- Governments generally consider C-PACE program less risky than R-PACE ones, because the projects financed are generally relatively large in scope and are carefully vetted by professional project finance managers on both sides of the agreement.
- Since C-PACE financing is charged through property taxes, owners can pass along the cost of these improvements to tenants who have signed a conventional "triple net lease" agreement. This is an important benefit for commercial property owners who are often challenged to recoup the cost of energy retrofits financed through traditional mechanisms, because the triple net lease agreement only requires the tenant to pay for operating expenses related to the building (e.g., utility charges, insurance, property taxes, and maintenance).
- This transitional contractual arrangement disincentivizes energy retrofits because the building owner bears the capital cost of the upgrade, but the tenant captures the energy savings.
- A second benefit to building owners is that C-PACE financing is generally considered to be an "off balance sheet" loan. This means that the loan does not

PACE Nation, "2019 PACE Facts." Retrieved from: https://pacenation.org/2019-pace-facts/

impact a property owner's debt-to-equity ratio and is therefore less likely to compete with a property's other capital priorities that must be financed through more conventional mechanisms.

Residential PACE (R-PACE)

- In the United States, R-PACE programs in California, Florida, and Missouri finance more than USD\$6.2 billion in capital project upgrades for over 280,000 homes.² The programs have created more than 108,000 jobs in these states.³
- For homeowners, a well-designed R-PACE program will simplify and streamline
 the financing processes for home energy retrofits. The programs welcome lowerincome homeowners who may lack access to conventional financing; many do
 not perform credit checks when evaluating an application, but instead consider
 the homeowner's property tax payment history.
- Unique features lower credit risk for R-PACE investors, which in turn typically allows program administrators to access lower-cost capital. This can subsequently lead to more favourable terms and conditions and more attractive interest rates than conventional financing mechanisms.⁴

British Columbia - Current State

- On four separate occasions—in 2014, 2016, 2017, and 2019—local governments at the Union of BC Municipalities conference passed resolutions in support of legislation that would enable PACE programs.
- In its response to the 2019 UBCM resolution, the Ministry of Municipal Affairs and Housing stated that the province was open to PACE discussions, but also cautioned about mixed experiences with the program in other jurisdictions.
- The September 2020 BC Economic Recovery Plan included \$2 million for the province to support the development of a PACE financing tool
- The Minister of Energy, Mines, and Low Carbon Innovation and the Minister of Municipal Affairs were issued Mandate Letters in November 2020 that include direction for the ministers to enhance energy efficiency programs and incentives for residential and commercial buildings, including PACE financing.
- The BC Ministry of Environment and Climate Change Strategy is currently working with a private consultant, Dunsky Energy Consulting, to review PACE financing and other financing mechanisms to support building decarbonisation in BC.
- A limited form of residential PACE (R-PACE) financing may already be permissible for certain measures under the B.C. Community Charter using Local

² PACE Nation. "Pace Programs." Retrieved from: https://pacenation.org/pace-programs/

³ PACE Nation. "2019 PACE Facts." Retrieved from: https://pacenation.org/pace-market-data/

⁴ National Association of State Energy Officials. "Residential Property Assessed Clean Energy (R-PACE): Key Considerations for State Energy Officials." 2018. Retrieved from: https://www.naseo.org/data/sites/1/documents/publications/NASEO%20R-PACE%20Issue%20Brief.pdf

- Improvement Charges (LICs). For example, building improvement projects that reduce GHG emissions and the risk of oil spills from existing heating-oil systems arguably have significant direct community benefits and services, and therefore warrant the use of LICs.
- To date, only the District of Saanich is planning to use LICs to fund private building upgrades to reduce GHG emissions and lower risk of domestic oil spills. However, to operationalize the program the district would need to pass a specific bylaw for each LIC/PACE loan provided. This is cumbersome.
- In addition to local government interest, a coalition of industry and environmental organizations recently formed under the name PACE BC to advocate for and support enabling legislation.
- PACE enabling legislation would also help B.C. municipalities access funding from the Federation of Canadian Municipalities' (FCM) Community Energy Financing Programs. Municipalities may access this \$300 million funding stream to create financing programs for energy efficiency retrofits.⁵
- Enabling C-PACE and R-PACE (for smaller rental properties) in British Columbia may need an additional amendment to the Community Charter to allow local governments to "aid a business." Section 25(1) of the Community Charter states that local governments "must not provide a grant, benefit, advantage or other form of assistance to a business." The only exception to this pertains to assistance given for actions that relate to heritage properties (as per Section 25(2) and Section 25(3) of the Community Charter). A C-PACE program could potentially be interpreted as aiding a business, and therefore out of compliance with Section 25(1).
- The province currently offers low interest financing through its CleanBC Better Homes program. However, the offer is only available for the cost of installing an electric heat pump system for homeowners switching from a fossil-fuel based heating system; it cannot be used in conjunction with the current CleanBC heat pump rebate offer. The applicability of this financing tool is therefore quite narrow and limits participation by lower-income homeowners.
- Past financing pilot programs in B.C. have met with minimal success (i.e. BC
 Hydro and Fortis BC's On-Bill Financing pilot, and the City of Vancouver's
 Retrofit Energy Efficiency Financing Pilot).⁶ A study by the Pacific Institute for
 Climate Solutions attributes the low uptake to ineffective and inadequate
 marketing, lack of buy-in from contractors, overly stringent underwriting criteria,

⁵ Federation of Canadian Municipalities. "Community Efficiency Financing New Existing Residential Energy Financing Programs." Retrieved from: https://fcm.ca/en/funding/gmf/community-efficiency-financing-new-existing-residential-energy-financing-programs

⁶ Duffy, Robert and Beresford, Charley. "This Green House II: Building Momentum on Green Jobs and Climate Action Through Energy Retrofits Across Canada." Columbia Institute. 2016. p.30. Retrieved from: https://www.columbiainstitute.ca/sites/default/files/Columbia_This_Green_House_II_web_Mar_22_final_0.pdf

- and needlessly complicated requirements for energy audits and program applications.⁷
- The set of recommendations advanced by the UBCM Special Committee on Climate Action includes a provision for the province to develop a retrofit financing program that matches payments to energy savings.

Next Steps

Potential next steps for government include the following actions.

- Meet with local government representatives and other key stakeholders to establish a plan to remove legislative barriers for successful R- PACE and a C-PACE programs. "Property Assessed Clean Energy in Canada," a recently published Pembina Institute report, summarizes industry consultations in identifying many of the needed changes.
- Amend the Community Charter and Vancouver Charter to create enabling legislation for PACE or create standalone legislation.
- Create two working groups to design a R-PACE and a C-PACE program, and include representatives of the construction industry (e.g. the Urban Development Institute), the renovation industry (e.g. Home Energy Performance Council), financial institutions, institutional investors (e.g. Canada Infrastructure Bank), mortgage insurers (e.g. Canada Mortgage and Housing Corporation), building owners and managers (e.g. Building Owner and Managers Association), ENGOs, local governments, and the Federation of Canadian Municipalities.
- Leverage these working groups to provide recommendations to local governments on how to structure PACE bylaws, and to identify a potential provincial third-party administrator for a coordinated province-wide approach.
- Signal its interest in creating a loan-loss reserve fund that would support and reduce risk for a provincially scaled PACE program and use the stakeholder engagement processes described above to validate its benefits and clarify its terms.
- Ensure that British Columbians can seamlessly access PACE loans and CleanBC incentives through the same application.
- Establish program design and implementation supports to help ensure that all local governments across the province, regardless of their size and location, can take advantage of a PACE financing program.

Fefe, Seref et al. "Cheaper Power Bills, More Jobs, Less CO2: How On-Bill Financing Done Right can be a Quick Win for British Columbia." Pacific Institute for Climate Solutions. 2015. p. 11. Retrieved from: http://pics.uvic.ca/sites/default/files/uploads/publications/On-Bill%20Financing%20FINAL.pdf

⁸ Kennedy, Madi et al. "Clean Energy in Canada: Design Considerations for PACE Programs and Enabling Legislation." The Pembina Institute. 2020. Retrieved from: https://pembina.org/pub/pace-financing-canada



Report to Committee

To:

Public Works and Transportation Committee

Director, Sustainability and District Energy

Date:

May 19, 2021

From:

Peter Russell

File:

10-6150-00/Vol 01

Milton Chan, P.Eng

Director, Engineering

Re:

Habitat Enhancement Opportunities for Dike Improvement Projects

Staff Recommendation:

- 1. That, as described in the staff report titled 'Habitat Enhancement Opportunities for Dike Improvement Projects', dated May 19, 2021, from the Director, Sustainability and District Energy and Director, Engineering:
 - a. An agreement with the Department of Fisheries and Oceans Canada to establish a Fish Habitat Bank be endorsed;
 - b. A public communication plan and stakeholder consultation program be developed; and
 - c. The impacts to service levels and the capacity of existing resources to absorb these activities be monitored and should there be a need for additional staffing resources, staff submit the request for consideration in the annual budget process.

Peter Russell

Director, Sustainability and District Energy

(604-276-4130)

Milton Chan, P.Eng Director, Engineering

(604-276-4377)

Att. 1

REPORT CONCURRENCE			
ROUTED TO: Finance Policy Planning Parks Services	Concurrence 図 図 図	CONCURRENCE OF GENERAL MANAGER Jh him	
SENIOR STAFF REPORT REVIEW	Initials:	APPROVED BY CAO	

Staff Report

Origin

This report outlines the federal framework for fish habitat banking in BC and identifies opportunities to acquire fish habitat credits to offset anticipated habitat impacts related to capital projects. Anticipated habitat impacts relate mainly to dike raising projects.

Related to the above, during the June 20, 2018 Public Works and Transportation Committee meeting, staff received the following referral:

"That staff use the Terra Nova model to explore opportunities to receive credits towards releasing of habitat compensation requirements on future projects, and report back."

This report supports Council's Strategic Plan 2018-2022 Strategy #1 A Safe and Resilient City:

Enhance and protect the safety and well-being of Richmond.

This report supports Council's Strategic Plan 2018-2022 Strategy #2 A Sustainable and Environmentally Conscious City:

Environmentally conscious decision-making that demonstrates leadership in implementing innovative, sustainable practices and supports the City's unique biodiversity and island ecology.

2.1 Continued leadership in addressing climate change and promoting circular economic principles.

Analysis

Habitat Offsetting under the Federal Fisheries Act

The protection of fish and fish habitat is regulated by the federal Department of Fisheries and Oceans Canada (DFO), pursuant to the federal *Fisheries Act*. DFO assesses most activities occurring in or near water to determine risks related to various activities. Fish habitat includes water frequented by fish and any other areas that fish depend on for life processes such as spawning, rearing, food supply and migration. A hierarchy of measures to avoid potential impacts and mitigation measures are used to reduce impacts through project design. When unavoidable impacts remain, following avoidance and mitigation, DFO requires additional measures such as habitat offsetting, to reduce the overall loss of fish habitat due to development.

Fish habitat banking was established federally by DFO in the 1980s as a tool for fish habitat offsetting. The concept, now legislated under the *Fisheries Act*, allows proponents to acquire *credit*, in the form of *area*, by creating or improving fish habitat that can be banked to offset impacts in advance of future projects, such as diking improvements. An agreement between DFO and the proponent is required that outlines the terms and conditions of the fish habitat bank, including how the bank will be implemented and jointly managed. Many fish habitat banks have been created in BC (and Canada), ranging from ongoing, well-established restoration programs to smaller, single-sourced projects needed to offset an immediate project need.

Fraser River Estuary and Richmond's Ecological Network

Over two-thirds of BC's population lives in the Fraser River basin and 54% of that population is situated in the Lower Mainland. Historical land uses such as land reclamation, agriculture, and diking have altered the form and function of the Fraser River and its estuary. It is estimated that over 70% of the historical wetlands in the Fraser River estuary have been diked, drained and/or filled.

The City's Ecological Network, first articulated in the City's 2041 Official Community Plan in 2012, was developed in response to the aforementioned concerns and impacts. The Ecological Network is the inter-connected system of natural and semi-natural areas across Richmond, including terrestrial, riparian and marine (shoreline and intertidal), encompassing both public and private lands. The City's Ecological Network Management Strategy was endorsed by Council in 2015 and provides an opportunistic framework for managing land (sites, hubs and corridors) within the City's jurisdiction or through development. Richmond's Riparian Management Area Network and the Fraser River foreshore are corridors in the Ecological Network that provide linkages between hubs and facilitate the movement of species, water and nutrients to the Fraser River. The City's Riparian Management Area Network is comprised of channelized watercourses and sloughs that have setbacks on minor (5 metre) and major (15 metre) features. Residential, commercial and industrial development is subject to setbacks in these areas. While the Fraser River's bed and banks are provincially-owned, the City's foreshore is designated as an Environmentally Sensitive Area in the Official Community Plan. Private developments proposed in these areas require City review and potential authorization through a Development Permit. Eighty percent of the Ecological Network is located on private property, in the Agricultural Land Reserve, within the dike footprint or on provincial land.

Richmond's Flood Management Strategy

Richmond's diking system changed the physical characteristics of the landscape and allowed for permanent settlers on Lulu Island. The earliest dikes in Richmond, constructed of earth, were low and unstable. To reinforce these early dikes, excavating machines were used in the late-1940s to gather denser materials adjacent to existing dikes to create taller, more stable dikes. This method was a more efficient and economical means to enhance flood protection but also resulted in the formation of wider and deeper drainage canals adjacent to dikes. Non-pervious dikes have been constructed since the 1970s based on improved provincial standards. New standards under the provincial Dike Design and Construction Guidelines now discourage constructed features on the landside of dikes, such as channelized watercourses, because they can lead to seepage and slope stability concerns. Many of the channelized watercourses created through this process are now within the City's Riparian Management Area network and are subject to federal and provincial regulatory requirements for proposed works at or near their boundaries due to the riparian habitats that have thrived along the watercourses.

The Council endorsed 2019 Richmond Flood Protection Strategy identifies the perimeter dike system as the primary flood protection system to protect the community against climate change induced sea level rise, the freshet and seasonal flooding. The current strategy identifies raising the dikes in advance of 2100 to a minimum dike crest elevation of 4.7 metres over a newly updated 50-year timeframe, which would protect the City against the conservative projections for a one metre sea level rise and 0.2 metre of land subsidence. Accelerating the dike upgrade

program will provide additional flood resilience for the City by raising the dikes well in advance of the current sea level rise projections used by the City for modelling. Dike Master Plan Phases 1, 2, 3, and 5 have been endorsed and Dike Master Plan Phase 4, focusing on the North Dike, is under consideration.

Flood protection maintenance works and upgrades, include raising dikes are required and will impact the City's Ecological Network. Dike improvements require an expanded footprint when constructed and provincial design standards discourage large channelized watercourses adjacent to dikes. Only smaller stormwater collection features such as the minor ditches resulting from the dike improvements on the South Dike (between No. 3 Road and Dike Road) are recommended to handle local overland flows. The proposed dike footprint in each planning phase has been conceptually designed to avoid high-value fish habitat along the Fraser River. Where it cannot be avoided, a loss of existing riparian and freshwater aquatic habitat, through the infill of Riparian Management Area on the land side, is anticipated. In addition, a significant portion of the Phase 4 study area is designated as an Environmentally Sensitive Area forming a part of the City's Ecological Network. The need to raise the dikes and fill these areas will trigger provincial and federal permitting requirements that include offsetting for the loss of habitat.

Habitat Impacts Associated with Dike Improvements

Most dike improvement projects (and dike maintenance activities) are currently subject to federal and provincial regulations and in some cases, the City has been required to offset past dike improvement works, either onsite or in other locations, in Richmond. Notwithstanding habitat negotiated through private development, the City has completed approximately 8 hectares of fish habitat enhancement required to offset project impacts. Enhancements have included the marsh benches near the Olympic Oval, the riparian habitat at the Woodward Slough and various pump station upgrades.

Similarly, proposed dike configurations within the City's Dike Master Plan are expected to impact existing fish habitat within the conceptual footprint as work progresses. The Dike Master Plan covers the entire island and in some cases, the existing dike lies beneath roads, such as River Road. Channelized watercourses, with 5 and 15 metre setbacks, often parallel the land-side toe of the road. It is estimated that the City will be required to offset approximately 15 hectares of riparian habitat to complete just the proposed Dike Master Plan 4 improvements. Land use adjacent to the dike in this area is generally a mixture of agricultural, light industrial, parkland, and low density residential. A considerable amount of riparian and aquatic habitat is expected to be affected by construction in this area as the dike footprint expands into the channelized watercourse. Significant habitat impacts like this are another reason why the provincial design standards now recommend against large channelized watercourses along dikes. The proposed land-side impact is preferred because the City's channelized watercourses generally provide lower quality fish habitat compared to the Fraser River. Dike expansion and existing land use restrictions such as private ownership present a challenge to offset these future impacts. Three scenarios are currently acceptable under the *Fisheries Act*, including:

No Net Loss Project-Specific Measures – This approach offsets impacts to fish habitat on
a project-by-project basis to target a no net loss of fish habitat onsite and is the typical
method currently used by the City. This approach is generally accommodated through the
capital planning process but requires higher offset ratios (e.g. 3:1 habitat area

replacement) and extended monitoring programs following construction. When using this option, it is also more difficult to find suitable land for enhancement if land is not available at or near the site of disturbance, which has led to some inefficiencies for staff when trying to plan overall restoration works;

- Net Gain Project-Specific Measures This approach offsets impacts to fish and fish habitat on a project-by-project basis to target a net gain of habitat by creating additional fish habitat onsite that may be carried forward as credit to offset future project impacts. This approach is more difficult to coordinate with the City's capital planning process as it requires DFO's pre-approval (which can not be reliable), and additional City-owned land in the project footprint, to create or restore fish habitat. This option is susceptible to project permitting delays and is considered a less measured approach to enhancement planning; and
- A Fish Habitat Bank A fish habitat bank can reduce the burden of the large-scale offsetting measures required for future diking projects and improve local habitat value to fish in a measured approach. DFO classifies offsetting projects as either habitat restoration and enhancement or habitat creation under the Fisheries Act. Potential project opportunities can be further defined by scope, habitat type and land tenure, the quality of existing habitat, and partnerships. Attachment 1 provides additional information related to qualifying offsetting projects in a fish habitat bank. A habitat agreement can take considerable time to establish. Successful habitat banks are reliant on the availability of land and an effective stakeholder and Indigenous consultation program as recommended. This option also requires a reliable funding source as most senior government funding opportunities are not available for habitat credit projects.

While the first two scenarios are always available to the City, establishing a Fish Habitat Bank best suits the needs of the City because it offers a consistent and reliable permitting arrangement to support the City's future offsetting requirements and can be deployed strategically to strengthen and build the City's Ecological Network. This proposed arrangement is also expected to satisfy provincial permitting requirements and can build on the information gathered from previous enhancement projects and existing projects such as the sediment nourishment project proposed on Sturgeon Banks and the ongoing South Arm Jetty Breaches. The City also has an advantage as a landowner over other organizations leading fish habitat banks in the region. Many organizations must actively seek suitable locations in the Lower Fraser. This has lead to a highly competitive market, while the City can rely on the land within and near its municipal boundaries.

Next Steps

Work is currently underway as part of the City's Flood Protection Management Strategy to carryout regular maintenance and upgrades to the City's 49 kilometres of existing dikes. Staff recommend pursuing a fish habitat bank agreement to meet the City's future habitat offsetting needs that will allow for a measured approach to habitat enhancement with the City's Ecological Network. If endorsed, staff will begin to negotiate an agreement with DFO, through the regulated process, and define the future terms and conditions of the City's offsetting projects. Part of these negotiations will require the City to prepare a proposal document outlining possible project sites and developing key partnerships with local stakeholders such as Metro Vancouver and local Indigenous Groups. Information gathered from engagement can also be used to better understand

species distribution in the Ecological Network and support future environmental policy work including updates to the City's *Ecological Network Management Strategy*. Staff will also begin developing a public communication plan and stakeholder consultation program, including Indigenous Groups, which is required to support the management of a bank. As an agreement is being negotiated, the City will be required to utilize the other two options to support obtaining project permits under the *Fisheries Act*. If endorsed, a fish habitat agreement will not preclude the City from using other offsetting measures to address future impacts, should it be more practical to do so.

The City will not be permitted to begin receiving credits until an agreement has been jointly negotiated with DFO and projects are fully completed. Negotiations are expected to be lengthy and it may take years to finalize the terms and begin constructing projects. Priority would be given to identifying areas on City-owned land, such as Terra Nova Park, but dedicated funding will be required for planning purposes. The City currently completes habitat enhancement for diking upgrades on a project by project basis. These are primarily funded through the Drainage and Diking Utility and senior government grant funding as part of the Council approved Capital Budget. Staff will prepare a capital project submission for consideration in future budget processes that will benefit future diking projects. If endorsed, future projects, outside of the proposed dike footprint or not on city-owned land, may be presented to Council in the form of closed reports due to the ongoing competition for projects in the Lower Fraser.

Funding options for projects that accrue credits are limited, so staff intend to pursue partnership opportunities, where possible, to reduce the overall cost needed to support habitat projects. Staff do note that some of these costs will be (indirectly) offset by the successful and ongoing pursuit of flood management funding obtained from senior governments.

Staff Resources

Staff expect to handle the additional work associated with the early stages of negotiating a fish habitat bank agreement within existing staffing resources. Additional staff resources are expected to manage the fish habitat bank, if endorsed and prior to a final agreement with DFO to plan, evaluate and consult on prospective (future) projects. Staff intend to monitor the DFO negotiations as it relates to the capacity of existing resources. Should there be a need for additional staffing resources, staff will submit the request for consideration through the annual budget process for Council's consideration.

Financial Impact

None at this time. Should Council endorse the recommended fish habitat bank arrangement with DFO, staff will prepare submissions to be considered through the annual budget process.

Conclusion

The City has immediate and future needs to maintain and upgrade its dikes as part of its overall flood management strategy. Current and future works, required to protect the community, will have unavoidable impacts on existing riparian and aquatic habitat along the landside of the dike. Existing environmental legislation under the federal *Fisheries Act* requires that unavoidable impacts to fish and fish habitat be offset. The Department of Fisheries and Oceans Canada

provides a method for proponents to arrange a formal fish habitat bank that would allow the City to accrue credits that can be used towards future dike improvement projects. If endorsed, staff will begin early negotiations with the Department of Fisheries and Oceans Canada, develop public and stakeholder consultation plans, including Indigenous Groups, and monitor this service level change for possible staffing shortfalls as the work progresses.

Chad Paulin, M.Sc., P.Ag. Manager, Environment

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(604-247-4672)

Att. 1: Suitable Types of Fish Habitat Enhancement Projects

Suitable Types of Fish Habitat Enhancement Projects

A summary of suitable types of fish habitat enhancement projects and a brief description of each is tabulated below.

Riparian Habitat Enhancement	This project type includes control or removal of invasive plants and revegetation with native riparian plants. Riparian enhancement may involve planting dike slopes or constructing riparian benches at or above high-water levels.
Marsh Bench	This project type enhances existing shoreline habitat through establishment of an intertidal marsh composed of native emergent vegetation (e.g. mudflats).
Fringe Tidal Marsh	This project type involves the restoration of tidal marsh on the river-side of the dike. Tidal marsh restoration can also integrate tidal channel excavation to increase habitat value for fish and wildlife usage and structural complexity.
Sediment Accretion	This project type involves installation of in-stream structures to promote sediment accretion such as barrier islands, based on ambient hydrodynamic processes.
Sediment Nourishment	This project type would mainly apply to Sturgeon Bank and will involve addition of a sediment source.
Aquatic Off-channel Habitat	This project involves creation of additional off-channel habitat vital for juvenile salmon and white sturgeon rearing.
Industrial Reclamation	This project type involves conversion of industrial lands to functional habitat. This includes restoration of hardened and contaminated surfaces to functional intertidal and riparian habitat.
Restore Orphaned Compensation Sites	This project type targets old compensation sites that are no longer being maintained and now require restoration and enhancement.
Offshore Barrier Islands	This project type targets exposed offshore areas (e.g. tidal flats) where the creation of barrier islands may offer protection to shorelines from storm surges.



Report to Committee

To:

Public Works and Transportation Committee

Date: N

May 20, 2021

From:

Milton Chan, P.Eng. Director, Engineering File:

10-6060-01/2020-Vol

01

Re:

Dike Master Plan Phase 4 - Public and Stakeholder Engagement

Staff Recommendation

That, as outlined in the staff report titled "Dike Master Plan Phase 4 – Public and Stakeholder Engagement", dated May 20, 2021, from the Director, Engineering, the public and stakeholder engagement program be endorsed.

Milton Chan, P.Eng. Director, Engineering (604-276-4377)

Att. 2

	REPORT CONCURRE	ENCE
ROUTED TO:	Concurrence	CONCURRENCE OF GENERAL MANAGER
Parks Services Roads & Construction Real Estate Services Sewerage & Drainage Development Applications Policy Planning Transportation Sustainability & District Energy		John hung
SENIOR STAFF REPORT REVIEW	INITIALS:	APPROVED BY CAO

Staff Report

Origin

The Council-endorsed Flood Protection Management Strategy is the City's guiding framework for continual upgrades and improvement to the City's flood protection system. A key action identified in the City's Flood Protection Management Strategy involves continuing to upgrade the City's perimeter dike in anticipation of climate change induced sea level rise. The City's Dike Master Plans address this need by recommending dike upgrade options for each dike section throughout the City.

The following Dike Master Plans have been endorsed by Council:

- Dike Master Plan Phase 1 Steveston and the West dike south of Williams Road, adopted by Council on April 22, 2013;
- Dike Master Plan Phase 2 West dike between Williams Road and Terra Nova Rural Park and north dike between Terra Nova Rural Park and No. 6 Road, adopted by Council on April 23, 2018;
- Dike Master Plan Phase 3 South dike between No. 2 Road and Boundary Road, adopted by Council on March 25, 2019; and
- Dike Master Plan Phase 5 Sea Island dike from the Sea Island Connector Bridge to the south end of 3800 Cessna Drive, Mitchell Island and Richmond Island, adopted by Council on March 25, 2019.

This report presents the recommended dike upgrade concepts that are required to address climate change induced sea level rise for Dike Master Plan Phase 4, which includes the north dike between No. 6 Road and Boundary Road, and seeks Council endorsement to engage the public and key stakeholders for feedback on the proposed concepts. A map summarizing the Dike Master Plan study areas can be found in Attachment 1.

This report supports the following strategies within Council's Strategic Plan 2018-2022:

Strategy #1 A Safe and Resilient City:

Enhance and protect the safety and well-being of Richmond.

- 1.2 Future-proof and maintain city infrastructure to keep the community safe.
- 1.3 Ensure Richmond is prepared for emergencies, both human-made and natural disasters.

Strategy #2 A Sustainable and Environmentally Conscious City:

Environmentally conscious decision-making that demonstrates leadership in implementing innovative, sustainable practices and supports the City's unique biodiversity and island ecology.

2.1 Continued leadership in addressing climate change and promoting circular economic principles.

Analysis

Background

As detailed in the City's Flood Protection Management Strategy, Richmond is situated approximately 1.0 metres above sea level, and flood protection is integral to protecting the health, safety, and economic viability of the City. Richmond is protected from flooding by infrastructure that includes 49 kilometres of dike. Current climate change science estimates that sea level will rise approximately 1.0 metre by the year 2100 and 0.2 metre of land subsidence is forecasted over the same time period.

The Flood Protection Management Strategy identifies strengthening and raising the City's perimeter dike to 4.7 metres geodetic elevation as the priority response to sea level rise. All new dikes are designed to accommodate a further height increase to 5.5 metres to address sea level rise beyond 2100.

Dike improvements are ongoing through the Council-approved 5-Year Capital Program as well as through re-development. At the April 12, 2021 Regular Council Meeting, Council adopted a 50-year implementation period for an accelerated flood protection program with the objective of achieving \$30 million in annual revenue from the Drainage and Diking Utility by 2031. Acceleration of the City's dike upgrade program will provide additional flood resilience for the City should the rate of sea level rise increase from current projections. Staff will continue to monitor actual sea level rise and climate change forecasts and report significant updates to Council as required.

Phase 4: Recommended Approaches to Upgrading Dikes

Dike Master Plan Phase 4 recommends diking improvements that consider a number of factors including adjacent land use, available land for diking, environmental conditions, and potential amenity improvements. Existing configurations along the north dike between No. 6 Road and Boundary Road are generally either dike with road located on top, or standard dike with no roadway. Attachment 1 shows the locations for the various phases of the Dike Master Plan.

The following are typical dike upgrade approaches recommended in Dike Master Plan Phase 4:

Separated Dike and Road

Approximately 87% of the dikes within the Phase 4 study area include an existing roadway located on top of the dike. In this scenario, staff recommend separating the dike from the road (Figure 1).

This is the recommended dike upgrade concept between No. 6 Road and Queens Canal. A separated dike and road already exists in 4% of the dikes located within this stretch.

A separated dike and road involves relocating the road from the top of the dike further inland, adjacent to the dike. Road elevations can be adjusted to facilitate access to adjacent properties or be at a similar elevation as the improved dike, which would provide additional stability for the dike.

The dike portion of the overall crest would be 10 metres wide to accommodate future dike raising without having to modify the road. This option is recommended because it is the most robust of the options considered, as it includes an earth fill embankment (dike and road) with a total width of approximately 22 metres at the crest. This is a significant increase over the standard dike crest width of 4 metres and will increase overall dike stability and resilience.

Separating the dike and road would provide opportunities for various community benefits, such as a linear park and trail system with improved site amenities (benches, picnic tables, etc) and improved pedestrian, cyclist and vehicle safety. A separated multi-use path for cyclists and pedestrians is proposed on top of the upgraded dike and a designated bike lane is proposed on the new road.

Additional advantages include the ability to develop the new road in advance of upgrading the dike. This would significantly decrease the impact to vehicle traffic during construction, allow road elevation adjustments in order to facilitate access to existing adjacent properties, and allow for the relocation of existing utilities away from the dike core to improve dike reliability.

Disadvantages of this option include a higher capital cost, impacts to existing habitat and vegetation, impacts on existing infrastructure and larger land requirements.

RIVER-SIDE

10.0 m

12.1 m

LAND-SIDE

Future Build-out
5.5-6.0 m

4.7-5.0 m

12.1 m

Relocate Utilities from Dike to Road Fill and Replace/Relocate Drainage Infrastructure

Drainage Infrastructure

Standard Dike

This concept (Figure 2) is recommended where a road does not exist on top of the dike, accounting for approximately 6% of the total Phase 4 study area. This is the scenario between Queens Canal and Boundary Road and at a few locations within the Phase 4 study area where the road is setback from the Fraser River.

A standard dike raises the dike crest to design elevation and extends the footprint to either the land side or water side. Standard dikes can incorporate multi-use paths for cyclists and pedestrians and provide a green buffer between the road and path. Advantages of this option also include reduced cost and smaller land requirement.

Disadvantages of this option include larger grade differences between the adjacent land and the dike, as well as reduced seismic performance. In addition, there is no designated bike lane and reduced space for additional public amenities when compared to a separated dike and road.

RIVER-SIDE LAND-SIDE

Superdike

Superdikes are dikes where the land behind the dike is built up to the same elevation as the dike (Figure 3). The City has been successful in implementing superdikes to date through development. Although development potential is minimal throughout the Phase 4 study area, superdikes are recommended where land adjacent to the dike does re-develop. This eliminates visual impacts of a raised dike structure on waterfront views, while providing an enhanced flood protection structure for the City.

A superdike can accommodate a separated dike and road and provide the same advantages as those outlined in the separated dike and road concept. In addition, superdikes may include multi-

functional landscapes that can be tailored to area requirements and provide increased opportunities for environmental enhancements through landscape improvements.

The creation of superdikes is compatible with the previously described dike approaches and can be accomplished over the long term as land raising is implemented to meet agricultural or development needs.

RIVER-SIDE

LAND-SIDE

LAND-SIDE

10.0 m 12.1 m 3.7 m 3.7 m 3.7 m 1.7 m

Adjacent Land Uses in the Phase 4 Study Area

Land use adjacent to the dike in the Phase 4 study area includes single-family residential, industrial, agricultural and dedicated park land. In addition, there are marine-based industries that either require access to the river over the dike or may be located outside of the dike. The adjacent land use in the Phase 4 study area can be found summarized in Table 1.

Table 1: Adjacent Land Uses

Location	Land Use
No. 6 Road to No. 7 Road	Industrial, marine-based industry and dedicated park land.
No. 7 Road to Nelson Road	Industrial, agricultural, single-family residential and marine-based industry.
Nelson Road to Queens Canal	Agricultural, single-family residential, marine-based industry and the Northeast Bog Forest.
Queens Canal to Boundary Road	Industrial and single-family residential.

There are a few sites that require specific, non-standard strategies, making up 3% of the dikes in the Phase 4 study area. These locations and the recommended strategies are outlined in Table 2 below.

Table 2: Phase 4 Non-Standard Sections

Location	Dike Upgrade Solution
Railway Trestle Crossing	The recommended dike upgrade solution is to raise the road
	to the design dike elevation (4.7 metres) and construct the
	road on top of the dike. A vertical clearance of 4.7 metres at
	the trestle would be established to allow for larger vehicle
	passage (Figure 4).
Northeast Bog Forest	The recommended dike upgrade solution is to have a
	separated dike and road and use retaining walls on the land-
	side to minimize impacts to the Northeast Bog Forest
	(Figure 5). Potential impacts and offsetting improvements to
	this ecologically sensitive park will be studied further
	during the detailed design phase.
Tree Island Steel / Hamilton	Tree Island Steel is currently located outside of Richmond's
Transit Centre	perimeter dike. The recommended dike upgrade solution is
	to construct a standard dike between Tree Island Steel and
	Hamilton Transit Centre using the existing right-of-way
	between the two properties. Boundary Road north of River
	Road would need to be raised to accommodate this solution.
	Alternatively, if redevelopment occurs, staff recommend
	pursuing a superdike at the Tree Island Steel property.

Figure 4: Railway Trestle Crossing

12.1 m

Existing Rail Trestle

4.7 m

3.7 m

3.7 m

3.7 m

3.7 m

Figure 5: Northeast Bog Forest

RIVER-SIDE

Future Build-out 5.5 = 6.0 m

A.7 - 5.0 m

No Parallel Burled Utilities from Dike to Road Fill and Burled Utilities within Dike Core Replace/Relocate Drainage Infrastructure

Land Acquisition and Land Raising

There are a number of areas where the existing dike corridor is confined on one or both sides by private property. Land acquisition will be required to construct a raised dike and to provide the improvements to pedestrian, cyclist and vehicular safety provided by a separated dike and road.

Although the City has been successful in acquiring land for dike upgrades through development in other areas of the City, the development potential is minimal throughout the Phase 4 study area. Most of the dike upgrading in Phase 4 will be done independently of development. In the areas where re-development does occur, land acquisition is recommended on an opportunistic basis.

In other areas, staff may recommend strategic land purchases to advance the necessary flood protection measures as individual land parcels come onto the market, or through cooperative work with individual landowners. Long term strategic acquisition of land and cooperative work with the development community and individual landowners can help reduce the impact of dike improvements on the adjacent properties. As with all capital projects, the detailed design of any given section of dike will take private property impacts into consideration.

Additionally, as outlined in the staff report titled "Review of Land Raising Initiative in the City's Flood Protection Management Strategy", dated February 22, 2021, from the Director, Engineering, land raising over the long term (100-year horizon) would mitigate the impacts of climate change induced sea level rise and land subsidence. Any land raising behind the dikes would help to resolve dike access issues and in turn provide an enhanced flood protection structure similar to a superdike.

Environmental Considerations

In all locations, the City's dikes are adjacent to or overlap with significant environmental assets. Recognizing that any change or improvement to the dikes necessitates the removal of existing environmental assets, a key objective of all flood protection works is to leave behind a new, enhanced and improved environment that is compatible with the dike and can grow over the long term.

Dike improvements require an expanded footprint when constructed and provincial design standards no longer allow for the City's channelized watercourses on the inland side of dikes. The proposed dike footprint for this phase has been conceptually designed to avoid high-value fish habitat along the Fraser River. Where it cannot be avoided, a loss of existing riparian and freshwater aquatic habitat through the infill of a Riparian Management Area (RMA) on the land side is anticipated. In addition, a significant portion of the Phase 4 study area is designated as an Environmentally Sensitive Area (ESA) forming a part of the City's Ecological Network (EN). The need to raise the dikes and fill these areas trigger provincial and federal permitting requirements that include offsetting for the loss of habitat.

This presents an opportunity to explore potential habitat enhancement projects that would create higher value habitat on the river-side of the dike when possible. Figure 6 illustrates potential habitat enhancement opportunities to be explored throughout the Phase 4 Study Area. Where this design concept is not feasible due to site specific scour velocities, existing channel erosion, dike footprint and operation and maintenance requirements, habitat compensation will be developed and appropriately designed in other areas of the City.

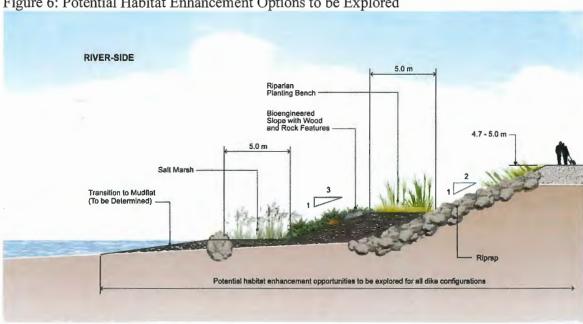


Figure 6: Potential Habitat Enhancement Options to be Explored

Potential habitat enhancement features could include vegetation on the water side dike slope, although hard features like riprap are essential to protecting the dike and preventing erosion. In addition, visual rip rap inspection is required to identify deficiencies that could lead to a dike breach. Vegetation may require periodic mowing to enable inspection and any chosen plant species would need to be tolerant of this. Vegetated low slopes on the water side of the dike is also an option, where space permits. Vegetated low slopes along the Fraser River would require additional erosion protection to keep them in place. This type of slope provides habitat benefits, wave protection, improved aesthetics, and added dike stability.

Staff are seeking Council endorsement to establish a fish habitat bank arrangement with the Department of Fisheries and Oceans Canada through a separate report to Council. If endorsed, this type of arrangement can support the City's future offsetting requirements and contribute to maintaining the City's Ecological Network.

Proposed Public Consultation Program

Staff recommend consultation with key external stakeholders and the public on the Dike Master Plan Phase 4 preferred dike upgrade concepts. Key stakeholders include:

- Adjacent residences, businesses and the general public;
- Richmond Food Security and Agricultural Advisory Committee;
- Richmond Advisory Committee on the Environment;
- Agricultural Land Commission;
- CN Rail;
- Environment Canada:
- Port of Vancouver;
- Department of Fisheries and Oceans;

- Ministry of Forests, Lands, Natural Resource Operations and Rural Development;
- · Ministry of Agriculture, Food and Fisheries;
- BC Inspector of Dikes;
- Urban Development Institute (UDI);
- Pembina Pipeline;
- Ministry of Transportation and Infrastructure; and
- City of New Westminster.

Public consultation for Dike Master Plan Phase 4 will be more extensive relative to past Dike Master Plan outreach. Engagement events will highlight the essential challenges and opportunities for Richmond posed by climate change induced sea level rise and will gain feedback on environmental, transportation and park features to be included in the preferred dike upgrade concepts.

Staff have created a Dike Master Plan Phase 4 video to demonstrate these potential enhancements to the public, which will be circulated to Council for information.

Key external stakeholder groups will be engaged through leveraging the City's social media tools such as Let's Talk Richmond, Facebook, Instagram, and a dedicated Flood Protection website. In addition, staff will hold community workshops, focus group events and open houses targeting key external stakeholders either virtually or in person when the COVID-19 Pandemic restrictions have been lifted. Staff will notify Council when dates are booked for the public events.

The results of external stakeholder engagement and any updates to Dike Master Plan Phase 4 will be presented to Council in a future report for Council's consideration.

Staff plan to use the platform created through the Dike Master Plan Phase 4 public engagement process to provide the community with more detailed and timely information on the City's progress with implementing flood protection infrastructure upgrades.

Flood Protection Improvement Financing

Improvements to the City's flood protection system to address the needs of ageing infrastructure and climate change are funded through three basic funding sources, as outlined below.

Drainage and Diking Utility

The Drainage and Diking Utility was established by Council in 2000 and currently generates \$13.4 million annually to maintain and upgrade Richmond's flood protection infrastructure.

At the April 12, 2021 Regular Council Meeting, Council adopted a 50-Year Implementation Period for an accelerated flood protection program with the objective of achieving \$30 million in annual revenue by 2031. Acceleration of the City's dike upgrade program will provide additional flood resilience for the City should the rate of sea level rise increase from current projections. Staff will continue to monitor actual sea level rise and climate change forecasts and report significant updates to Council as required.

Senior Government Grant Funding

The City's Flood Protection Management Strategy aims to acquire senior government funding for a wide range of flood prevention and protection research, monitoring, studies, planning and improvements. As a result of proactive flood protection planning efforts, the City has been successful in securing approximately \$40 million in senior government grants since 2010 that helped fund over \$70 million of dike upgrades, pump station improvements and master planning updates.

Development

The City has successfully partnered with developers to secure dike upgrades through development. In particular, the City is actively pursuing opportunities to construct superdikes, where land supporting development behind the dike is filled to the same elevation as the dike crest. This eliminates visual impacts of a raised dike structure on waterfront views while providing an enhanced flood protection structure for the City. Staff estimate that up to 20% of dike upgrades along Lulu Island's perimeter dikes will be completed through development.

Financial Impact

None.

Conclusion

Consistent with the City's Flood Protection Management Strategy, Dike Master Plan Phase 4 has been drafted to address climate change induced sea level rise. Dike Master Plan Phase 4 presents the City's preferred dike upgrade concepts for the north dike between No. 6 Road and Boundary Road.

Staff request Council's endorsement to consult the public and external stakeholders on the Dike Master Plan Phase 4 and obtain their feedback on environmental, transportation and park features to be included in the preferred dike upgrade concepts. Feedback will be utilized to update and finalize Dike Master Plan Phase 4, which will subsequently be presented to Council for consideration.

Jason Ho, P.Eng.

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Corrine Haer, P.Eng.

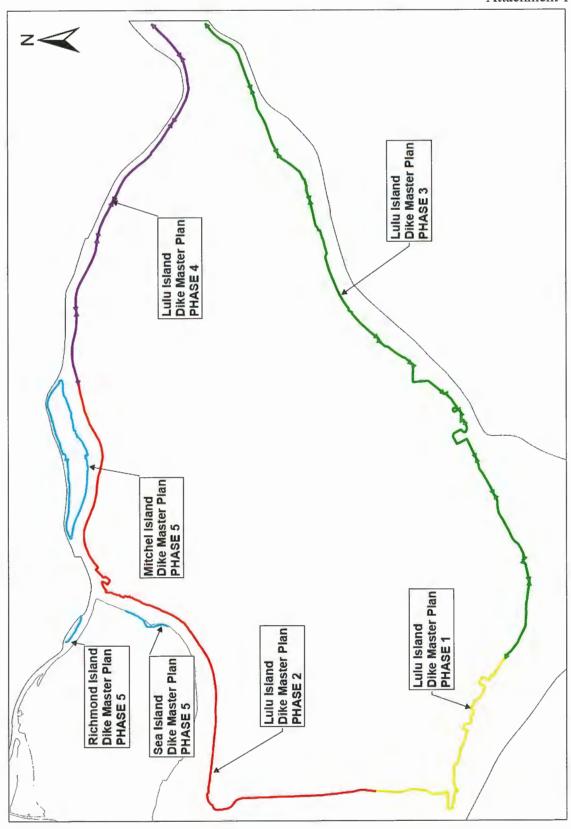
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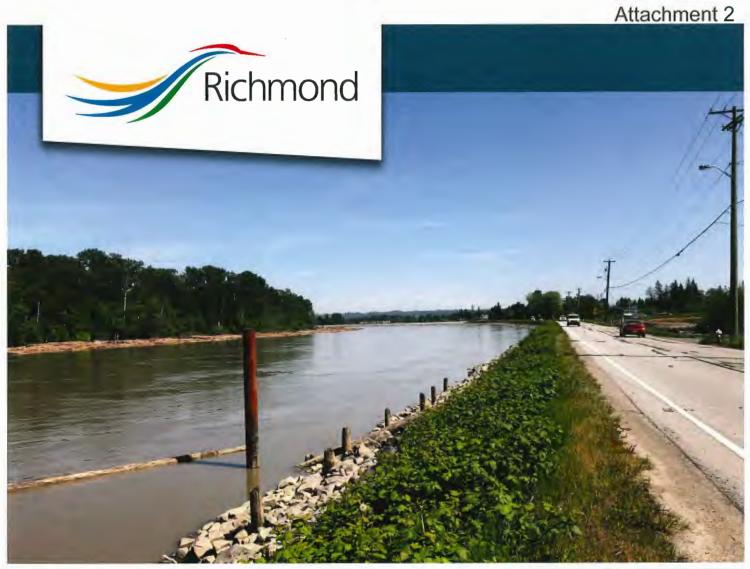
(604-276-4026)

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Att. 1: Dike Master Plan Study Areas

Att. 2: Dike Master Plan – Phase 4 Draft











Draft Report

Richmond Dike Master Plan - Phase 4

November 2018 KWL File No. 0651.122-300

Submitted by:





Richmond Dike Master Plan – Phase 4 Draft Report November 2018

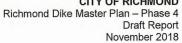
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Report Submission

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KERR WOOD LEIDAL ASSOCIATES LTD.





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Appendix B: Richmond Dike Master Plan Landscape Concepts and Dike Typologies

Appendix C: Geotechnical Engineering Analysis Report (Thurber)

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Executive Summary

The City of Richmond uses a Dike Master Planning program to guide future dike upgrading projects, and to ensure that land development adjacent to the dike is compatible with flood protection objectives. The program includes 4 phases for the 49 km of the Lulu Island perimeter dike that is within Richmond, plus another phase for Sea Island, Mitchell Island, and Richmond Island. The immediate goal is to raise the dikes to allow for 1 m of sea level rise, and to allow for further upgrading in the future. The ultimate goal is to provide the City with a world class level of flood protection to keep pace with the rapidly growing community that relies on the dikes.

Dike Master Plan Phase 4 covers 9 km of the Lulu Island perimeter dike along the Fraser River North Arm, between No. 6 Road and Boundary Road. The dike within Phase 4 is mainly under River Road, with private property inside and outside of the dike. Phase 4 land use along the dike corridor is primarily industrial in the west, agricultural in the middle, and residential/industrial in the east. Specific features within the Phase 4 area that complicate dike upgrading include River Road on top of the dike, driveways to private property inside and outside the dike, pedestrian and bicycle traffic and safety issues along the dike/road, utilities within the dike, large drainage channels immediately inside the dike, a railway trestle crossing above the dike, the North East Bog Forest, and liquefiable soils beneath the dike.

This report describes existing conditions, develops an ideal vision for dike upgrading, presents design criteria, identifies options for dike upgrading, and presents recommended dike upgrading options that appropriately address the challenges. This work can be used as a basis for design of dike upgrading projects, recognizing that site-specific refinement of recommended options will be required in some areas. This work can also be used to assist with land use planning activities along the dike corridor.

The main recommended upgrading option in Phase 4 involves separating the dike and River Road, and raising River Road to the dike crest elevation. This will produce a total crest (dike plus road) width of over 20 m which will provide robust flood protection, separated multi-use paths and a linear park, and utilities relocated out of the dike.

Some of the additional features of the recommended options in Phase 4 are described below.

- Raise the dike crest to allow for 1 m of sea level rise. West of Nelson Road, the raised dike crest would be 4.7 m (CGVD28). East of Nelson Road, the raised dike crest would increase to 5.1 m at Boundary Road. The plan also allows for longer term upgrading to accommodate a further 1 m of sea level rise (i.e. 2 m of sea level rise).
- Replace the drainage channel immediately inside the dike with storm sewers and swales. This will improve
 dike stability, and will provide some of the land needed to relocate River Road.
- Raise land and roads immediately inside the dike (during redevelopment) to improve seismic resilience.
 This will also improve liveability by allowing residents to looking down over the water.
- Construct the north section of a secondary dike near Boundary Road.

It is also recommended that the City prepare a comprehensive implementation plan for dike upgrading that incorporates the elements of the Phase 4 Dike Master Plan, and the elements of the other Dike Master Plans.

To address habitat compensation issues associated with dike upgrading, it is further recommended that the City consider development of a habitat banking program that could provide effective large-scale compensation.

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1. Introduction

Flood protection in Richmond is guided by the City's 2008-2031 Flood Protection Management Strategy which includes a comprehensive suite of measures including structural measures (e.g. dikes and pump stations), non-structural measures (e.g. flood construction levels), and flood response and recovery plans.

Dike Master Plans are critical components of the City's 2008-2031 Flood Protection Management Strategy and are used to guide the implementation of long-term dike upgrades.

The City of Richmond (City) has retained Kerr Wood Leidal (KWL) to prepare the Richmond Dike Master Plan Phase 4.

Phase 4 covers the north-eastern portion of the Lulu Island perimeter dike, from No. 6 Road to Boundary Road (City of New Westminster). Figure 1-1 presents the extent of the City's Dike Master Plan phases. Phase 4 has been subdivided into 6 reaches with relatively uniform conditions. Figure 1-2 shows the reaches of the Phase 4 Dike Master Plan

1.1 Background

Richmond has a population of about 220,000 and is situated entirely on islands within the overlapping Fraser River and coastal floodplains (Lulu Island, Sea Island, Mitchell Island, Richmond Island, etc.). The City's continued success is due in part to its flat, arable land and its strategic location at the mouth of the Fraser River and on the seashore. The low elevation of the land and its proximity to the water comes with flood risks.

Lulu Island is the most heavily developed part of Richmond. Lulu Island is bounded by the Fraser River and the Strait of Georgia and is subject to flood risks from the Fraser River and the sea. Lulu Island is also subject to other flood-related hazards, including dike breach, seismic effects, internal drainage, tsunami, and river instability. The typical natural ground elevation is in the range of 1 m to 2 m as shown on Figure 1-1.

The cornerstone of the Lulu Island flood defenses is a 49 km long perimeter dike. Internal drainage is provided by an integrated system of channels and storm sewers that drain to 39 pump stations / floodboxes. Richmond occupies over 90% of Lulu Island. The balance of Lulu Island (the upstream end) is occupied by the Queensborough neighbourhood of the City of New Westminster.

As Richmond is fully situated within the river/coastal floodplain, there is no option to locate development out of the floodplain. The continued success of the City depends on providing a high level of structural and non-structural flood protection measures. Without continued improvements, the flood risk within the City would progressively rise as a result of rising flood levels (due to climate change), subsiding land, and increasing development.

The 2008-2031 Flood Protection Management Strategy guides the City's flood risk reduction activities across the City's organizational structure and across the spectrum of structural and non-structural flood protection measures.

The Lulu Island perimeter dike is the most critical structural flood protection measure. With essentially unlimited inflow available from the Fraser River and the sea, significant flood damages and impacts could occur in the event of a dike breach.

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¹ All elevations in this report refer to the Canadian Geodetic Vertical Datum of 1928 (CGVD28), unless stated otherwise.



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1.2 Purpose and Objectives

The purpose of the Dike Master Plan is to guide the implementation of dike upgrades and provide a starting point for the City to work with proposed developments adjacent to the dike. The Dike Master Plan defines the City's preferred and minimum acceptable dike upgrading concepts.

The Dike Master Plan facilitates the City's annual dike upgrading program by providing critical information for the design of dike upgrades, including:

- general design concept;
- alignment;
- typical cross-section (conceptual design);
- footprint and land acquisition and tenure needs;
- design and performance criteria;
- · infrastructure changes required for dike upgrading;
- operation and maintenance considerations;
- environmental features and potential impacts;
- social and public amenity considerations;
- guidance for future development adjacent to the dike; and
- guidance on interaction with other structural flood protection measures (e.g. secondary dikes).

The Dike Master Plan is intended to guide dike upgrading over the next 20 to 30 years.

Other flood protection measures, including non-structural measures, are addressed in the City's 2008-2031 Flood Protection Management Strategy.

1.3 Approach and Methodology

The Dike Master Plan has been developed using a 5-step approach presented and described below.



Define: Confirm Dike Master Plan objectives and design/performance criteria.

Understand: Collect and compile relevant information, including spatial data and background reports from the City and several other parties (City of New Westminster, provincial regulators, the port, etc.).

Assess: Develop dike upgrading options and identification of constraints and potential impacts. Desktop and field review of options with City staff to identify preferred options.

Consult: Present to and gather feedback from council and stakeholders on preferred options.

Refine: Develop the master plan informed by consultation and review by the City.

The scope for the Dike Master Plan includes the following main tasks:

- goals and objectives development;
- background data collection and review;
- design criteria development and identification of constraints;
- · options development and review;
- site visits;

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- · drainage impacts assessment;
- desktop habitat mapping and impacts review;
- geotechnical assessment:
- · public amenity review;
- · stakeholder consultation; and
- report preparation.

1.4 Report Format

This report is organized as follows:

- The executive summary provides a high-level overview of the master plan and key features;
- Section 1 introduces the master plan context and process;
- Section 2 documents the existing conditions;
- Section 3 documents the options development and assessment, and presents the recommended options;
- Section 4 provides implementation strategy, including costs, phasing, and coordination;
- Section 5 is a compilation of 2-page summary sheets highlighting existing conditions and key features of the preferred option for each reach; and
- Section 6 provides general and reach specific recommendations for next steps and implementation.

Appendix A provides figures showing conditions along the existing dike alignment, and the preliminary design footprint for a number of upgrading options discussed in Section 3.

1.5 Project Team

The KWL project team includes the following key individuals:

- Colin Kristiansen, P.Eng., MBA Project Manager;
- Mike Currie, M.Eng., P.Eng., FEC Senior Engineer and Technical Reviewer;
- Amir Taleghani, M.Eng., P.Eng. Project Engineer;
- Laurel Morgan, M.Sc., P.Eng., P.E. Drainage Engineer;
- Daniel Brown, B.Sc., B.Tech., BIT Project Biologist; and
- Jack Lau GIS/CAD Analyst.

This report was primarily written by Amir Taleghani. The report was reviewed by Mike Currie and Colin Kristiansen.

Thurber Engineering Ltd. (Steven Coulter, M.Sc., P.Eng.) provided geotechnical engineering services and Hapa Collaborative (Joseph Fry, BCSLA) provided landscape architecture services.

The project was guided on behalf of the City by:

- Lloyd Bie, P.Eng. Manager, Engineering Planning;
- Corrine Haer, P.Eng. Project Engineer, Engineering Planning; and
- Pratima Milaire, P.Eng., PMP Project Engineer, Engineering Planning.

Many additional City staff contributed to the project during workshops, site visits, and in reviewing draft report materials.

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2. Existing Conditions

This section summarizes the options development process undertaken, including the following components:

- review of existing conditions;
- design considerations;
- · upgrading strategies; and
- · preferred options and concepts.

2.1 Reaches and Major Features

River Road is a defining feature of the dike in Phase 4 because the road is located on the dike crest for most of the dike alignment. A variety of land uses, structures, and infrastructure are located on either side of the road/dike. Space is limited along the road corridor, presenting unique challenges for the master plan. City staff have identified road safety, including pedestrian and cyclist safety, as an important consideration for the Dike Master Plan.

Land uses adjacent to the dike in Phase 4 comprise industrial, agricultural, and single family residential. Drainage channels run parallel to River Road on the south side. On the north side of River Road, the setback between the river bank and the dike (road) varies from more than 15 m to none where the edge of the dike/road is the river bank and riprap bank protection is in place. Several industrial and single family residential parcels are located on the river-side (north) of the dike (road), and therefore are not protected by the dike. Much of the dike alignment is adjacent to, or in some places on, the Agricultural Land Reserve (ALR).

Phase 4 has been subdivided into 6 reaches with relatively uniform conditions. The reach extents are presented on Figure 1-2.

Table 2-1 describes the existing conditions and features of each reach. It is anticipated that these defined reaches can be subsequently used for dike upgrading implementation phasing.

Appendix A provides a set of figures showing the existing dike alignment, adjacent land tenure, municipal infrastructure, and existing habitat.

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Table 2-1: Phase 4 Reaches and Features

Reach ID and Name	Extent / Length	Existing Dike Alignment	e Major Features
	No. 6 Road		 Drainage pump station at No. 6 Road Industrial site (Mainland Sand and Gravel) north of River Road
1 – Bridgeport	to	0.00	FortisBC gas pipeline river and facility west of No. 7 Road
Industrial	No. 7 Road	NIVEL NOAU	Drainage channel and pipe south of road
	(1.7 km)		Riparian area north of road
			Potential future tie-in with proposed mid-island dike
			Water-oriented industrial parcels located north of road (tug boat operation and Tom-Mac Shipyards)
2 – Industrial	No. 7 Road to	River Road	Residential/storage properties located north of road with minimal setback between road and structures
and Shipyards	No. 8 Road		Large industrial parcels located south of road near No. 7 Road
	(1.7 Km)		ALR parcels with houses located south of road
			Drainage pump station at No. 8 Road
3 – Riverfront	No. 8 Road to		Residential/storage properties located north of road with minimal setback between road and structures near Nelson Road
Houses and	Nelson Road	Kiver Koad	ALR parcels with houses located south of road
	(0.9 km)		Metro Vancouver Tilbury watermain crossing near Nelson Road
			ALR parcels with cranberry farms south of road
7 6 0 0	Neisoli Road		Very large agricultural channel south of dike
4 – bog and Rail	Rail Treetle	River Road	North East Bog Forest (City park)
	(2.2 km)		Rail trestle river crossing
	()		No space between road edge and river channel (existing riprap bank protection)

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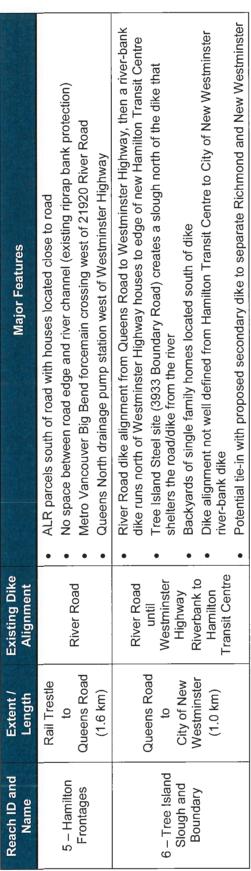
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2.2 Land Tenure

Most of the existing dike footprint is located within the City's road dedication, on a right-of-way, or on City-owned land parcels. However, there are several areas where the existing dike footprint encroaches onto private property or where space is very limited such that any upgrading would encroach onto private property.

The existing land tenure in Phase 4 is presented on Figure 2-1 and in more detail in Appendix A.

2.3 Infrastructure

There is considerable infrastructure and utilities associated with the existing dike corridor in Phase 4. In addition to the road that runs along the top of the dike for much of the reach, there are also watermains, drainage channels, and storm sewers that run parallel to the dike, predominantly at the landside toe. This infrastructure may need to be moved to accommodate any increases to the dike footprint.

There are 4 pump stations and 1 PRV (water) station that cross through the dike in Phase 4. The pump stations and the associated reach are summarized in Table 2-2. The condition of each pump station was not assessed as part of preparing the master plan.

Table 2-2: Phase 4 Pump Stations and Reach Locations

Pump Station	Reach
No. 6 Road North	1
No. 7 Road North	1
No. 8 Road North	2
Queens North	6

2.4 Habitat

Desktop Review

A desktop review was conducted to assess the ecological setting along and adjacent to the existing dike alignment. Spatial data were used to identify overlap of known environmental values with the Phase 4 study area.

Spatial data reviewed in the desktop study included:

- Fraser River Estuary Management Program mapping (FREMP 2012, 2007) mapping used to identify riparian and intertidal habitat types and quality;
- iMapBC web application (iMapBC 2017); and
- City of Richmond aerial photographs and Riparian Area Regulation 5 m and 15 m buffer layers (Richmond Interactive Map 2017).

The location and extent of high quality Fraser River riparian and intertidal habitat was identified to inform development of dike upgrade options and their potential impacts. FREMP habitat polygons were assigned the following categories: high quality riparian, high quality intertidal, or other. Deciduous tree woodland polygons were categorized as high quality riparian habitat because these communities provide cover and nutrients to fish using nearshore habitat. Mud, sand, and marsh polygons were

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categorized as high quality intertidal habitat because of the foraging and nesting habitat they provide for bird species and the foraging, egg deposition and rearing habitat they provide for fish species. Aquatic and riparian habitat on the land side of the existing dike was identified and mapped using the Riparian Area Regulation buffer layers and interpretation of recent aerial photography (City of Richmond 2017).

Aquatic and Riparian Habitat

High quality intertidal and riparian habitat is present in all six Phase 4 reaches on the Fraser River side of the dike. This important habitat provides forage and cover habitat as well as a staging area for anadromous salmonids transitioning from saltwater to freshwater. Conversely, armoured sections of shoreline on the Fraser River side of the existing dike are present in Reaches 1, 4, 5, and 6. These sections provide limited habitat value and construction here would have less of a negative impact on fish.

On the land-side of the dike, drainage channels are present in all six reaches. These channels provide low to moderate quality aquatic and riparian habitat for fish and amphibians.

Two fish habitat compensation projects are present in the Phase 4 study area. These were created in 1986 and 1989 respectively and included the creation of intertidal marsh habitat to compensate for damage to habitat elsewhere.

Wildlife and Terrestrial Habitat

Terrestrial habitat types in Phase 4 include deciduous tree woodland, tall shrub woodland, low shrub woodland, and vascular plant meadow, as well as uncategorized sections (e.g. paved lots; FREMP 2007). These habitat types have potential to provide nesting habitat to migratory birds in all six reaches of Phase 4. Orthoimagery review identified potential raptor nesting trees in all six reaches of the Phase 4 study area.

The internal drainage channels that are mentioned above and are present in all six reaches of Phase 4 are likely used by native amphibian species as breeding habitat as well as by fish species. It is possible that additional amphibian habitat is present in small ponds or channels along the dike that were not identified in the desktop review.

Species and Ecological Communities at Risk

No known occurrences of terrestrial wildlife species at risk are present in the Phase 4 study area, but several occurrences exist on nearby islands in the Fraser River or on the river banks across from Richmond. It is possible that individuals of these species also occur on the Richmond side of the Fraser River. The Lower Fraser River population of White Sturgeon (*Acipenser transmontanus* pop. 4) is known to occur in the Fraser River next to the dike. Mapped critical habitat for at-risk species is not present within 500 m of the Phase 4 study area.

FREMP mapping (2007) indicates the presence of intertidal marsh communities in all six reaches of the Phase 4 study area. Many of these communities in British Columbia are considered at-risk (i.e. Blue-Listed; special concern, or Red-Listed; threatened, or endangered). No ecological communities at-risk are shown in either the study area on BC iMap (2017), but it is likely that some are present in the Phase 4 study area.

Table 2-3 presents the findings of the desktop review on a reach-by-reach basis and separates Fraser River side results from land-side results.

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Reach #	Location	Environmental Setting	Construction Constraints	Construction Opportunities	FREMP Habitat Types	Known Species at Risk Occurrence Near Dyke Alignment	Potential Raptor Nesting Trees	Ne M	Potential Migratory Bird Nesting Habitat
	Land Side	Sections of channelized watercourse (amphibian habitat) Sections of moderate quality low shub woodland	Drainage channels and moderate quality habitat	Limited sections without drainage channels or shrub woodland	Low shrub woodland Deciduous tree woodland Meadow	White Stureeon (Lower			
1 Bridgeport Industrial	Fraser River side	Low-quality habitat, gravel lot and amoured bank at west end High quality deciduous treed woodland riparian habitat along east 34 of reach. High Quality marsh and mudfat habitat along east 34 of reach.	High quality riparian and aqualic habilat in east 3/4 of reach	Low quality habitat at west end of reach	Marsh Deciduous tree woodland Muditats Meadow	Frase River population (Acipenser transmontanus pop. 4)	>		>
	Land Side	Channelized watercourse adjacent to dike (amphibian habitat) along full length of reach	Drainage channels along full length of reach	піа	Deciduous free woodland Meadow	White Sturgeon (Lower			
industrial and Shipyards	Fraser River side	High-quality deciduous tree woodland riparian habitat along 75% of reach High-quality marsh and muditats habitat along 90% of reach	High quality habitat along >90 % length of reach	n/a	Deciduous tree woodland Marsh Mudfats Meadow	Fraser River population) (Acipenser transmontanus pop. 4)	>		>
P'	Land Side	Channelized watercourse adjacent to dike (amphibian habitat) along full length of reach	Drainage channels along full length of reach	n/a	Deciduous tree woodland Meadow	White Sturgeon (Lower		l	
Riverfront Houses and ALR	Fraser River side	High-quality deciduous tree woodland riparian habitat along 75% of reach High-quality marsh habitat along full length of reach	High quality habitat along full length of reach	n/a	Marsh Deciduous tree woodland	riaser river population) (Acipenser transmontanus pop. 4)	>		>
- 179	Land Side	Channelized watercourse adjacent to dike (amphibian habitat) along full lengh of raach High-quality shrubland habitat connected to North East Bog Forest in east end of reach	Drainage channels along full length of reach	n/a	Deciduous tree woodland Meadow Low shrub woodland Tall shrub woodland	Green-fruited Sedge (Carex interrupt)			
Bog and Rail	Fraser River side	High quality deciduous tree woodland riparian habitat along west 60% of reach. High-quality marsh habitat along west 60% of reach Low quality armoured bank habitat in east 40% of reach	High quality habitat along west 60% of reach	Low quality habitat at least 40% of reach	Deciduous tree woodland Marsh	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	>		>
lo.	Land Side	Channelized watercourse adjacent to dike (amphibian habitat) along full length of reach Moderate quality low shrub woodland and meadow in middle of reach	Drainage channels along full length of reach	n/a	Meadow Low shrub woodland Tall shrub woodland	White Sturgeon (Lower Fraser River population)	>		>
Hamilton Frontages	Fraser River side	High-quality muditat habitat and small patches of marsh at east end of reach Low quality amoured bank habitat along full length of reach	High quality habitat along east half of reach	Low quality habitat at west end of reach	Mudflat Marsh	(Acipenser transmontanus pop. 4)			
6 Tree Island Slouch	Land Side	Channelized watercourse adjacent to dike (amphibian habitat) along west end of reach Mostly low-quellity habitat, paved or maintained lawn	Drainage channels along west end of reach	Low quality habitat along most of reach	Tall shrub woodland Deciduous tree woodland	White Sturgeon (Lower Fraser River population)	>		\
and Boundary	Fraser River side	High quality mudifat habitat and small patches of marsh at west end of reach Low quality habitat armoured bank at west half of reach	High quality habitat along full length of reach	Low quality habitat at west end of reach	Mudflat Marsh Meadow	(Acipenser transmontanus pop. 4)			

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3. Options Assessment

This section summarizes the options development process, including the following components:

- · design considerations and design criteria;
- · upgrading strategies;
- · upgrading options and concepts;
- options evaluation; and
- · recommended options for implementation.

The next version of the draft report will include a summary of external stakeholder engagement results.

3.1 Design Considerations

This section summarizes the main themes and issues that have informed the development of upgrading strategies and options for Phase 4.

Dike Performance, Maintenance, and Upgrading

Dike performance, maintenance, and upgrading are the most important design considerations for the Dike Master Plan.

The following themes define an ideal vision for dike upgrading:

- 1. Level of Protection: The City's 2008-2031 Flood Protection Management Strategy sets a target level of protection for structural measures. The City is presently developing an updated flood protection management strategy that will have an even more ambitious flood protection level target. The level of protection translates to a hazard-based design flood scenario to be incorporated into the Dike Master Plan. At this time, the proposed design flood scenario for the Lulu Island perimeter dike is the 500-year return period flood event (0.2 % annual exceedance probability, AEP) with climate change allowances including 1 m of sea level rise. However, the Dike Master Plan should be flexible to accommodate a future change in the design flood scenario in the future.
- 2. Form and Performance: The preferred form of the dike is a continuous, compacted dike fill embankment with standard or better geometry. Walls and other non-standard forms are less reliable and are not preferred. The level of performance of the Lulu Island perimeter dike should be in line with the significant population and assets that the dike protects. The dike should meet all relevant design guidelines of the day and in some cases, exceed guidelines to provide a higher level of performance. Dike performance can be expressed in terms of freeboard above the design flood scenario water level, and factors of safety against various failure processes, including flood conditions and internal erosion (piping).
- Passive Operation: Minimal human or mechanical intervention or operation should be required to achieve full dike performance. To achieve this, the dike should not have any gaps, gates, or stop log structures.
- 4. Enhance Performance (slow failure): The likelihood of a catastrophic dike failure causing significant flood damages can be reduced by design features that aim to slow down failure processes, provide redundancy, and provide time to implement emergency repairs. In general, failure can be slowed or controlled with additional setback, crest width, and armouring of the river-side slope, crest, and land-side slope. Such measures can slow the impacts of river erosion, overtopping erosion, and stability failures. Increased monitoring approaches and technology may also be helpful.

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- 5. Post-earthquake Protection: The dike should provide adequate protection following a major earthquake until permanent repairs can be implemented. In general, this means avoiding dike conditions where a major earthquake results in a sudden and full failure of the dike cross-section into the river, referred to as a 'flowslide failure'. Other conditions where the dike crest settles, but still provides sufficient freeboard and factors of safety until repairs can be conducted may be acceptable. In general, increased crest width, crest elevation, and setback from the river may be undertaken to help achieve adequate post-earthquake protection. In some cases, improved seismic performance will also require ground improvement and densification works.
- 6. Future Upgrading: Uncertainty in climate change, particularly sea level rise timing, may require the City to further upgrade the dike sooner or higher than anticipated by current guidelines and policies. Sufficient space should be reserved under secured land tenure for future upgrading based on standard geometry. Conceptual design is provided for design flood levels which incorporate 1 m of sea level rise, and proof-of-concept design is provided for design flood levels which incorporate another 1 m water level increase for further climate change impacts (i.e. 2 m of sea level rise).

Some specific design considerations related to the above principles are presented in Table 3-1.

Table 3-1: Ideal Dike Design Principles and Considerations

Design Principle	Ideal Design Principles and Considerations	
Level of Protection	Based on 2008-2031 Flood Protection Management Strategy Currently proposed: 500-year return period (0.2% AEP) with climate change allowances as per provincial studies	
Form and Performance	 Continuous, compacted dike fill with standard or better geometry Crest elevation and adequate freeboard Factors of safety against stability Minimal infrastructure within the dike corridor Adequate bank protection or setback 	
Passive operation	No gaps, gates, or stop logsPassive monitoring (e.g. SCADA water levels)	
Enhance Performance (slow failure)	 Wide dike crest Armoured river-bank slope to resist erosion Paved/armoured crest and/or land-side slope to resist overtopping Wide setback from the river 	
No loss of full dike geometry into the river ("flowslide failure to a return period to be determined Adequate post-earthquake freeboard and stability until rep Wide dike crest and/or wide setback from the river		
Future upgrading	 Space and tenure for upgrading (standard or better geometry) Avoid need for future infrastructure relocation or land acquisition 	

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River Road Safety and Access

The safety of drivers, cyclists, and pedestrians using River Road is a significant consideration in Phase 4. City transportation engineering staff were consulted during the master plan development to provide input on dike upgrading concepts that will also improve road safety. The City's preferred concept for River Road is to provide wider vehicle travel lanes and separated multi-use paths, which may be located on the dike crest. Preferred travel lane and multi-use path widths are documented in the design criteria in Section 3.2. Additionally, the City's goal is to create a continuous path around Lulu Island along the river/on the dike system.

Vehicle access to properties located on both sides of River Road is also a significant consideration. Dike raising along River Road will impact driveway access in some areas. Land use on these properties includes industrial / port-related uses, residential, and agricultural. As such, a variety of vehicles, including semi-trailer trucks, need safe access from River Road to these properties. Currently, these properties are generally at grade with or slightly below River Road, and access is provided via asphalt or gravel driveways. For properties located south of River Road, the driveway crosses the existing drainage channel via a culvert. In some areas where the channel is large, the driveway crossing culvert has a large lock block headwall.

Driveway access was considered in options development by identifying several access upgrading concepts including upgrading driveways with retaining walls, land filling to raise sites to the dike/road level, and providing vehicle parking at the dike/road level. Retaining walls should consider the need for handrails for safety, in accordance with applicable regulations.

Internal Drainage System

As with any diked area, the drainage for the interior protected area must be integrated with the flood protection measures such that the protected area does not experience flooding due to conflicting functions between the drainage of water from the interior area and prevention of flooding from water exterior to the dike system.

In this part of Lulu Island, there are large drainage channels adjacent to the interior (land) side of the existing dike and River Road through much of this area. Most upgrading options (discussed in Section 3.4) will impact these drainage channels throughout Phase 4.

The master plan assesses the potential drainage impacts of filling in the existing channel adjacent to River Road and installing a piped drainage system. The assessment was conducted using East Richmond hydraulic model (MIKE URBAN software) provided to KWL by the City.

Land Raising and Acquisition

Land acquisition is an important consideration for the development and evaluation of dike upgrading options. In many areas, the River Road dike corridor is confined on both sides by private property with no room for expansion of the dike footprint.

The figures in Appendix A present the overlap between the proposed dike footprint and private property for select upgrading options discussed in this section. This overlap can be used to produce a land acquisition plan.

In some locations, an alternative to land acquisition may be to raise private property lots up to the dike elevation to create a much wider land raising platform (similar to recent developments along the Middle Arm (e.g. Olympic Oval).

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Environmental Considerations

City of Richmond Bylaws

The City's Official Community Plan (OCP) bylaw (2011) includes an Ecological Network Management Strategy (ENMS) that identifies ecologically important areas in the City's Ecological Network (EN). These areas include Environmentally Sensitive Areas (ESAs), Riparian Management Areas (RMAs), and EN components (hubs, sites, and corridors, shoreline, city parks).

ESAs are designated as Development Permit Areas (DPAs) with specific restrictions and guidelines for development controlled through a review and permitting process (HB Lanarc-Golder and Raincoast Applied Ecology 2012). There are five ESA types, based on habitat, each with specific management objectives. These are summarized in Table 3-2 and more detailed guidelines can be found in HB Lanarc-Golder and Raincoast Applied Ecology (2012). According to Richmond's OCP, dike maintenance is exempt from development permits in ESAs. However, the guidelines provide useful direction that can be used to minimize impacts to these areas and provincial and federal legislation (see below) still applies to these areas.

RMAs are setbacks that were implemented in accordance with the provincial *Riparian Areas Protection Act* and act as pre-determined Streamside and Protection Areas (SPEAs) under the Act. They extend 5 m or 15 m back from the top of bank of the City's higher value drainage channels or more natural watercourses and are to remain free from development unless authorized by the City (City of Richmond, 2017). RMAs are present in all six Phase 4 reaches.

Hubs, sites, and corridors are components of the City of Richmond's EN, which aren't specifically afforded protection, but often overlap ESAs and RMAs, which are protected. These components are present in all 6 reaches of Phase 4.

Dike upgrade options will consider the potential impacts to these areas.

Table 3-2: City of Richmond ESA Type Management Objectives

ESA Type	Reaches Where Present	Management Objectives
Intertidal	All	 Prevent infilling or direct disturbance to vegetation and soil in the intertidal zones Maintain ecosystem processes such as drainage or sediment that sustain intertidal zones
Shoreline	1, 2, 3, 4, 6	 Preserve existing shoreline vegetation and soils, and increase natural vegetation in developed areas during development or retrofitting
Upland Forest	1	Maintain stands or patches of healthy upland forests by preventing or limiting tree removal or damage, and maintaining ecological processes that sustain forests over the long-term
Old Fields and Shrublands	None	 Maintain the extent and condition of old fields and shrublands, while recognizing the dynamic nature of these ecosystems Preservation should recognize the balance between habitat loss and creation with the overall objective of preventing permanent loss of old fields and shrublands

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ESA Type	Reaches Where Present	Management Objectives
Freshwater Wetland	None	Maintain the areal extent and condition of freshwater wetland ESAs by preserving vegetation and soils, and maintaining predevelopment hydrology, drainage patterns, and water quality
Modified from HB Lanarc-Golder and Raincoast Applied Ecology 2012		

Fish Habitat and Offsetting

Fish and aquatic habitat is protected by the federal *Fisheries Act*. Under the Act, *serious harm to fish* must be authorized by the Minister of Fisheries and Oceans and impacts that cannot be avoided or mitigated must be balanced through offsetting. Offsetting plans are negotiated on a case-by-case basis and may require consultation with aboriginal groups and the Province. Offsetting measures include habitat restoration or enhancement and habitat creation and must be proportional to the loss caused by the project.

Often, the amount of offsetting habitat created is greater than the area of habitat impacted. The area of offsetting may need to be increased to account for uncertainty of effectiveness and time lag between impacts and offsetting. Selecting offsetting locations and beginning habitat creation works prior to all impacts occurring can help to reduce requirements for additional offsetting area required due to lag time. Creation of a smaller number of larger area habitat restoration, enhancement, or creation sites would allow for a more efficient use of resources and potentially reduce uncertainty.

Wildlife Considerations

Migratory birds, their eggs, and active nests are protected by the *Migratory Birds Convention Act* and appropriate measures must be taken to avoid incidental take. The most effective and efficient of these measures includes scheduling vegetation clearing outside of the migratory bird nesting season. If this is not possible, bird nest surveys can be completed immediately prior to vegetation clearing to identify active nests and delay vegetation clearing until the nest is no longer active.

The nests of Bald Eagles, herons and other raptors (both active and inactive) are protected under the provincial *Wildlife Act*. It is also prohibited under the *Wildlife Act* to disturb or harm birds and their eggs. The detailed design stage for dike upgrading should attempt to avoid the removal of trees where bald eagle nests are located.

Native amphibian species may use the drainage channels on the land side of the dike at certain times of year. These species are protected by the provincial *Wildlife Act* and detailed design should also consider potential impacts to these species.

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Tie-in with City of New Westminster Dike

The Phase 4 dike needs to tie into the City of New Westminster portion of the Lulu Island perimeter dike.

As shown in the Appendix A, the dike alignment within the tie-in area is not well-defined. The alignment crosses between industrial sites including the Tree Island Steel property (3933 Boundary Road) and the recently developed Translink Hamilton Transit Centre property (4111 Boundary Road) to reach the border (Boundary Road) with the City of New Westminster.

The dike alignment on the City of New Westminster side of the boundary also doesn't appear well defined. Coordination between the City and the City of New Westminster is important to confirm the dike tie-in design at the boundary.

Potential Future Secondary Dikes

The City's 2008-2031 Flood Protection Management Strategy identifies potential secondary dike concepts which are important considerations for Phase 4, including the proposed mid-island dike and the proposed Richmond-New Westminster boundary dike. The purpose of these secondary dikes would be to limit flood damage by creating flood cells on Lulu Island which would contain flooding to smaller areas, and prevent complete flooding of the island if dike breaches were to occur.

The Phase 4 Dike Master Plan has been developed to allow tie-ins with the proposed mid-island dike and the proposed Richmond-New Westminster boundary dike. It is understood that the City is also considering implementation of both of these proposed dikes through gradual land raising through development as opposed to a dedicated dike corridor. The City's 2008-2031 Flood Protection Management Strategy provides additional information regarding potential future secondary dikes.

Public Realm and Ecological Enhancement

The dike is a major existing public realm feature providing a variety of recreation opportunities. The Dike Master Plan provides an opportunity to significantly enhance the public amenity of the dike system, particularly in the Phase 4 project area where walking, biking, and resting opportunities along River Road are limited. Additionally, the dike upgrading provides an opportunity to enhance ecological value through the landscaping treatments that will define the dike surface and edges.

Appendix B presents a suite of landscape concepts prepared by Hapa landscape architects to supplement the Dike Master Plan. These include landscape design principles, an overall network connectivity concept for the Lulu Island perimeter dike trail, and design toolkits for ecological enhancement and public realm features. Additionally, the Appendix B also includes descriptions of landscape concepts associated with the upgrading options presented in this section.

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3.2 Design Criteria

This section describes the main design criteria used in the Dike Master Plan.

Table 3-3 presents a summary of the design criteria, and is followed by additional discussion. The criteria are presented in terms of both a minimum acceptable level, and a preferred level.

Table 3-3: Design Criteria Summary

Item	Value and Description		
item	Minimum Acceptable	Preferred	
Proposed Dike Crest Elevation	4.7 m CGVD28 downstream of Nelson Road 4.7 m CGVD28 to 5.0 m CGVD28 between Nelson Road and Boundary Road		
Future Dike Crest Elevation (for proof-of-concept design)	5.5 m CGVD28 downstream of Nel 5.5 m CGVD28 to 6.0 m CGVD28 to Boundary Road		
Geometry and Stability	4 m wide crest with dike fill core 3H:1V land-side slope 3H:1V river-side slope (or 2H:1V with riprap revetment) Retaining walls minimized Sheetpile walls acceptable only with minimum 4 m wide dike fill core behind wall No standalone flood walls Meet minimum geotechnical factors of safety	Meets or exceed provincial dike standard and City dike standard	
Land Tenure	Registered right-of-way	Dike located on City-owned land	
Infrastructure in Dike	Crossings designed with seepage control Locate parallel infrastructure to land-side outside of dike core	No infrastructure in dike	
Land Adjacent to Dike	Land is raised as much as is practical	Land is raised to meet or exceed dike crest elevation	
Seismic Performance	Minimum 3.2 m CGVD28 post- earthquake dike crest elevation and maintain dike core integrity	No damage to dike from earthquakes up to a return period to be determined	

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	Value and Description		
Item	Minimum Acceptable	Preferred	
River-side Slope and Setback	2H:1V bank slope with riprap revetment designed for freshet flow velocities and vessel- generated waves	>10 m setback between river top of bank and dike river-side slope toe 3H:1V river-side bank slope with acceptable vegetation	
Crest Surfacing and Land- side Slope Treatment	Crest surfacing: 150 mm thick road mulch Land-side slope treatment: hydraulically seeded grass	Meet or exceed provincial dike standard and City dike standard Consider paved crest and land- side slope vegetation/armouring to add robustness against overtopping	
River Road Design Width	From river-side to land-side: 4.0 m multi-use path 0.5 m allowance for barrier 0.6 m min horizontal clearance Two 3.7 m travel lanes 0.6 m min horizontal clearance 0.5 m allowance for barrier Total width: 13.6 m	From river-side to land-side: 4.0 m multi-use path 0.5 m min horizontal clearance 0.5 m allowance for barrier 0.6 m min horizontal clearance Two 3.7 m travel lanes 0.6 m min horizontal clearance 0.5 m allowance for barrier 2.0 m pedestrian walkway Total width: 16.1 m	

Dike Crest Elevation

At this time, the Province has not established a Fraser River flood profile and dike design profile that considers sea level rise and climate change. It is understood that the Fraser Basin Council's Lower Mainland Flood Management Strategy project may produce a recommended flood profile in the near future. The most recent available flood profile information is provided in the Province's 2014 study of climate change and sea level rise effects on the Fraser River flood hazard.

The designated flood profile for the purpose of developing the Dike Master Plan is proposed as the maximum of the following flood scenarios:

- 500-year return period coastal water level with 1 m of sea level rise (no wave effects); and
- 500-year return period freshet with moderate climate change impacts and 1 m of sea level rise.

Figure 3-1 shows the estimated flood profile water levels (in CGVD28 vertical datum, excluding freeboard) along the river in the study area. As shown on the figure, the coastal flood scenario governs from the Ocean upstream to approximately Nelson Road.

Design dike crest elevations are derived by adding freeboard and an allowance for land subsidence to the flood level. Table 3-4 presents the components that sum to the proposed dike crest elevation.

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Table 3-4: Flood Levels and Dike Crest Elevations

	Downstream of Nelson Road (flat profile)	Upstream of Nelson Road (sloped profile)		
ltem		Nelson Road	Boundary Road (Border with City of New Westminster)	Eastern Tip of Lulu Island
Governing Flood Hazard	tide + storm surge	Fraser River freshet		
Level of Performance	500-year return period (0.2% annual exceedance probability)			
Climate Change Allowance	1 m sea level 1 m sea level rise and 20% freshet flow increase		freshet flow	
Design Flood Level (m, CGD28)1	3.8 4.2 4.6		4.6	
Wave Effects Allowance	None			
Freeboard (m)	0.6			
Land Subsidence Allowance (m)	0.2			
Dike Crest Elevation ² (m)	4.6 5.0 5.4		5.4	

Notes:

1. From (BC MFLNRO, 2014).

The Dike Master Plan also allows for further upgrading by providing proof of concept for raising to between 5.5 m downstream of Nelson Road, and 6.0 m at the boundary with the City of New Westminster.

Seismic Performance

The current provincial seismic performance criteria for dikes are difficult to meet without costly and complex ground improvement works. Additionally, the guidelines are considered very conservative in some situations because they require performance under extremely rare scenarios. For example, the guidelines require dikes to maintain 0.3 m freeboard in the event of a 10-year return period flood occurring following a 2,475-year return period earthquake which has a probability of 0.004% in a 1-year period. This is significantly rarer than the design event for the dike crest elevation (500-year return period event has a 0.2% annual exceedance probability). It is understood that the Province is conducting a review of the current criteria and associated guidelines.

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The City's adopted downstream design crest elevation (4.7 m) exceeds the minimum required elevation (4.6 m). This is a
result of updated coastal water level analysis methods (joint probability analysis) that result in a discrepancy when compared
to previous methods (additive method).



For the purpose of the Dike Master Plan, an alternative seismic performance approach that focuses on failure mechanisms and post-earthquake level of protection is proposed. The alternative criteria are presented below.

Table 3-5: Proposed Alternative Seismic Performance Criteria

Criteria	Description / Value
Failure Mechanisms	Flowslides (resulting in full loss of dike cross-section into the river or channel) are not acceptable up to a return period to be determined (e.g. 2475-year return period).
Maximum post-earthquake overtopping probability	0.2% annual exceedance probability Calculate probability through comparison of various post-earthquake dike crest elevations and future flood levels + 0.3 m freeboard. Assume a minimum 1-year exposure period for dike repairs, or longer if local site conditions warrant. In general, this results in a minimum post-earthquake dike crest elevation of 3.2 m which corresponds to the governing scenario of an average annual maximum coastal water level (1.9 m) with 1 m of sea level rise occurring within 1 year of a 475-year return period earthquake. The post-earthquake dike crest would need to provide adequate dike performance and static stability (i.e. no major deformations and cracks).

This approach would make the service level of the dike in a seismic scenario consistent with the service level for the dike crest elevation which is set based on a 500-year return period flood or a 0.2% annual exceedance probability.

For the coastal design dike crest elevation of 4.7 m CGVD28, this approach would allow for up to 1.5 m of vertical settlement, as long as core dike integrity is maintained.

The length of time between earthquake and dike repair will be a critical assumption for analysis to support this approach. The City may wish to specify consistent assumptions through the Dike Master Plan to ensure consistent analyses. For example, reconstruction of a dike that has failed into the river channel following a flowslide failure from an extreme earthquake may take up to 2 years or more, whereas more straightforward compaction and raising of a settled dike could be done in less than a year after an earthquake.

In addition, it should be noted that meeting the seismic performance criteria through increasing the dike crest elevation, as opposed to ground densification, has the added benefit of increasing the level of protection against flood events.

The seismic performance criteria may need to be further reviewed if/when the Province issues updated guidelines for seismic performance of dikes.

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3.3 **Alternative Upgrading Strategies**

Several high-level upgrading strategies, summarized in Table 3-6, were considered to inform the development of specific options for the Dike Master Plan.

Strategy	Advantages	Disadvantages
Road Dike Raise road to dike crest elevation	Smaller footprintWider crest (more robust)Smaller impacts to habitat	 Operation and maintenance challenges Infrastructure within dike High cost to raise dike in the future
Separated Dike and Road Conventional dike adjacent to road	 Operation and maintenance separated from road No infrastructure within dike	Larger footprint and impact to infrastructure and habitat
Raise Riverbank Dike Conventional dike along riverbank	Minimize footprint	 Limited space Impacts to river side riparian and intertidal habitat and land side riparian and aquatic habitat Reduced seismic performance Erosion hazard
Fill River-side Dike Build into river to achieve conventional dike	Less impacts to existing development and on-shore infrastructure	 Larger impacts to river side riparian and intertidal habitat Reduced seismic performance Erosion hazard
Setback Dike Realign significantly away from river	Increased seismic performance Reduced erosion hazard Increased opportunities for riparian and intertidal habitat enhancement	 Increase in unprotected development High infrastructure impacts High cost to construct new dike alignment Would result in 2 dikes (existing and setback) to maintain
Land Raising ("superdike") Raise development and roads adjacent to dike	 Wider crest (more robust) Reduced grading issues (after implementation) Less impacts to raise a dike in the future 	 Timing and phasing depends or development High cost to raise large lots with low-density land use Grading and access issues for water-oriented developments

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3.4 Options and Concepts

Through a series of meetings and site visits with City staff, the high-level upgrading strategies have been narrowed down to a set of options and concepts for each reach.

The options developed for Phase 4 include:

- Option 1: Raise dike and road, extend land-side (Figure 3-2);
- Option 2: Raise dike and road with retaining walls (Figure 3-3);
- Option 3: Raise dike only and extend river-side (Figure 3-4); and
- Option 4: Raise dike only and extend land-side.

In addition to the above options, the following options have been developed to address site-specific issues at the rail trestle (Reach 4) and at the tie-in with the City of New Westminster (Reach 6):

- Option 6: Rail trestle raise road/dike under trestle (Figure 3-5);
- Option 7: Rail trestle fill in between trestle piles (Figure 3-6);
- Option 8: City of New Westminster tie-in raise Boundary Road (Figure 3-7);
- Option 9: City of New Westminster tie-in fill Tree Island Steel property to dike level (Figure 3-8); and
- Option 10: City of New Westminster tie-in new alignment across Tree Island Slough (Figure 3-9).

Table 3-7 presents a summary of the options as applied to each reach based on discussions with City staff and is followed by a discussion of the options. Appendix B includes landscape concepts prepared by Hapa associated with the cross-section options.

Table 3-7: Major Dike and Road Alignment and Cross-section Options

Reach ID and Name	Alignment and Cross-section Options
1 – Bridgeport Industrial	Option 1: Raise dike and road, extend land-side**
2 – Industrial and Shipyards	Option 1: Raise dike and road, extend land-side**
3 – Riverfront Houses and ALR	Option 1: Raise dike and road, extend land-side**
4 – Bog and Rail	 Option 1: Raise dike and road, extend land-side Option 2: Raise dike and road with retaining walls Option 3: Raise dike only and extend river-side** <u>Specific options for rail trestle:</u> Option 6: Rail trestle – raise road/dike under trestle Option 7: Rail trestle – fill in between trestle piles
5 – Hamilton Frontages	 Option 1: Raise dike and road, extend land-side** Option 3: Raise dike only and extend river-side
Option 3: Raise dike only and extend river-side** Option 4: Raise dike only and extend land-side Specific options for tie-in with City of New Westminster dike: Option 8: City of New Westminster tie-in – raise Boundary R Option 9: Fill Tree Island Steel property to dike level Option 10: City of New Westminster tie-in – new alignment across Tree Island slough	
Notes: ** Option footprint is presented in A	Appendix A plan figures.

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Raise Dike and Road, and Extend Land-side

The preferred option developed for Reaches 1 to 3 involves separating the dike and River Road, raising both to the dike crest elevation, and extending the footprint of the fill towards the land-side. Figure 3-2 presents a typical cross-section for this option.

Figure 3-2 shows a 10 m wide dike crest to allow for additional future dike raising without the need to reconstruct the road. An alternative approach to reduce the overall footprint at first would be to have a 4 m wide dike crest and to extend the footprint and reconstruct the road in the future.

This option addresses several of the main design considerations including providing a substantially wide dike and improving River Road safety by separating vehicles and cyclists/pedestrians.

Extending the footprint towards the land-side takes advantage of the space currently occupied by drainage channels. This option requires filling in the existing channel and replacing or relocating the drainage conveyance and storage. The preferred approach is to replace the channels with pipes. This will result in a loss of aquatic and riparian habitat and will require habitat creation or enhancement to be completed elsewhere to offset the loss. Drainage modification options are discussed separately below.

Extending the footprint towards the land-side will also require land acquisition where the existing corridor width is insufficient. In general, this would affect a narrow strip of land on the frontage of large lots and should be feasible to implement.

However, there are also areas on both the land-side and the river-side where the upgrade will result in access issues. The areas with the most severe space limitations and potential options to address the access issues are presented in Table 3-8.

Table 3-8: Space Limitations and Access Issues Options to Address Footprint Reach / Location / **Photo** and Access Description Retaining walls and steeper Reach 1 driveway access Replace pump station during dike No. 7 Road Pump Station upgrades Reach 1 Retaining walls and steeper 15700 River Road driveway access Coordinate with FortisBC to raise parcel during next major upgrade FortisBC gas pipeline facility

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Reach / Location / Description	Photo	Options to Address Footprint and Access
Reach 2 16291 River Road Residential / Office Space		 Retaining walls Provide parking on land-side (instead of driveway down to lot) Raise parcel of land at time of redevelopment Land acquisition / managed retreat (buy-out, relocate, or do not allow redevelopment)
Reach 2 16971 River Road Tom-Mac Shipyard on water side, Residential on inland side		 Retaining walls Provide parking on land-side (instead of driveway down to lot) Raise parcel of land at time of redevelopment Managed retreat (buy-out, relocate, or do not allow redevelopment)
Reach 3 17740 River Road No. 8 Road North Drainage Pump Station		Retaining walls Replace pump station during dike upgrades
Reach 3 18871 River Road Storage, and Residential lots (Water Side) Large Channel (Inland Side)		 Retaining walls Provide parking on land-side (instead of driveway down to lot) Raise parcel of land at time of redevelopment Land acquisition / managed retreat (buy-out, relocate, or do not allow redevelopment)

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Reach / Location / Description	Photo	Options to Address Footprint and Access
Reach 3 19051 River Road Metro Vancouver Tilbury Watermain Crossing		 Retaining walls and steeper driveway access Coordinate with Metro Vancouver to raise parcel during next major upgrade
Reach 4 21200 River Road CN Rail Trestle Bridge		Refer to rail trestle discussion paragraph in this section (page 3-18)
Reach 5 22760 River Road Queen Road North Drainage Pump Station		 Retaining walls and steeper driveway access Replace pump station during dike upgrades

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Filling in Drainage Channels (Extending Land-side)

The interior channels along River Road will generally be filled in the preferred option which involves raising the dike and River Road, and extending the footprint towards the land-side. Options considered to replace the conveyance and storage capacity provided in the channels are described in Table 3-9.

Table 3-9: Options for Replacing Existing River Road Drainage Channels

T G D	Option Comments		
	Option	Comments	
		Would impact the adjacent properties, requiring acquisition of right-of-way or, potentially, of whole lots (depending on extent of impact to the lot)	
1.	Relocate channels	New channels may not need to be as wide as the existing channel	
	further inland to new River Road toe	New channels would be located at the toe of the road and outside the dike section	
		It is not ideal to have a channel near the toe of the dike and the option of locating a channel near the toe of the dike would need to be evaluated by a geotechnical engineer for seepage concerns	
		Would involve replacing the channel functions with a pipe below the road	
2.	Replace channels	Pipe would be located within the road base but must be outside of the dike cross-section or toe of the dike	
	with pipe	The size of pipe that could be fit into the available space in the road cross-section is a potential limitation	
		Would result in a loss of land side aquatic and riparian habitat	
3.	Reconstruct channels at rear of lots along	Would require re-grading of lots and re-connection of lot drainage to rear of lot	
		Property acquisition for drainage right-of-way would be required	
	River Road	Road drainage would need to be accommodated in additional infrastructure – likely a pipe below the road on the inland side	

The option expected to be both the simplest to implement and the least cost is to replace the existing channels along River Road with pipes. As noted, this option is limited by the size of the pipe that can fit within the road cross-section and outside of the dike cross-section in the preferred option for the dike upgrades. It is estimated that maximum pipe size is approximately 1.2 m diameter, and a circular pipe will fit better than a box section in the available space.

Drainage from both River Road and the interior lots adjacent to the road would be directly connected to the new drainage pipes. The new pipes would drain to the existing north-south channels that convey runoff to the pump stations.

A preliminary assessment of the replacing the drainage channel with a piped system was done to determine whether it could provide the necessary conveyance and storage functions to replace the existing channels along River Road. The existing hydraulic model of the east Richmond drainage system was provided to KWL for this purpose by the City. The preliminary assessment indicates that replacement of the existing River Road channels with 1.2 m diameter concrete pipes would provide adequate conveyance and storage for drainage of the design storms from the interior drainage system.

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The internal drainage system in the eastern part of Lulu Island provides irrigation service as well as drainage service. The system of channels allows water from intakes on the Fraser River to flow into Lulu Island and distribute through the drainage conveyance system to provide irrigation water to the farmlands in eastern Lulu Island. This use of the drainage conveyance system relies on the storage capacity within the channels to provide adequate water to the farmlands. The system was reviewed relative to the impacts on irrigation functions with the proposed removal of the large storage channels along River Road and their replacement with pipe infrastructure. The function of these channels for the irrigation system was discussed with City staff (Derek Hunter, Pump Station Manager). From an irrigation perspective, these changes to the system along River Road are not expected to impact the irrigation functions of the system. The east-west running channels along River Road have one-way flow gates at the junctions with the north-south running channels that convey flow to and from the pump stations and the irrigation intake points. These one-way gates allow the water to drain out of the eastwest channels along River Road to flow to the pump stations, but they block irrigation water from entering the east-west channels when the irrigation function of the channels is in use during the growing season. Therefore, the proposed replacement of the channels along River Road with pipe infrastructure should not impact the irrigation system. Similar one-way gates should be used on the new pipe infrastructure to allow the irrigation flow in the north-south channels to continue to bypass the drainage infrastructure that will provide drainage service along the new River Road.

Infilling drainage channels will remove a large amount of aquatic and riparian habitat important for fishes and amphibians. This will require a significant amount of habitat creation, restoration, and/or enhancement to offset this loss.

North East Bog Forest (Reach 4)

In Reach 4, raising both the dike and River Road to the design dike elevation and extending the footprint towards the land-side (Option 1) would encroach onto the north-east Bog Forest, and is generally not preferred from an environmental perspective. The bog is a unique feature on Lulu Island, and impacts to the bog need to be carefully considered.

To avoid encroaching onto the bog, the following additional options are considered for Reach 4:

- Option 2: Raise dike and road with retaining walls; and
- Option 3: Raise dike only and extend river-side.

Option 2 would limit the encroachment onto the bog by retaining the road land-side slope using retaining walls. Settlement may be a significant concern with Option 1 and Option 2 because the soils adjacent to the bog may experience significant settlement.

By filling towards the river-side instead of the land-side, Option 3 would avoid encroachment and filling in the bog. Building into the river would cause an impact to existing riparian and aquatic habitat and require offsetting. However, the desktop habitat review (Section2.4) shows that there are existing areas of low quality riparian and aquatic habitat in the eastern portion of Reach 4. As such, building into the river provides an opportunity to replace the low quality riparian habitat with higher quality riparian habitat. One concept to achieve this is to build out a shallow river-side slope with riparian and marsh benches, as shown in Figure 3-4. A shallow river-side slope would also reduce the erosion concern and reliance on riprap bank protection. Aquatic habitat loss will have to be offset elsewhere.

Since this option would involve filling in a portion of the river channel, it may have some impact on channel conveyance or navigation. However, the existing trestle piles and piers located upstream already limit the conveyance and navigation in this area. These impacts should be considered further if this option is preferred.

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Rail Trestle (Reach 4)

The existing rail trestle structure at eastern end of Reach 4 is an obstacle to conventional dike upgrading due to limited space for widening the dike and road, and due to limited overhead clearance space for raising the road – as shown on the photo below.



The existing maximum road clearance below the structure is posted at 5.88 m. Raising the road/dike would reduce the clearance.

The following options have been developed for dike upgrading at the rail trestle:

- · Option 6: Rail trestle raise road/dike under trestle; and
- Option 7: Rail trestle fill in between trestle piles.

To achieve Option 6, the trestle structure may need to be modified to achieve a minimum acceptable overhead clearance (to be confirmed with City staff).

Option 7 would avoid reducing the overhead clearance by leaving the road as-is and constructing a new dike on the river-side filling in between the trestle piers. The feasibility of this option needs to be confirmed from geotechnical engineering and constructability perspectives. Additionally, this option would involve filling in a portion of the river channel and may have an impact on channel conveyance or navigation. However, the existing trestle piles and piers already limit the conveyance and navigation in this area. These impacts should be considered further if this option is preferred.

Hamilton Frontages (Reach 5)

Upstream of the rail trestle, in Reach 5, the primary option is the same as Reach 1 to 3. This involves raising the road and the dike to the design dike elevation, and extending the footprint to the land-side (Option 1). This will remove a large amount of aquatic and riparian habitat and will require a significant amount of habitat creation, restoration and/or enhancement to offset the loss.

However, Option 3, raise dike and extend to river-side, is also considered because of the opportunity to convert the existing low quality riparian and aquatic habitat into higher quality habitat (see Section 2.4). One concept to achieve this is to build out a shallow river-side slope with riparian and marsh benches, as shown on Figure 3-4. A shallow river-side slope would also reduce the erosion concern and reliance on riprap bank protection. Additionally, this option is considered in both Reach 4 and Reach 6, and would allow for continuity in alignment. This option would involve filling in a portion of the river channel and may have an impact on channel conveyance or navigation.

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Tree Island Slough and Tie-in with City of New Westminster Dike (Reach 6)

Near the western end of Reach 6, River Road intersects Westminster Highway. The existing dike runs along the river bank, and is separated from River Road. The existing dike runs east until it reaches the recently developed Hamilton Transit Centre. The existing dike alignment is not well defined from the Hamilton Transit Centre to Boundary Road where jurisdiction of the Lulu Island perimeter changes to the City of New Westminster.

The following options have been developed for Reach 6:

- · Option 3: Raise dike only and extend river-side; and
- Option 4: Raise dike only and extend land-side.

The following specific options have been developed for tie-in with the City of New Westminster dike:

- Option 8: City of New Westminster tie-in raise Boundary Road;
- Option 9: Fill Tree Island Steel property to dike level; and
- Option 10: City of New Westminster tie-in new alignment across Tree Island Slough.

Options 3 and 4 address dike upgrading along the existing dike alignment from Reach 5 to the Hamilton Transit Centre, from which there are 2 compatible options for tie-in with the City of New Westminster dike:

- construct a dike along the right-of-way north of the Hamilton Transit Centre and raise Boundary Road (Option 8); and
- fill the Tree Island Steel property (3933 Boundary Road) up to the dike elevation through redevelopment.

Option 3 (extend river-side) would involve impacts to existing intertidal habitat, but also presents the opportunity to improve river side riparian habitat, while Option 4 would have private property impacts.

Raising Boundary Road (Option 8) may be difficult to achieve through a standard dike design because there is a railroad access line to the Tree Island Steel property that crosses Boundary Road. This may require a rail gate, which is not desired.

Raising the land elevation of the Tree Island Steel property (Option 9) would create a wide and robust dike at the tie-in, but this option is dependent on redevelopment of the site and may have feasibility issues due to access requirements.

Option 10 provides an alternative approach that realigns the dike to cross over the slough and runs along the Tree Island Steel property and directly connects to the City of New Westminster dike along the river bank. Option 10 would involve partially or completely closing off the slough and presents the opportunity to construct a large habitat enhancement project. One concept for this is to create an intertidal marsh in the slough and have a tide gate installed on the dike crossing at the outlet of the slough.

3.5 Stakeholder Engagement

Stakeholder engagement for Phase 4 is being completed jointly in two stages. Prior to City Council review, initial stakeholder engagement included meetings with internal City departments and some regulatory agencies. This initial stakeholder engagement provides input from City groups on options developed, additional background, and future coordination, with the goal of informing the preferred upgrade options. Following Council review, additional stakeholder engagement is planned, which will include meetings with specific stakeholder groups and a public consultation event. The second stage of

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stakeholder engagement is intended to inform the public on the draft recommended options and seek any feedback the City may wish to consider in finalizing the Dike Master Plan to implementation.

The parties consulted to date include the following:

- · City of Richmond Transportation;
- · City of Richmond Parks, Planning, and Sustainability;
- · City of New Westminster; and
- Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (MFLNRORD), including Inspector of Dikes, Flood Safety, and Water Authorizations staff.

The Department of Fisheries and Oceans (DFO) declined to meet with the City, stating that input would be provided during later stages in the established review and approvals process.

Additional stakeholder consultation following Council review is planned to include the public and specific groups and properties who may be uniquely impacted by dike upgrades.

3.6 Options Evaluation and Selection

The options described in Section 3.4 have been evaluated based on the design considerations and feedback from the stakeholder meetings held to date.

Draft recommended options have been identified and are described below. Environmental impacts and geotechnical considerations associated with the recommended options are also summarized below.

It is understood that the recommended options will be confirmed through Council and additional stakeholder consultation.

Recommended Options

In general, the recommended option is to separate River Road from the dike, and have both the road and the dike at the dike crest elevation. This is referred to as the "separated dike and road" option and is presented as Option 1 in Section 3.4.

The main features of this option are described below.

- Separate the dike and roadway such that there is an over-wide dike and separate travel areas for vehicles and cyclists/pedestrians.
- Raise the dike crest and road surface to the design dike crest elevation and extend the footprint of fill towards the land-side.
- Retain the land-side toe of the road with retaining walls (e.g. MSE) where necessary (e.g. to minimize impact to North East Bog Forest).
- Fill existing land-side drainage channel and replace with a piped drainage system.
- Modify driveways and access ramps into adjacent properties where reasonable (some constrained areas may require major modifications, redevelopment, or property acquisition).
- Incorporate public space, linear park, and multi-use path features appropriate for a dike crest.
- Install bank protection works on the river-side to match existing (may not be required where the alignment is setback from the river-bank).

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The dike portion of the overall crest would be 10 m wide to accommodate future dike raising without having to modify the road. This option is recommended because it is the most robust of the options considered as it produces an earth fill embankment (dike and road) that would be approximately 22 m wide at the crest. This is a significant increase above the standard dike crest width of 4 m and is expected to reduce the likelihood of failure for a variety of processes. Additionally, separating the dike and road would provide several community benefits including improved pedestrian, cyclist, and vehicle safety, and the opportunity for a linear park / multi-use path.

Other options are recommended below in areas which are constrained and do not allow for the separated dike and road option.

- Riverbank Dike (Option 4):
 - Use in eastern end of Phase 4 where there is no road associated with the dike.
 - Raise the dike crest to the design height and extend the footprint of fill towards the land-side.
 - o Install bank protection works on the river side to match existing.
- Combined Dike and Road Below Trestle (Option 6):
 - Use only at the CP rail trestle crossing where there is not enough space for a separated dike and road.
 - There is sufficient clearance to raise the road to the design dike elevation based on discussion with City transportation staff.
 - Install bank protection works on the river side to match existing.
- Construct Dike Between Tree Island Steel and Hamilton Transit Centre, and Raise Boundary Road (Option 8):
 - Use to tie-in with the City of New Westminster's portion of the Lulu Island perimeter dike.
 - Use existing right-of-way between Tree Island Steel property (3933 Boundary Road) and the Hamilton Transit Centre (4111 Boundary Road).
 - Raise Boundary Road from Tree Island Steel property towards river bank to tie into City of New Westminster's portion of the Lulu Island perimeter dike.
 - Boundary Road raising will require road and possible intersection changes.
 - The existing rail spur line servicing Tree Island Steel will need to be addressed (e.g. rail dike gate, raise rail spur, etc.).
 - Alternatively, if redevelopment of the Tree Island Steel property occurs during the implementation period of the Dike Master Plan, then the recommended alternative option is raise the property (or a portion of it) to the dike crest elevation as per Option 9.

In addition to the options listed above, another recommendation for flood protection in all areas of Phase 4 is to target land raising of the areas behind the dike.

Table 3-10 below presents a summary of the recommended options for each reach.

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Table 3-10: Recommended Dike Upgrading Options

Recommended Options			
Option 1: Separated dike and road			
Option 1: Separated dike and road			
Option 1: Separated dike and road			
 Option 1: Separated dike and road¹ <u>Site specific option at rail trestle crossing:</u> Option 6: Combined dike and road below trestle 			
Frontages • Option 1: Separated dike and road			
 Option 4: Riverbank dike <u>Site specific option for tie-in with City of New Westminster dike:</u> Option 8: Raise boundary road 			

Environmental Impacts of Recommended Options

In total, the estimated impact for the selected Phase 4 options is 3,300 m² of high quality Fraser River intertidal habitat, 1,900 m² high quality Fraser River riparian habitat, 28,500 m² drainage channel aquatic habitat, and 106,200 m² drainage channel riparian habitat. These areas represent an estimate based on FREMP habitat mapping (2007), and City of Richmond orthoimagery interpretation (2017). Not all Fraser River riparian and intertidal habitat was quantified. The desktop review only quantified high-quality riparian and intertidal habitat types on the Fraser River side of the existing dike. The remaining habitat area, while not calculated here, would also be required in calculations for determining offsetting requirements. Calculation of the exact area of impact of selected options will require an aquatic habitat survey and aquatic effects assessment.

Table 3-11 presents the summary of habitat impacts for the recommended options by reach.

Table 3-11: Reach-by-Reach Summary of Habitat Impacts

Reach # and Name	High-Quality Fraser River Intertidal (m²)	High Quality Fraser River Riparian (m²)	Drainage Channel Aquatic (m²)	Drainage Channel Riparian (m²)
1 - Bridgeport Industrial	-	500	3,300	14,800
2 - Industrial and Shipyards		800	5,900	28,000
3 - Riverfront Houses and ALR	50	300	3,000	16,100
4 - Bog and Rail	100	300	10,200	23,500
5 - Hamilton Frontages	900	*	5,900	23,700
6 - Tree Island Slough and Boundary	2,200	-	-	-

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Geotechnical Considerations for Recommended Options

The proposed dike improvements were assessed with consideration for the BC Seismic Design Guidelines for Dikes.

Thurber Engineering Ltd. (Thurber) assessed 3 sample cross-sections to estimate the potential deformation resulting from seismic events. The cross-sections were based on the preferred cross-section at what was judged to be the most susceptible areas for deformation. Soil conditions were determined by cone penetration tests. Seismic performance was assessed on the basis of existing foundation conditions, (i.e. no additional ground improvement/densification) to determine the need for ground improvement or alternative approaches. The analysis included seismic events representing 100, 475 and 2475-year return period events. Seismic performance was assessed using 2 methods: 1-D (i.e. flat ground) liquefaction assessment to estimate reconsolidation settlements, and 2-D numerical deformation assessment to estimate dynamic deformations. The methods are complimentary, and the results are interpreted together.

The preliminary geotechnical report is attached in Appendix C.

The key results of the geotechnical analysis are summarized below.

- Proposed dike cross-sections will not meet the performance requirements of the seismic design guidelines, without ground improvement or alternative approaches, based on the results of both assessment methods.
- The liquefaction hazard is considered insignificant for earthquakes up to the 100-year return period event.
- The liquefaction hazard is considered moderate and high for the 475 and 2475-year return period events respectively. The resulting deformations would be large.
- Liquefaction may result in a flowslide into the river for dike alignments along the river-bank due to lateral spreading, whereas it would result only in vertical deformation for dike alignments significantly set back from the river bank.
- The deformation analysis indicates that dikes may meet the performance requirements of the seismic design guidelines if they are typically set back 50 m to 100 m from the river-bank and have flat slopes or some localized ground improvement.

Options to address seismically induced deformations, and opinions on each, include:

- Densification The typical approach to densification is to install stone columns. To be effective
 against the liquefaction expected to follow the 2475-year return period event, densification would
 have to extend the depth of the liquefaction zone, and for a similar width. In a typical scenario, this
 can be considered as a 30 m (width) by 30 m (depth) densification located at the river-side toe of
 the dike. Densification can be very costly (e.g. \$9,000 to \$18,000 per lineal metre of dike).
 Alternate experimental techniques are being tested by the City that may offer a more
 economic solution.
- Higher Crest For the 100-year return period event, additional crest elevation may compensate for
 deformations caused by settlement. For events that cause liquefaction, added height just results in
 added deformation, so it would be less effective. This is not an effective strategy by itself for return
 periods above 100-year due to lateral spreading and large vertical deformations.

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- **Setback and Slope** Flatter side slopes on the dike improves seismic stability. However, to prevent large deformations in the 2475-year return period event, the maximum acceptable slope between the river channel invert and the dike crest would need to be approximately 2%, which would require a significant setback between the dike and river.
- Wide Crest ("superdikes") A very wide dike (e.g. crest width of 100 m to 200 m) could be used to
 extend the dike beyond the limit of significant lateral spreading due to liquefaction. A portion of the
 wide crest could be considered sacrificial in the even to major lateral spreading. Raising the land
 for approximately 200 m inland of the dike is desirable for related flood protection reasons, and may
 be desired by the City for other reasons such as land use planning. It has already been done as
 part of multiple family, commercial, and industrial development projects along the waterfront.
 Buildings within this area must already account for liquefaction in their foundation design.
- Dike Relocation / Secondary Dikes Place the dike inland of the liquefaction lateral spreading zone (similar to set back approach) or place a secondary dike inland of the liquefaction lateral spreading zone. The wider option above would essentially include a secondary dike. Relocating the primary dike inland would be a form of retreat and would leave property and buildings exposed outside of the dike.
- Post-earthquake Dike Repair Dike reach specific plans could be developed for post-earthquake
 dike repairs. These would need to consider the feasibility of dike repair construction following a
 major earthquake. In general, it is likely not feasible to quickly repair a dike that has failed due to a
 flowslide induced by liquefaction lateral spreading, especially if the breach results flooding from
 regular high tides. However, it may be feasible to prepare dike repair plans for dikes where a
 flowslide is not anticipated.

Additionally, the City may wish to use alternative seismic performance criteria, such as the criteria discussed in section 3.2 which aims to develop a consistent level of performance between seismic scenarios and flood level scenarios (i.e. an overall 0.2% annual exceedance probability of failure across all hazards).

Recommendations to manage the seismic risk include:

- Consider the proposed alternative seismic performance criteria provided in Section 3.2. Review the criteria if/when the Province issues updated guidelines for seismic performance of dikes.
- Fill land for approximately 200 m inland of the dike to dike crest elevation. Buildings in this zone should be built above the dike crest elevation and have densified foundations capable of withstanding liquefaction. The required distance requires some additional evaluation and may be addressed in the pending updated to the Flood Protection Management Strategy.
- Continue to investigate practical densification options and consider earthquake induced dike deformations in emergency response and recovery planning.

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3.7 Cost Opinions

Cost opinions for the recommended option in each reach are provided to help the City consider the financial implications for planning and comparing options. A breakdown is provided to help understand the proportional cost for recommendations such as separating and raising the road.

Costs are based on unit rate cost estimates and tender results for similar works. The most relevant rates are from the City's Gilbert Road dike project. The City provided a summary of the cost estimate prepared by WSP for this project.

Rates from recent tenders for diking on the Lower Fraser River and other locations within the Lower Mainland were used to check the reasonableness of the rates and estimate other features such as sheet piles or large diameter drain pipes.

The costs were broken down by reach so that unit rates could be applied to similar typical cross-sections. They were also broken down into the main features that coincide with options that the City may wish to consider further. These features are described below.

- Dike Raising this is the core element required to provide flood protection. It includes a 10 m crest width that can be raised while still achieving a 4 m crest width. This includes site preparation, fill, and erosion protection.
- Road Structure and Utilities this includes stripping, subgrade preparation, pavement structure, drainage and utilities. Where the existing road is atop the dike, most of this cost would be incurred regardless of where it gets relocated.
- Road Raising To Dike Crest this includes the additional fill required to raise the road to the dike
 crest elevation.
- Other –This category was used to capture pathways and utilities if the option did not include road construction.
- Contingency A 40% contingency is provided because the costs are based on concept plans only.

Table 3-12 presents a summary of all reaches with cost breakdowns for the items described above. Costs for each reach are also provided in the Reach Summary Sheets in Section 5.

Table 3-12: Summary of Construction Costs (\$ in Millions)

7.6 2.3 3.2	\$7.7 \$12.6 \$3.3	\$4.1 \$6.6 \$1.7	\$10.5 \$16.8 \$4.3	\$7.3 \$11.8 \$3.1	\$4.7 \$1.5 \$1.6	\$41.9 \$61.4 \$17.2
_	_	-				
3.2	\$3.3	\$1.7	\$4.3	\$3.1	\$1.6	\$17.2
			T	ΨΟ. Ι	Ψ1.0	Ψ17.2
1.5	\$2.0	\$1.1	\$2.0	\$1.5	\$4.6	\$12.8
9.8	\$10.2	\$5.4	\$13.5	\$9.5	\$5.0	\$53.3
4.3	\$35.8	\$18.9	\$47.1	\$33.1	\$17.4	\$186.6
9	.8	.8 \$10.2 4.3 \$35.8	.8 \$10.2 \$5.4 4.3 \$35.8 \$18.9	.8 \$10.2 \$5.4 \$13.5 4.3 \$35.8 \$18.9 \$47.1	.8 \$10.2 \$5.4 \$13.5 \$9.5 4.3 \$35.8 \$18.9 \$47.1 \$33.1	.8 \$10.2 \$5.4 \$13.5 \$9.5 \$5.0 4.3 \$35.8 \$18.9 \$47.1 \$33.1 \$17.4

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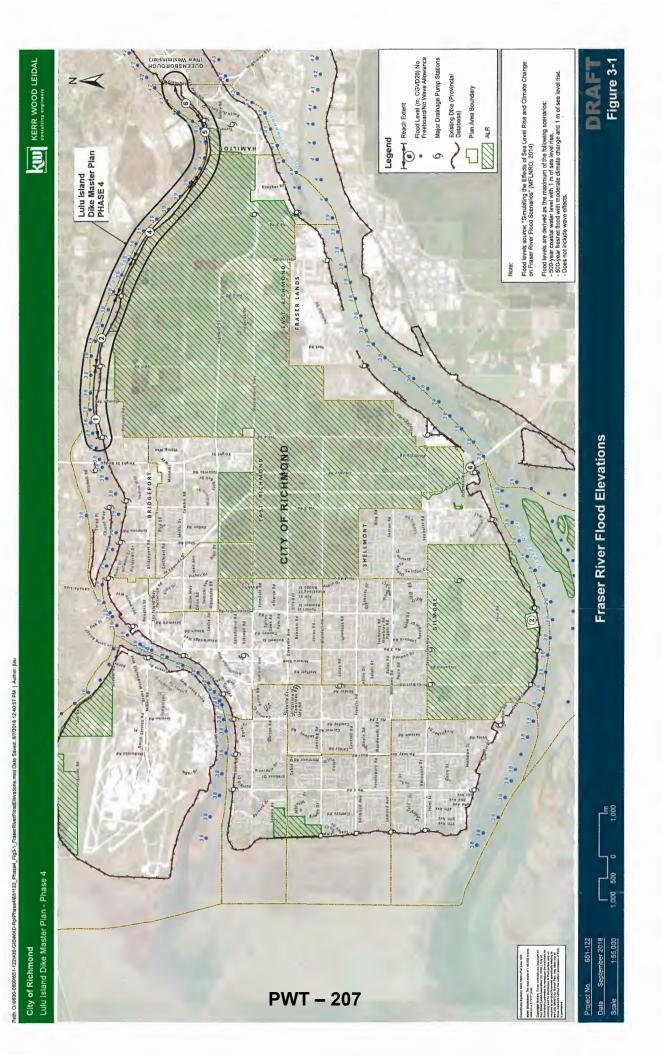


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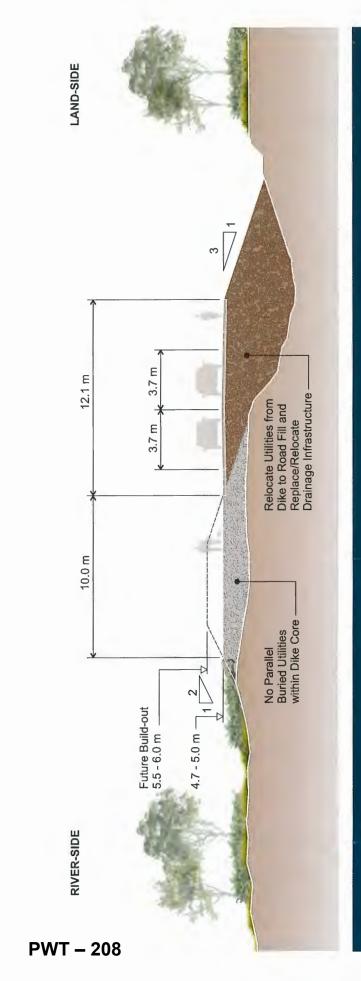
Costs that are not included are noted below.

- Land acquisition is not included. Ideally, land will be acquired during redevelopment. Similarly, there may be opportunities to have dike improvements tied to adjacent development.
- Densification is not included. The recommendation is to fill 200 m back from the dike face as a
 preferred strategy to deal with liquefaction. If the road and land behind the dike is not raised, then
 densification is recommended. Current techniques such as stone columns would cost
 approximately \$9,000 to \$18,000 per metre of dike.
- Off-site habitat projects (that may be needed beyond the habitat enhancement provided along the
 dike corridor) are not included. Such cost could be roughly 5% of the construction cost. It is
 understood that a separate Dike Master Plan may be prepared to address habitat compensation by
 identifying and developing medium to large habitat compensation concepts.
- Raising the land behind the dike is not included. This is proposed to be a condition of development behind the dike, with the cost and benefit attributed to the property owner.
- Professional fees (engineering, surveying, environmental, archeological, etc.) are not included. Such costs could be in the range of 10% to 15% of the construction cost.

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Option 1: Raise Dike and Road and Extend Land-side

May 2018 Not to Scale Scale

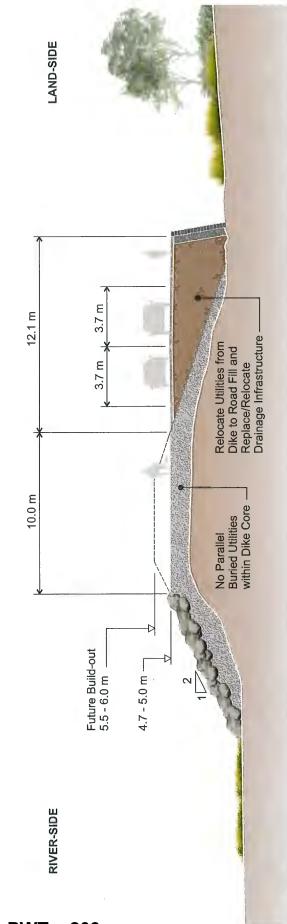
Project No.

Date

(Reaches 1-5) 651.122

Figure 3-2

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Option 2: Raise Dike and Road with Retaining Walls (Reach 4)

Figure 3-3

Not to Scale May 2018 Project No. Scale Date

651.122

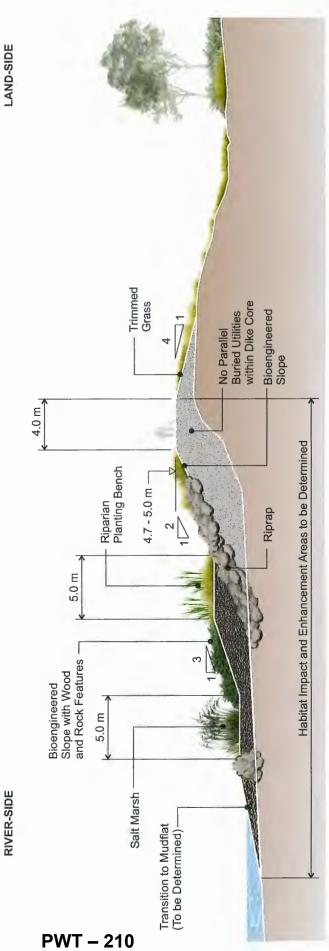
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RIVER-SIDE



Option 3: Raise Dike Only and Extend River-side (Reaches 4-6)	
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Figure 3-4

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LAND-SIDE Clearance Reduced to ~ 4.7 m 7 e / **Existing Rail Trestle** 9.6 m 귑 4.7 m + RIVER-SIDE FRASER

PWT - 211

Option 6: Rail Trestle - Raise Road/Dike Under Trestle (Reach 4)

Not to Scale May 2018 Project No. Scale Date

651.122

Figure 3-5

LAND-SIDE

4 Existing Clearance to ~ 5.9 m Maintain Existing Road Edge Existing Rail Trestle Fill in Between Piles es / 10.0 m Future Build-out 5.5 - 6.0 m 4.7 m FRASER

Option 7: Rail Trestle - Fill In-between Trestle Pile (Reach 4)

Figure 3-6

Date May 2018
Scale Not to Scale

651.122

Project No.

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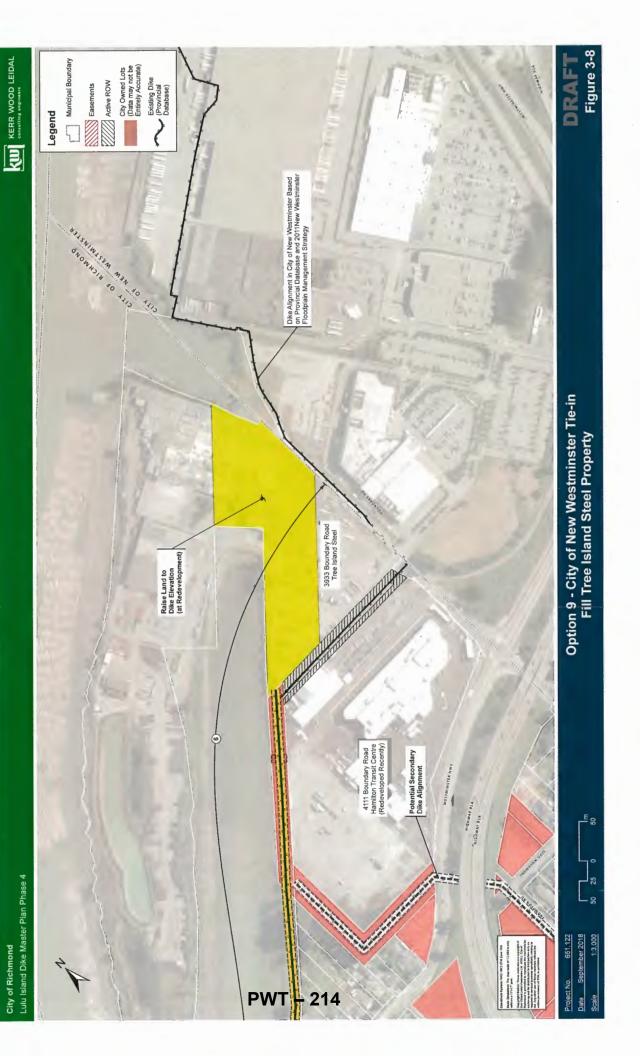
RIVER-SIDE

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4. Implementation Strategy

The implementation strategy has three parts:

- pre-design measures;
- construction sequencing for a typical reach; and
- prioritization of reaches for construction.

4.1 Pre-design Measures

Before construction can be implemented, the following steps are recommended.

- Use the Dike Master Plan as a planning tool with City land use planning to acquire land during redevelopment, and to rezone land with conditions for land raising inland of the dike.
- Acquire land prior to construction.
- Seek habitat compensation projects to bank credits in preparation for drainage channel and associated riparian area impacts. A separate mater plan for habitat compensation could be prepared to identify and develop medium to large habitat enhancement concepts to serve as compensation for multiple reaches.
- Assess required drainage system modifications (e.g. filling drainage channels and constructing a piped drainage system) in additional detail.
- Design with consideration for construction sequencing noted below.
- · Advance public space and multi-use path design concepts further.
- Consider the need for an appropriate building setback from the land-side toe of any future flood
 protection works in view of the current BC setback guideline of 7.5 m. This should consider the
 planned dike upgrade to 4.7 m CGVD28, as well as future buildout to 5.5 m CGVD28. This may
 require consultation with the Inspector of Dikes.

4.2 Construction Sequence

The construction sequence for a typical reach is provided below. A typical reach currently has a road atop the dike, and utilities within the dike.

- 1. Secure land.
- Coordinate third party utility relocations. This is mainly hydro on poles. Coordination with rail needed at trestle.
- Install storm sewer (approximately 1200 mm dia., to be confirmed through at design) in proximity to existing channel.
- 4. Fill over storm sewer to underside of road structure. The fill placement may be followed by a settlement period depending on geotechnical recommendations. If so, this fill may include a preload depth in excess of the road fill.
- 5. Install new utilities (typically water and hydro, with some sewer).
- 6. Construct new road with parking where access outside the dike will be impacted.

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- 7. Divert traffic to new road.
- 8. Remove existing road and utilities. Don't abandon utilities within dike.
- 9. Fill dike to crest elevation. Excavation of sub-grade may be required to remove unsuitable materials.
- 10. Complete armouring, trail, and landscaping.

Larger projects will result in less temporary road diversion works. As an alternate, the entire road could be reconstructed first, in phases, before the dike is built later. This would work with the new road being raised to dike crest elevation.

4.3 Prioritization

Priority for construction will depend on which section is the lowest and therefore most urgent to raise, opportunities such as site development or road improvement plans, level of preparedness for issues such as land acquisition and habitat offsets, and adjacent residents' receptiveness to a higher dike. A preliminary priority list is provided below. Opportunities may shift the order, and the reaches may be broken down into smaller or larger projects.

Table 4-1: Priority by Reach

	Reach ID and Name	Extent / Length	Notes
1	3 – Riverfront Houses and ALR	No. 8 Road to Nelson Road	Low section and road safety issues.
2	4 – Bog and Rail	Nelson Road to Rail Trestle	Low section and road safety issues. Rail coordination takes time.
3	5 – Hamilton Frontages	Rail Trestle to Queens Road	Relatively straightforward.
4	2 – Industrial and Shipyards	No. 7 Road to No. 8 Road	Seek redevelopment opportunities for land acquisition and to resolve access issues.
5	1 – Bridgeport Industrial	No. 6 Road to No. 7 Road	Seek redevelopment opportunities for land acquisition and to resolve access issues.
6	6 – Tree Island Slough and Boundary	Queens Road to City of New Westminster	Coordinate with planned park, road realignment, and redevelopment. Seek revised alignment with Tree Island Steel site, and further investigate Tree Island Slough habitat enhancement.

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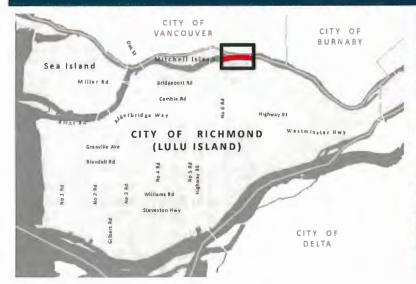


5. Reach Summary Sheets

This section contains 2-page, reach-by-reach summary sheets that summarize the existing conditions, design considerations and potential constraints for each reach of Phase 4. The second sheet will summarize the features of the master plan through each reach including typical cross-sections, plan features, costs and priority for upgrade.



Reach 1: Bridgeport Industrial





Existing Conditions

The existing dike in this reach is located in River Road. A watermain and overhead utilities run along the southern portion of the road.

This reach has wide vegetated channels on the inland side of the dike, and a wide vegetated riparian zone on the riverside.

Industrial lots and associated infrastructure exist throughout the reach, including warehouses and container storage.

No. 6 Road is the tie-in location with Phase 2 of the Dike Master Plan, and is also a potential tie-in location for the proposed mid-island dike.

Unique Features

- · Drainage pump station at No. 6 Road.
- Industrial sites with water access north of River Road (e.g. Mainland Sand and Gravel).
- FortisBC gas pipeline river crossing and facility west of No. 7 Road.
- Drainage channel and pipe south of road.
- Riparian area north of road.
- Potential future tie-in location with proposed mid-island dike.

Considerations



Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks

Boat waves

Industrial

Water access industrial sites north of road/dike

Road design and driveway grade to accommodate large trucks

Social

No. 7 Road Pier Park Align with 2009 Waterfront Strategy

Connect to existing and planned trails and public amenities

Wayfinding and public information signs



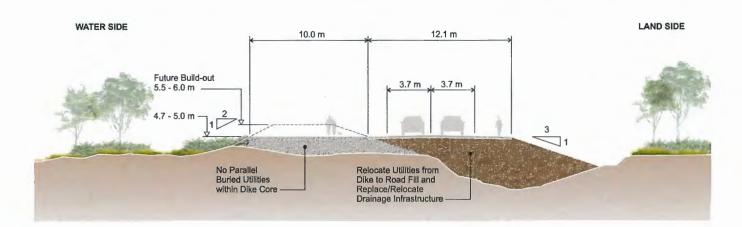
Fraser River side habitat includes high quality intertidal habitat and high quality riparian habitat

Land side includes drainage channels adjacent to dike

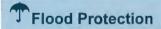
No. 7 Road Pier Park



Reach 1: Bridgeport Industrial - Recommended Improvements



Master Plan Features



Raise dike to 4.7 m and separate and raise road inland of the dike as illustrated above.

Dike alignment will typically extend up from the current face of dike, and widen inland.

Provide erosion protection along the face of the dike, typically consisting of np rap

Raise properties 200 m inland to 4.7 m or densify to the depth of potential liquefaction.

Replace channels with storm sewers and swales to improve stability and reduce seepage.

Industrial

Raise road to dike crest elevation to permit access over tide to industrial sites north of dike.

Raise industrial sites to dike crest elevation during redevelopment.

For lower sites, driveway ramps may need to extend into lots with grades that accommodate large trucks. Ramps may require retaining walls to limit footprint.

iiii Social

Construct multi-use path on top of dike, separate from road. Link to parks, trails, public amenities, and wayfinding.

Environmental

The proposed footprint would impact an estimated 500 m² of high quality Fraser River riparian habitat, 14,800 m² of drainage channel riparian habitat, and 3,300 m² of drainage channel aquatic habitat

NOTE: This is an estimate based on 2007 FREMP mapping and 2017 orthoimagery interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Priority

Priority is ranked 5th out of 6 reaches.

This is one of the lower priority reaches due to relatively good existing height, and benefits to coordinating with future land redevelopment. The dike is at a higher elevation than the high priority reaches. Required land may be secured through redevelopment opportunities. Land raising during redevelopment will also reduce the width required for dike and road work, and the need for interim access ramps.

Construction Cost

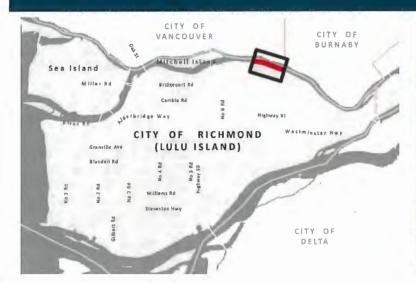
Costs below are for 1.7 km of dike similar to cross-section above.

Item	Cost per metre	Cost
Dike Raising	\$4,500	\$7.6 Million
Road Structure & Utilities	\$5,300	\$8.9 Million
Raise Road to Dike Height	\$1,900	\$3.2 Million
Pathway	\$600	\$1 Million
Other (Driveways, Ramps or Road Reconstruction)		\$.5 Million
Utilities (Drainage, Water)	\$2,000	\$3.3 Million
Contingency (40%)		\$9.8 Million
Total		\$34.3 Million

Cost opinions are in 2018 Canadian Dollars.



Reach 2: Industrial and Shipyards





Existing Conditions

The existing dike alignment in this reach is a dike in River Road. This reach has industrial lots, shipyards and a narrow riparian strip on the water side of the dike.

The inland side of the dike has access to industrial lots and residential lots to the east side of the reach.

Currently, there is parking along the dike for the shipyard employees.

Unique Features

- Water-oriented industrial parcels located north of road (tugboat operation and Tom-Mac Shipyards).
- Residential/storage properties located north of road with minimal setback between road and structures.
- Large industrial parcels located south of road near No. 7 Road.
- ALR parcels with houses located south of road.
- Drainage pump station at No. 8 Road.

Considerations



Industrial

Water access for tugboats, and shipyards.

Road design and driveway grade to accommodate large trucks

Drainage pump station at No. 8 Road

Parking for shipyards is along River Road

iiii Social

Align with 2009 Waterfront Strategy

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

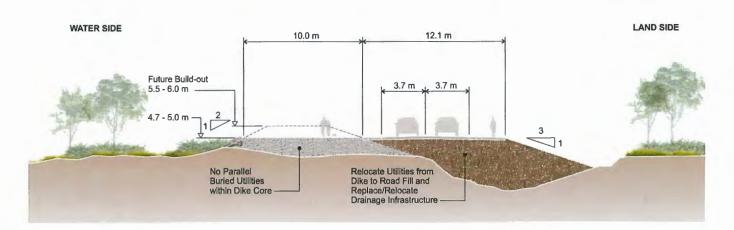
Environmental

Fraser River side habitat includes narrow deciduous treed woodland high-quality habitat

Western portion of Land side includes drainage channels adjacent to dike; eastern portion of land side has trees/hedges along residential lots



Reach 2: Industrial and Shipyards - Recommended Improvements



Master Plan Features



Raise dike to 4.7 m and separate and raise road inland of the dike as illustrated above.

Dike alignment will typically extend up from the current face of dike, and widen inland.

Provide erosion protection along the face of the dike, typically consisting of rip rap revetment.

Raise properties 200 m inland to 4.7 m or densify to the depth of potential liquefaction.

Replace channels with storm sewers and swales to improve stability and reduce seepage.

Industrial

Raise road to dike crest elevation to permit access over tide to industrial sites north of dike.

Raise industrial sites to dike crest elevation during redevelopment.

For lower sites, driveway ramps may need to extend into lots with grades that accommodate large trucks.

**** Social

Construct multi-use path along dike, separate from road. Link to parks, trails, public amenities, and wayfinding.

Environmental

The proposed footprint would impact an estimated 800 m² of high quality Fraser River ripanian habitat, 28,000 m² of drainage channel riparian habitat, and 5,900 m² of drainage channel aquatic habitat

NOTE: This is an estimate based on 2007 FREMP mapping and 2017 orthoimagery interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment



Priority is ranked 4th out of 6 reaches.

This is one of the lower priority reaches due to relatively good existing height, and benefits to coordinating with future land redevelopment. The dike is at a higher elevation than the high priority reaches. Required land may be secured through redevelopment opportunities. The adjacent industrial land is less developed than Reach 1, so opportunities for land acquisition and land raising through redevelopment may arise earlier than for Reach 1. Land raising during redevelopment will also reduce the width required for dike and road work, and the need for interim access ramps.

Construction Cost

Costs below are for 1.7 km of dike similar to cross-section above.

Item	Cost per metre	Cost
Dike Raising	\$4,500	\$7.7 Million
Road Structure & Utilities	\$5,300	\$9.1 Million
Raise Road to Dike Height	\$1,900	\$3.3 Million
Pathway	\$600	\$1 Million
Other (Driveways, Ramps or Road Reconstruction)		\$1 Million
Utilities (Drainage, Water)	\$2,000	\$3.4 Million
Contingency (40%)		\$10.2 Million
Total		\$35.8 Million



Reach 3: Riverfront Houses and ALR





Existing Conditions

The dike in this reach is a dike in River Road, with a combination of residential and industrial lots on either side of the dike.

The inland side of the dike has large residential lots separated from the road by a large channel and hedges. The water side of this reach has access to docks, storage, drainage pump station.

There is a major Metro Vancouver pipe river crossing in this reach.

Unique Features

- Residential/storage properties located north of road with minimal setback between road and structures near Nelson Road.
- ALR parcels with houses located south of road.
- Metro Vancouver Tilbury watermain crossing near Nelson Road

Considerations

Dike alignment Dike crest elevation Erosion protection Seismic performance Static stability and seepage River toe stability and setbacks Boat waves

Flood Protection

Industrial

Drainage pump station at east side of the reach

Storage and water access on the north side of River Road

Metro Vancouver watermain crossing

Road design and driveway grade to accommodate large trucks

iiii Social

Align with 2009 Waterfront Strategy

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

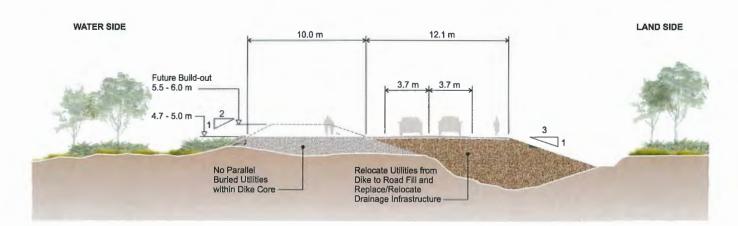
Environmental

Fraser River Side habitat includes narrow deciduous treed woodland high-quality habitat along the 75% of the reach

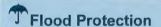
Land side has tree/hedges along residential lots and drainage channels



Reach 3: Riverfront Houses and ALR - Recommended Improvements



Master Plan Features



Raise dike to 4.7 m and separate and raise road inland of the dike as illustrated above.

Dike alignment will typically extend up from the current face of dike, and widen inland.

Provide erosion protection along the face of the dike, typically consisting of rip rap revetment.

Raise properties 200m inland to 4.7m or densify to the depth of potential liquefaction.

Replace channels with storm sewers and swales to improve stability and reduce seepage.

Industrial

Raise road to dike crest elevation to permit access over tide to properties north of dike.

Parking for properties north of dike to be provided at side of road, or with driveways and ramps or raised parking on private property.

**** Social

Construct multi-use path along dike, separate from road. Link to parks, trails, public amenities, and wayfinding.

Environmental

The proposed footprint would impact an estimated 300 m² of high quality Fraser River riparian habitat, 50 m² of high quality Fraser River intertidal habitat, 16,100 m² of drainage channel riparian habitat, and 3,000 m² drainage channel aquatic habitat NOTE: This is an estimate based on 2007 FREMP mapping and 2017 orthoimagery interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment



Priority is ranked 1st out of 6 reaches.

This is highest ranked priority due to low crest elevations and road safety issues.

Land acquisition may be required, but the large agricultural/residential lots typically include adequate setbacks to provide enough space without redevelopment.

Land raising during redevelopment will also reduce the width required for dike and road work, and the need for interim access ramps.

Construction Cost

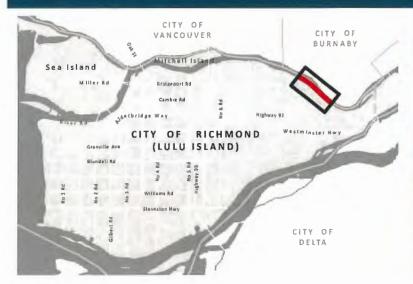
Costs below are for 0.9 km of dike similar to cross-section above.

Item	Cost per metre	Cost
Dike Raising	\$4,500	\$4 Million
Road Structure & Utilities	\$5,300	\$4.8 Million
Raise Road to Dike Height	\$1,900	\$1.7 Million
Pathway	\$600	\$.5 Million
Other (Driveways, Ramps or Road Reconstruction)		\$.6 Million
Utilities (Drainage, Water)	\$2,000	\$1.8 Million
Contingency (40%)		\$5.4 Million
Total		\$18.9 Million

Cost opinions are in 2018 Canadian Dollars.



Reach 4: Bog and Rail





Existing Conditions

The dike in this reach is within River Road.

There are environmental and agricultural constraints along either side of the dike. Outside of the dike on the riverside, there is a narrow strip of riparian zone and riprap along the Fraser River.

Informal agricultural (cranberry) dikes are located along the south edge of the road/dike. The drainage channel in this reach is very wide.

The North East Bog Forest is a city park/conservation area located south of the road/dike.

The east side of the reach includes a rail trestle bridge that crosses the dike and Fraser River.

Unique Features

- ALR parcels with cranberry farms south of road.
- Very large agricultural channel south of dike.
- North East Bog Forest (City park).
- Rail trestle river crossing.
- No space between road edge and river channel (existing riprap bank protection).

Considerations

TFlood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves
Soft solls (bog)

Industrial

Water access and parking for docks.

Road and Driveway access will need to be regraded.

Train rail trestle located at east side of reach.

Farm dike on the inside of the current dike.

**** Social

North East Bog Forest Align with 2009 Waterfront Strategy

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

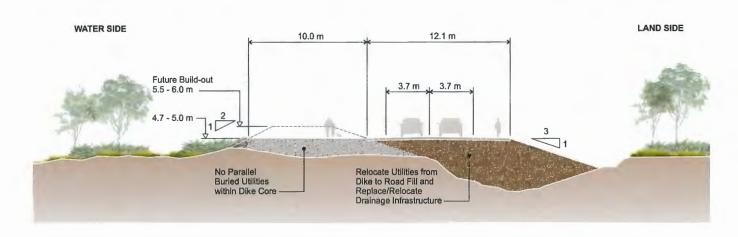
Environmental

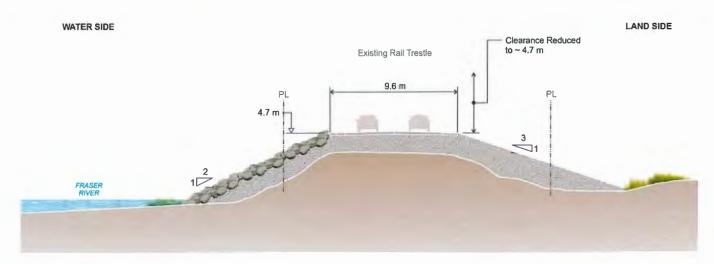
Fraser River side habitat includes narrow low-brush riparian zone on ½ of reach

Land side includes drainage channels adjacent to and North East Bog Forest at eastern end of the reach



Reach 4: Bog and Rail - Recommended Improvements





Master Plan Features



Raise dike to 4.7 m and separate and raise road inland of the dike as illustrated above.

Dike alignment will typically shift into the river, with some widening inland.

Provide erosion protection along the face of the dike, typically consisting of rip rap revetment.

Industrial

Coordinate work around rail trestle with rail company.

**** Social

Construct multi-use path along dike, separate from road. Link to parks, trails, public amenities, and wayfinding, per Lululoop concept developed in Phase 3. Ensure barriers are in place where the road and path narrow into closer proximity at the rail trestle.

Environmental

The proposed footprint would impact an estimated 300 m² of high quality Fraser River riparian habitat, 100 m² of high quality Fraser River intertidal habitat, 23,500 m² drainage channel riparian habitat, and 10,200 m² drainage channel aquatic habitat

NOTE: This is an estimate based on 2007 FREMP mapping and 2017 orthoimagery interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment



Reach 4: Bog and Rail - Recommended Improvements

Priority

Priority is ranked 2nd out of 6 reaches.

This is ranked high due to low crest elevations and road safety issues.

Regulatory and rail company approvals may take extra time due to proposed widening into river and work around the trestle structure.

Land acquisition may be required, but the large agricultural/residential lots typically include adequate setbacks to provide enough space without redevelopment.

Land raising during redevelopment will also reduce the width required for dike and road work, and the need for interim access ramps.

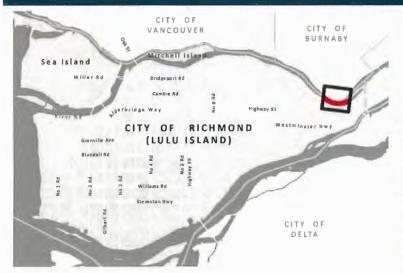
Construction Cost

Costs below are for 2.2 km of dike similar to cross-section above.

Item	Cost per metre	Cost
Option 1		
Dike Raising	\$4,500	\$10.3 Million
Road Structure	\$5,300	\$12.1 Million
Raise Road to Dike Height	\$1,900	\$4.3 Million
Pathway	\$600	\$1.4 Million
Other (Driveways, Ramps or Road Reconstruction)		\$.6 Million
Utilities (Drainage, Water)	\$2,000	\$4.8 Million
Option 6 Only at Rail Trestle Crossing		
9.6 m wide Dike Crest at 4.7 m c/w riprap with 15-20 m widening at base	\$4,500	\$.3 Million
9.6 m wide asphalt road with 2x1.1 m shoulder	\$1,900	\$1 Million
Contingency (40%)		\$13.5 Million
Total		\$47.1 Million
Cost opinions are in 2018 Canadian Dollars		



Reach 5: Hamilton Frontages





Existing Conditions

This reach of the dike is located on a narrow strip of right-ofway between the Fraser River, and agricultural/residential lots.

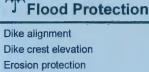
On the Fraser River side of the dike, there is a strip of riprap for bank protection. The inland side of the dike includes a minor drainage channel, agricultural land and residential lots at the east side of the reach.

There is a major Metro Vancouver pipe crossing in this reach.

Unique Features

- ALR parcels south of road with houses located close to road.
- No space between road edge and river channel (existing riprap bank protection).
- Metro Vancouver Big Bend forcemain crossing west of 21920 River Road.
- Queens North drainage pump station west of Westminster Highway.

Considerations



Seismic performance
Static stability and seepage
River toe stability and setbacks

Boat waves

Industrial

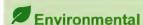
Pump station on waterside of dike Road design and driveway grade

iiii Social

Align with 2009 Waterfront Strategy

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

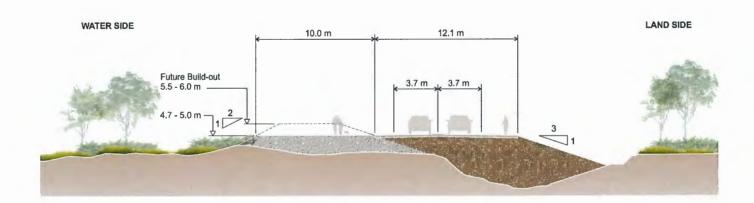


Fraser River side has narrow riprap slope, with low-quality habitat

Land side includes agricultural land for ½ of reach, and low-quality habitat and maintained lawn (residential) for remainder of reach. Drainage channels and associated riparian and aquatic habitat area present along the full length of the reach



Reach 5: Hamilton Frontages - Recommended Improvements



Master Plan Features

TFlood Protection

Raise dike to 4.7 m and separate and raise road inland of the dike as illustrated above.

Dike alignment will typically extend up from the current face of dike, and widen inland.

Provide erosion protection along the face of the dike, typically consisting of rip rap revetment.

Raise properties 200 m inland to 4.7 m or densify to the depth of potential liquefaction.

Replace channels with storm sewers and swales to improve stability and reduce seepage.

Industrial

Driveway ramps required to extend to access private properties until properties raised.

Social

Construct multi-use path along dike, separate from road. Link to parks, trails, public amenities, and wayfinding.

Environmental

The proposed footprint would impact an estimated 900 m² of high quality Fraser River intertidal habitat, 23,700 m² of drainage channel riparian habitat, and 5,900 m² of drainage channel aquatic habitat

NOTE: This is an estimate based on 2007 FREMP mapping and 2017 orthoimagery interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Priority

Priority is ranked 3rd out of 6 reaches.

This is ranked just above average high due to moderate elevations, but relatively straightforward implementation.

There are some active redevelopment plans for the area, including road realignment at the east end of the reach. Road and development changes may change the priority of this reach.

Land acquisition may be required, but the large agricultural/residential lots typically include adequate setbacks to provide enough space without redevelopment.

Land raising during redevelopment will also reduce the width required for dike and road work, and the need for interim access ramps.

Construction Cost

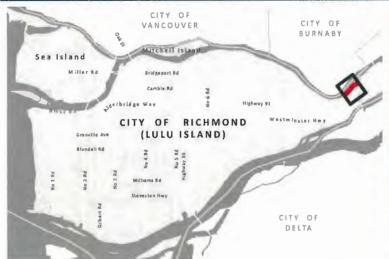
Costs below are for 1.6 km of dike similar to cross-section above.

Item	Cost per metre	Cost
Dike Raising	\$4,500	\$7.3 Million
Road Structure & Utilities	\$5,300	\$8.6 Million
Raise Road to Dike Height	\$1,900	\$3. Million
Pathway	\$600	\$1. Million
Other (Driveways, Ramps or Road Reconstruction)		\$.6 Million
Utilities (Drainage, Water)	\$2,000	\$3.2 Million
Contingency (40%)		\$9.5 Million
Total		\$33.1 Million

Cost opinions are in 2018 Canadian Dollars.



Reach 6: Tree Island Slough and Boundary





Existing Conditions

The dike system in this reach is between a slough and the backyards of single family residential homes. Riprap bank protection exists along the river-side slope.

The slough on the Fraser River side of the dike provides highquality marsh and mudflat habitat.

The existing dike alignment is not well-defined east of the Hamilton Transit Centre. It is understood that the current tie-in with the City of New Westminster's portion of the dike is along Boundary Road. The Tree Island Steel property (3933 Boundary Road) has rail access across Boundary Road which may be an obstacle to dike raising.

Existing city-owned lots provide an opportunity for a Richmond-New Westminster boundary secondary dike.

Unique Features

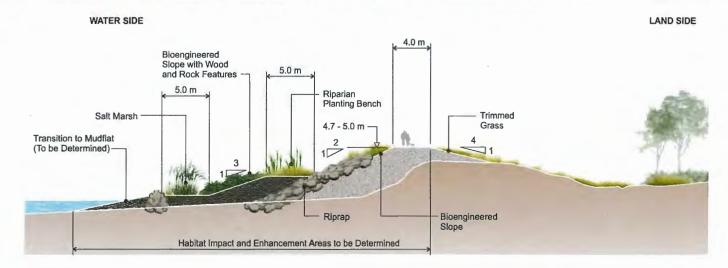
- River Road dike alignment from Queens Road to Westminster Highway, then a river-bank dike runs north of Westminster Highway houses to edge of new Hamilton Transit Centre.
- Tree Island Steel site (3933 Boundary Road) creates a slough north of the dike that shelters the road/dike from the river.
- · Backyards of single family homes located south of dike.
- Dike alignment not well defined from Hamilton Transit Centre to City of New Westminster river-bank dike.
- Potential tie-in with proposed secondary dike to separate Richmond and New Westminster.

Considerations





Reach 6: Tree Island Slough and Boundary



Master Plan Features

TFlood Protection

Raise dike to 4.7 m as illustrated above. Dike alignment will typically extend up from the current face of dike, and widen inland.

Provide erosion protection along the face of the dike, typically consisting of rip rap revetment.

Raise properties 200 m inland to 4.7 m or densify to the depth of potential liquefaction.

Construct north section of secondary dike near Boundary Road.

Industrial

Seek shift of dike alignment to include the Tree Island Steel side and Tree Island Slough if and when this site redevelops.

Raise the dike through the Hamilton Transit Centre during future redevelopment.

Social

Construct multi-use path along dike. Link to parks, trails, public amenities, and wayfinding, per Lululoop. Develop trail link to south dike at Boundary Road, plus links to New Westminster dike trail.

Environmental

The proposed footprint would impact an estimated 2,200 m² of high quality Fraser River intertidal habitat

NOTE: This is an estimate based on 2007 FREMP mapping and 2017 orthoimagery interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Cost



Reach 6: Tree Island Slough and Boundary

Priority

The is the lower ranked priority reach. This dike is higher than other sections. Stalling construction increases the chance that a realignment opportunity could arise with Tree Island Steel. Alternatively, Hamilton Neighbourhood Plan implementation may provide early opportunities to raise the dike along with road realignment, park development, and some property development.

Construction Cost

Option 4 Cost per metre

Costs below are for 1 km of dike similar to cross-section above.

Dike Raising \$4,500 \$3.6 Million Pathway \$600 \$.5 Million \$1,000 \$.8 Million Bioengineering Slopes Marsh Benches \$100 \$.08 Million Utilities (Drainage, Water) \$2,000 \$1.6 Million Other (Driveways, Ramps or Road \$.3 Million Intersection Reconstruction)

Option 8 – Through ROW between Hamilton Transit Centre and Tree Island Slough

Dike Raising \$4,500 \$1.1 Million

Pathway \$600 \$.1 Million

Retaining Walls \$1,500 \$.8 Million

Utilities (Drainage, Water) \$2,000 \$.5 Million

Option 8 – Raise Boundary Road from ROW between Hamilton Transit Centre and Tree Island Steel River Bank

Raise boundary road to become dike \$5,400 \$1.6 Million
Road Structure \$2,850 \$.9 Million
Utilities (Drainage, Water) \$2,000 \$.6 Million
Contingency (40%) \$5 Million

Total \$17.4 Million

Cost opinions are in 2018 Canadian Dollars.



CITY OF RICHMOND Richmond Dike Master Plan – Phase 4

Draft Report November 2018

6. Recommendations

It is recommended that the City adopt the Phase 4 Dike Master Plan as documented in this report, including the main features described below.

- Raise the dike crest to allow for 1 m of sea level rise. West of Nelson Road, the raised dike crest would be 4.7 m (CGVD28). East of Nelson Road, the raised dike crest would increase to 5.1 m at Boundary Road. The plan also allows for longer term upgrading to accommodate a further 1 m of sea level rise (i.e. 2 m of sea level rise).
- Widen the dike on the land side rather than into the Fraser River North Arm.
- Move River Road inside the dike to facilitate short-term and long-term dike upgrading. This will
 require the road to be reconfigured and reconstructed, with some additional need for land tenure.
 Moving the road will allow removal of utilities within the dike.
- Raise the relocated River Road to the dike crest elevation. This will facilitate driveway access over the dike to riverside properties. It will also be compatible with the desire to raise land inside the dike.
- Replace the drainage channel immediately inside the dike with storm sewers and swales. This will
 improve dike stability, and will provide some of the land needed to relocate River Road.
- Raise land and roads immediately inside the dike (during redevelopment) to improve seismic resilience. This will also improve liveability by allowing residents to looking down over the water, rather than at the backside of a dike.
- Improve pedestrian and cyclist safety by constructing a separate multi-use path along the dike. This would be consistent with the City Parks vision for a perimeter trail system (Appendix B)
- Construct the north section of a secondary dike near Boundary Road.

It is also recommended that the City prepare a comprehensive implementation plan for dike upgrading that incorporates the elements of the Phase 4 Dike Master Plan, and the elements of the other Dike Master Plans.

To address habitat compensation issues associated with the Dike Master Plans, it is further recommended that the City consider development of a habitat banking program that could provide effective large-scale compensation for the environmental impacts of dike upgrading. This could include the potential Tree Island Slough project identified in this report.

For all phases of the Dike Master Plan, continue to research alternative densification strategies for seismic stability, consider the proposed alternative seismic performance criteria in Section 3.2, and plan to fill land for approximately 200 m inland of the dike to crest elevation. The required fill distance requires additional evaluation and may be addressed in the pending update to the Flood Protection Management Strategy.

It is also recommended that the City prepare a comprehensive implementation plan for dike upgrading that incorporates the elements of Phase 5 and the other Dike Master Plans. To address habitat compensation issues associated with the Dike Master Plans, it is further recommended that the City consider development of a habitat banking program that could provide effective large-scale compensation for the environmental impacts of dike upgrading.

KERR WOOD LEIDAL ASSOCIATES LTD.



CITY OF RICHMOND

Richmond Dike Master Plan – Phase 4 Draft Report November 2018

Report Submission

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Revision History

Revision #	Date	Status	Revision	Author
E	November 21, 2018	Draft		ATAL
D	October 30, 2018	DRAFT	Updated Cost Estimates	ATAL
С	October 24, 2018	DRAFT		ATAL



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Richmond Dike Master Plan – Phase 4 Draft Report November 2018

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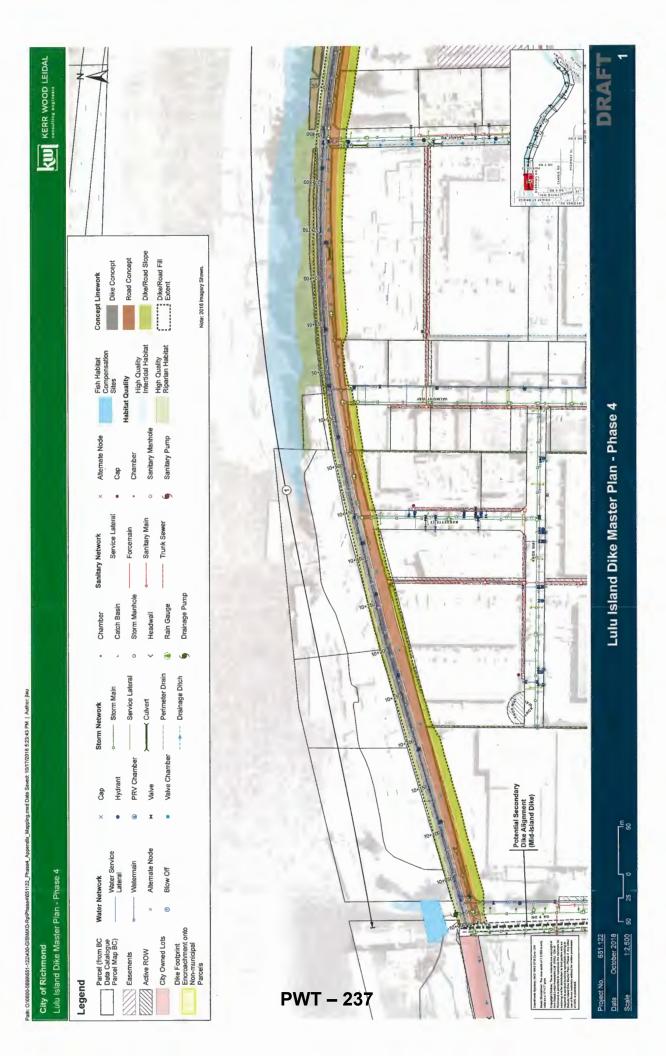
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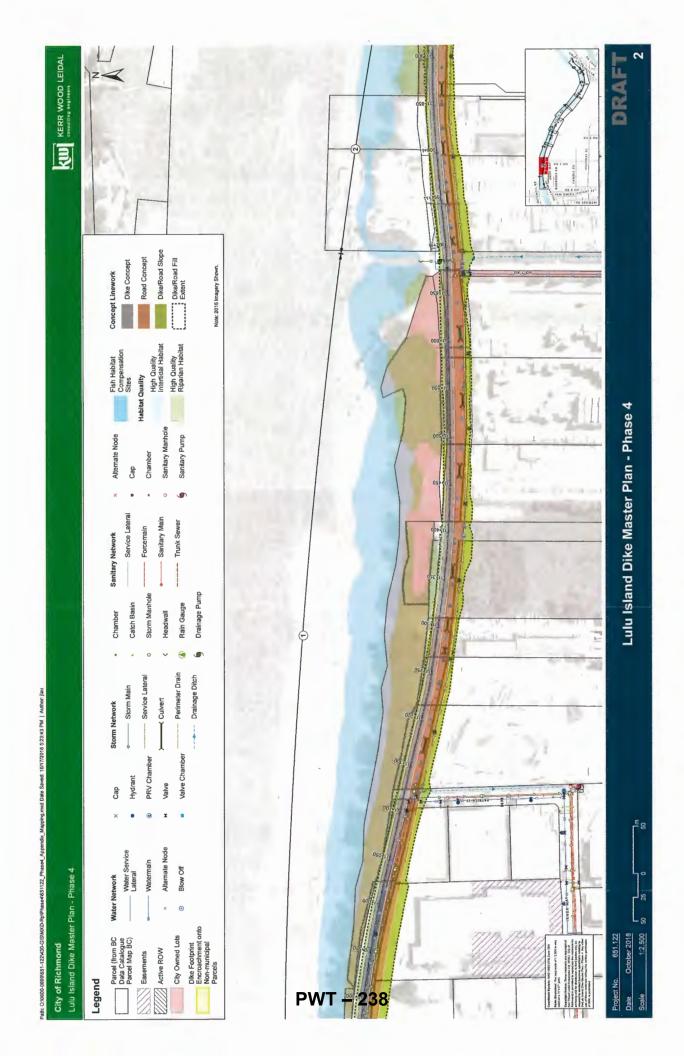
KERR WOOD LEIDAL ASSOCIATES LTD.

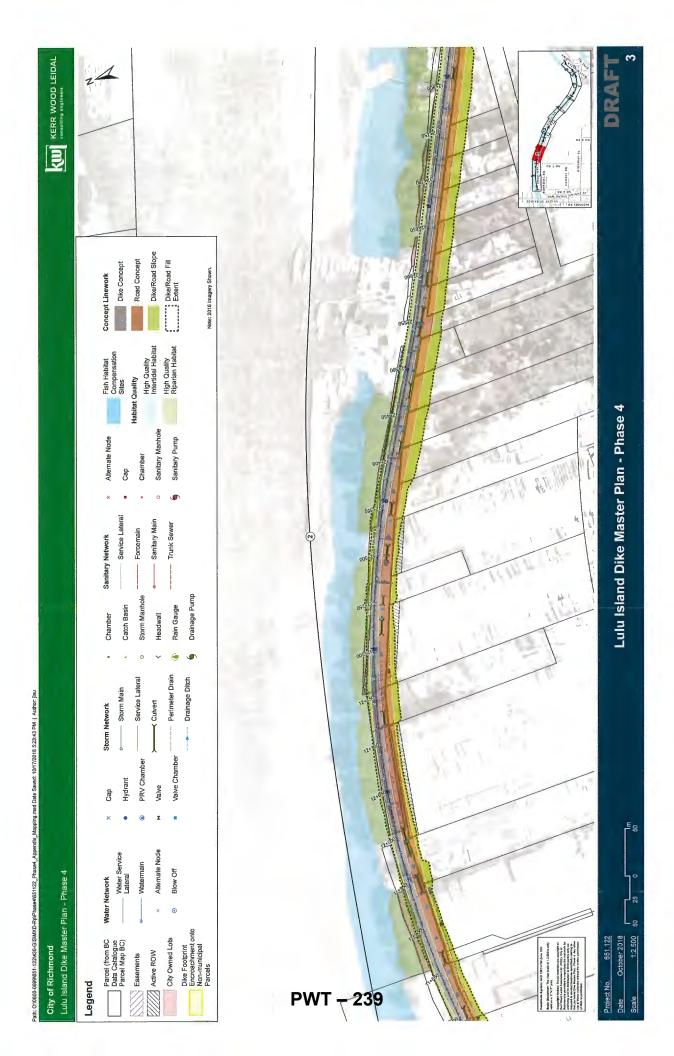


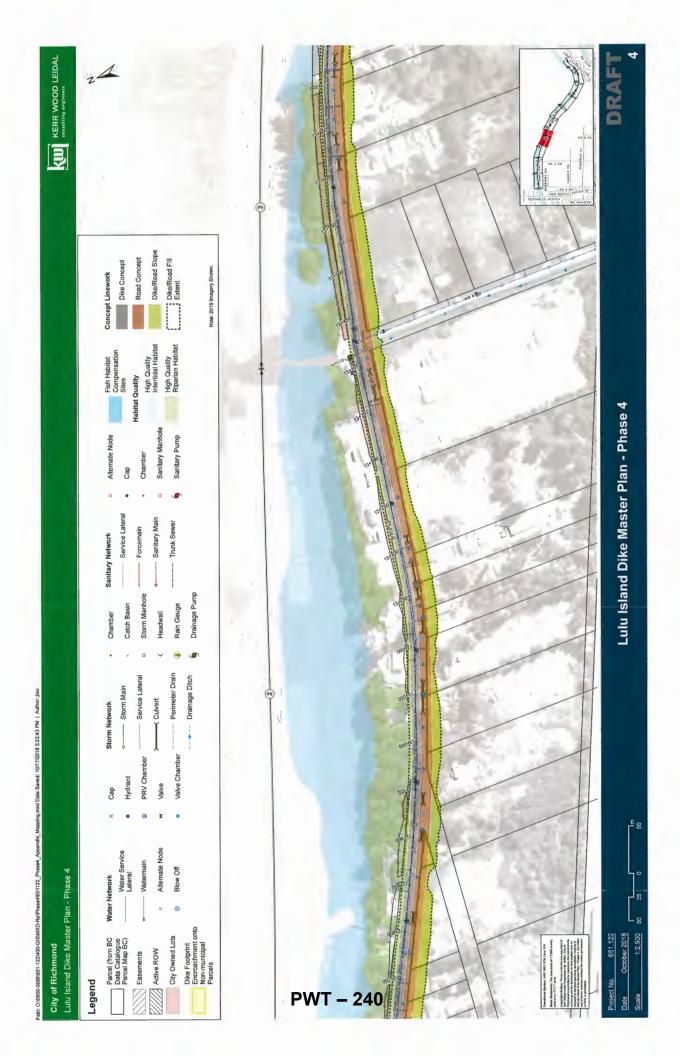
Appendix A

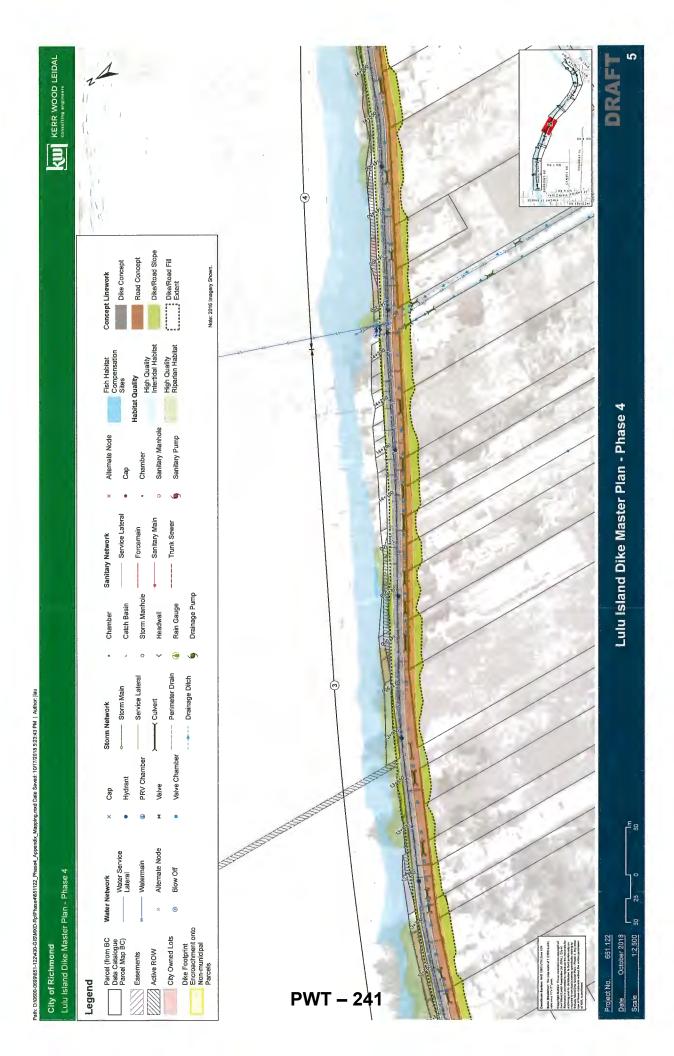
Plans and Sections for Richmond Dike Master Plan – Phase 4

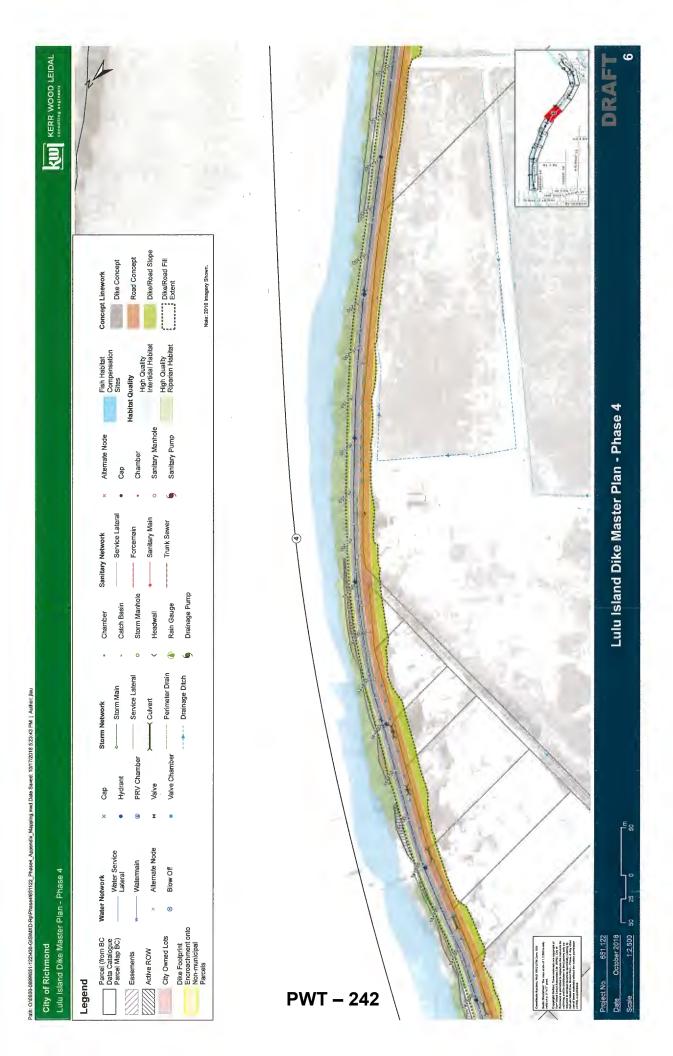


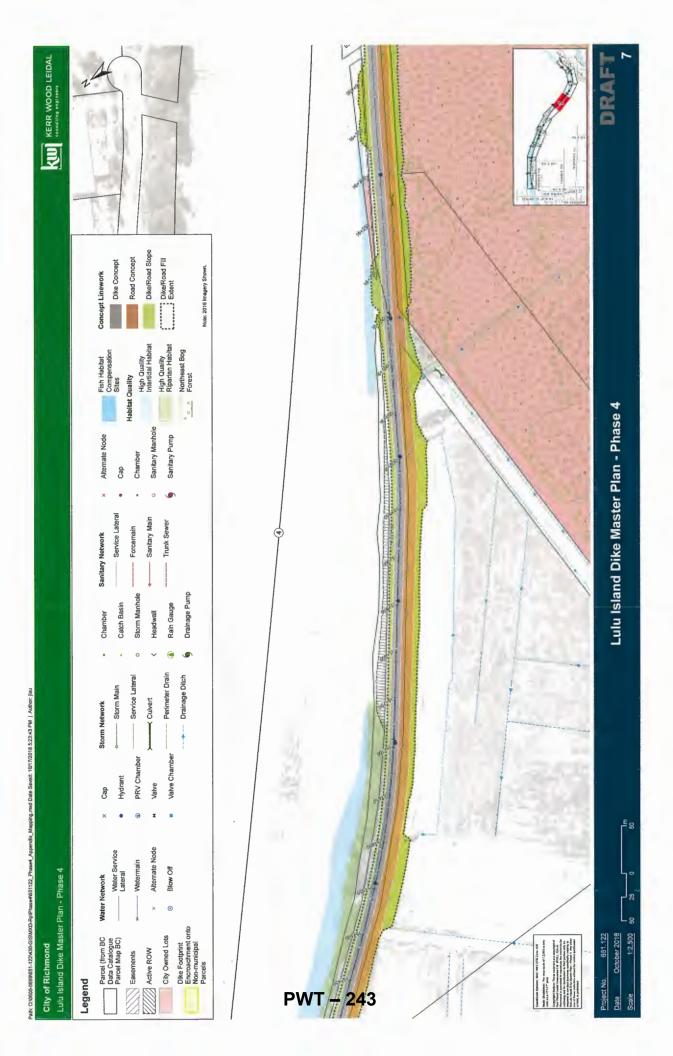


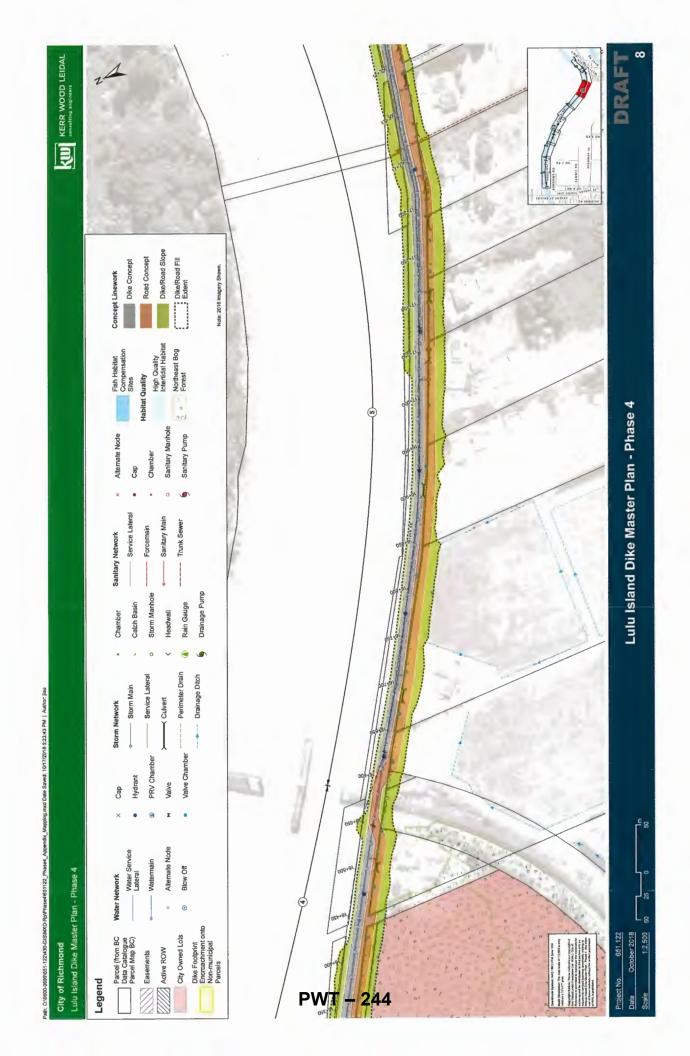


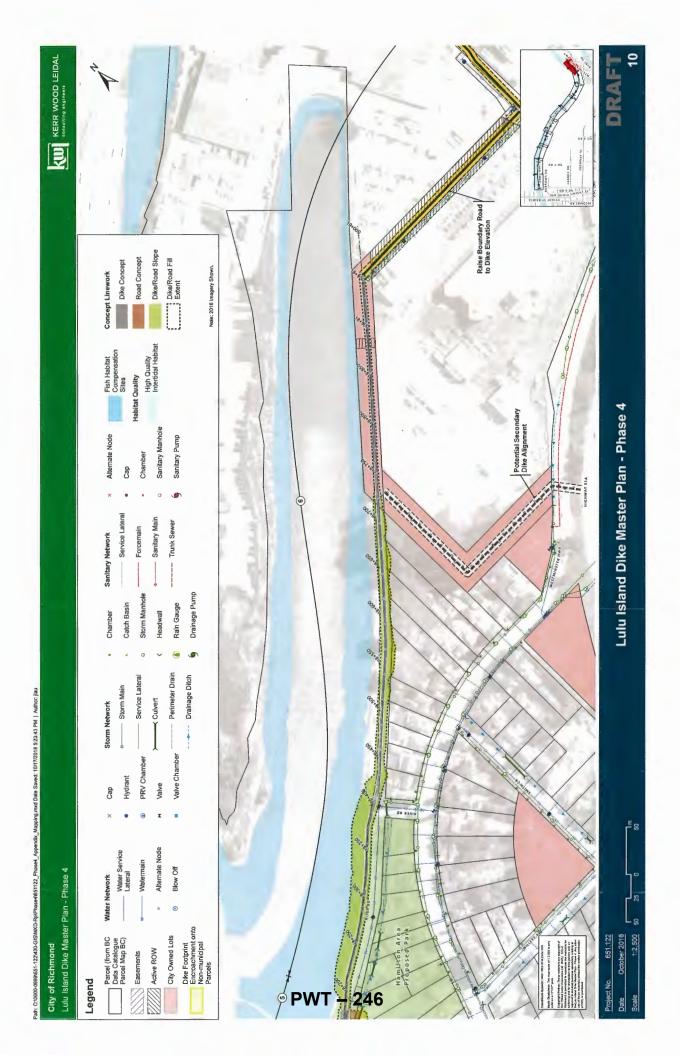


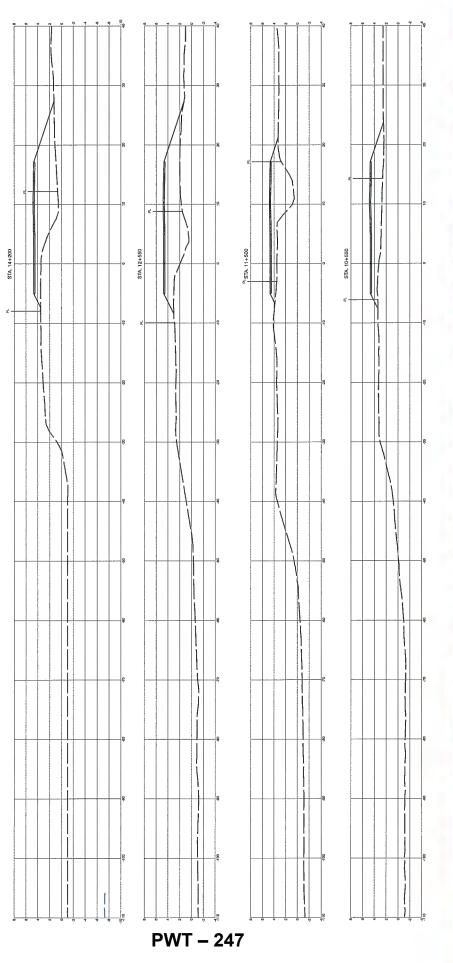












City of Richmond

Lulu Island Dike Master Plan - Phase 4

NOTE: 2016 1m DEM/SURFACE FROM EMBC LIDAR DATA - 2018 LOWER MAINLAND

BATHYMETRY DATA FROM PWGSC, DATE OF SURVEY 2015

Lulu Island Dike Master Plan - Phase 4 Cross-sections

5 25 0

Figure 1

DRAFT

Project No. 651.122

Date September 2018

Scale 1:400 5

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Appendix B

Richmond Dike Master Plan Landscape Concepts and Dike Typologies

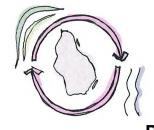
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LULULOOP A SCRICHMOND DIKE MASTER PLAN LANDSCAPE CONCEPTS

August 8th, 2018

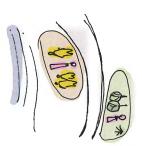
RICHMOND DIKE MASTER PLAN

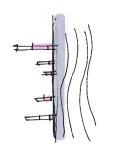
LANDSCAPE DESIGN PRINCIPLES











A PATH WORTH TAKING

Enhance the edges of roads, trail, and river with durable, maintainable materials that are also beautiful:

- utilize planting to soften hardscape and infiltrate stormwater;
- look for opportunities for street trees to provide a rhythm and buffer to roads;

separating paths or providing safe bollards, lighting, and furnishings;

supports the island and its nature;

circumnavigate Richmond and

observe how infrastructure

resolve gaps in the trail, threading delight the trail user from start to finish with attention to the unique

together tricky connections;

places along the way.

road shoulders;

mark out pedestrian areas with ensure the safety of cyclists by

pedestrians, bikes, and vehicles

Connect a network of paths to create a continuous public trail along the new sike:

THE LULU LOOP

safely and respectfully:

Integrate the movement of

ALL TOGETHER NOW

include parking where appropriate

and allow accessible transitions

between modes of travel.

rest, observation, and wayfinding. provide furnishings as points of

Activate special areas of public realm with a deployable toolskit sharing a consistent design language: SLAND INTEREST

- public space based on context, connectivity, and distribution; determine best locations for
- industrial, and cultural value for leverage areas of ecological, social connection;
- find opportunities for wonder in constrained spaces.

THE STORY OF THE RIVER

Illustrate the river's changing nature through features that allow glimpses of its past and future:

- reveal the important systems of the river and weather through interactive installations;
- acknowledge the diverse cultures that have gathered and modified the shoreline;
- educate the public on adaptations to sea level rise.









RICHMOND DIKE MASTER PLAN CONCEPT PLAN

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Richmond KWI KERR WOOD LEIDAL

ECOLOGICAL ENHANCEMENT

WATER SIDE



Approaches to treatment of the water side of dike; sites and planting to be developed with biologists and subject to environmental review:

- Management Strategy, Waterfront Strategy and planting exclusively with native species; consideration of Ecological Network applicable Provincial Acts;
- Ads that hold public interest.

 Ads that hold public interest.







INTERTIDAL

At or in the water, sometimes interspersed in rip-

rap or driftwood: SUB-AQUATIC

Frequently inundated by water, characteristic of river's edge:

builtushes and shrubs with small trees at the edges:

low-lying and submersive, following the water's

aquatic and semi-aquatic plants;

home to fish including salmon and sturgeon, and the foraging grounds of wading birds.

edge:

PRECEDENTS

- long and with variable width; teeming with song birds and hunting hawks, a common sight along the dike.

RIPARIAN

Interface between river and land with high ecological value:

- rich variety of plantlife;
- expanding width following intertidal zone;
- sensitive habitat but with a terrestrial connection that allows it to be more habitable by people under the right conditions.





















ECOLOGICAL ENHANCEMENT

ROAD EDGES



Contained, maintainable planting along road edge, without conflict with dike fill profile:

- drought-tolerant native and adaptive species; guidelines and Urban Forestry Management adherence to Street Tree and Planting
 - Strategy;
- Androin between traffic and pedestrians.

 Androin between traffic and pedestrians.

 Androin between traffic and pedestrians. creation of softscape buffers with ecological





HARDY SHRUB BUFFER
Durable shrub planting suited to high-use areas:

Roadside infiltration of stormwater with grasses,

RAINGARDEN

sedges, and shrubs:

- urban tolerant decidious trees;
- tightly spaced with consistent canopies,

below waist height for clear sightlines but as heavy duty shrubs that are resistant to

damage;

planted median between road and path

through shrub density. soft, barrier swathes;

pressures but fit rural and natural context. straight leaders, and shallow roots; species selected to withstand roadside



design.

permeable function but clean, maintainable linear with suitable sloped depressions; native plant species that can withstand inundation but also summer drought;



















ECOLOGICAL ENHANCEMENT

LAND SIDE



Land side approaches to natural space using medium to larger scale areas of habitat:

- contextual and sensitive interventions to enhance existing ecologies and unique natural features;
 - Management Strategy and Parks and Open Space Strategy along with Tree Protection consideration of Ecological Network
- Palaw:

 Tough trails and public realm features.

 N

 0







Layered plant community with texture and small trees:

WOODLAND

Open grassland with seasonal flowering interest:

MEADOW

native grasses and forbs with pollinator-

favoured species;

- native deciduous and coniferous trees, shrubs, and ground cover; meadow and with clusters of short trees and native grasses, shrubs, and deciduous trees;
- tight and somewhat tall, with shorter edges for windbreak, taking a clustered and wide shape;
 - occuring in specific areas where land provides suitable space.

less penetrable, but ecologically important to

shrubs;

idyllic and appealing planting with low impact flowing, elongated shapes accented with blooms;

on ground and sightlines.

nesting birds and small mammals.

more concentrated and concentric than



















PUBLIC REALM

REST AND RELAX

Small scale features to accomodate pedestrians and people on bikes along the dike trail:

- aim to provide seating as much as every 200m
 - in high pedestrain use areas; review of Waterfront Strategy, Trail Plan, and Parks and Open Space Strategy;
- situate elements with consideration of context: views to river, traffic noise, and connected rks or other areas of public interest.

 PWT - 256







LONG TABLE

The ultimate picnic table, tailored to the linear form of the trail:

powdercoated exposed steel and galvanized cedar timber table and seats with components;

powdercoated steel; simple, functional form easy to manufacture

BIKE RACK Steel bike rack for two bikes, side by side:

Heavy timber wood benches spaced to provide frequent resting:

BENCH

cedar timbers with powdercoated exposed

steel and galvanized components;

industrial character but obviously legible as a place to lock your bike.

heavy, durable form but comfortably tuned to human body;

references logs washed up on river bank.

and difficult to vandalize;

- long, linear form with mass and presence;
 - evocative of river industry.







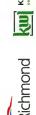














PUBLIC REALM

ACCESSIBLE GRADES

Small scale features to accomodate pedestrians and people on bikes along the dike trail:

- means for accessibly taking people from the dike crest down to lower areas on water side and land side;
 - respect BC Accessibility Handbook;
- Astinations and reduce negative impact on mostive constructions and habitats.

 TAM

 52. of observation or exploration to create combine features with other elements





SEAT STEPS

Heavy timber steps for access to area of interest:

STEPS

Graded wood ramp for rolling accessibility to lower

RAMP

cedar timbers marked for slip resistance; and securely embedded in landscape;

Stone or heavy timber seat steps where view and context allows:

- granite stone or large cedar timbers;
- cascading form sized for presence and simple form with guardrails where appropriate,
- comfortale depth of seating; industrial or geologic reference to river edge conditions of rip rap or glacial erratics.

characteristically familiar to bench and table furnishings.

PRECEDENTS

practical, functional feature without ornament. unobtrusive form but securely constructed on tight, level wood members run lengthwise;

foundation and drain rock;



















PUBLIC REALM

OBSERVE

Medium scale features for observation and connection to larger landscapes:

- habitable and sometimes sheltered elements for larger or longer public gatherings; acknowledge Waterfront Strategy and Parks and Open Space Strategy;
- especially with connection to event or sports situate in well-used areas and park spaces,

deas (especially fishing and kayaking), proportant spaces for birdwatching, and places historic or cultural importance.

- Last of the control of the contro









TOWER

Deck and boardwalk to allow viewing of the river

from its banks: VIEWPOINT

A shaded or warming respite from the weather

SHELTER

and place of gathering:

simple form with sloped roof and seating post and beam structure with tin roof;

contemporary boathouse feel.

around a hearth;

geometric alignment of boards or slats into different planes for sitting and leaning; appearing like a deconstructed boat deck oriented to bridge the river and bank.

cedar boards with simple guardrail;

Vantage point up a set of stairs for looking out and birdwatching:

- cedar posts, deck, and cladding;
- zig-zagging or spiral stairs leading up to a shielded bird blind with sightholes and shelter; referencing the historic radar reflectors on Sturgeon Bank or stilted fishing shacks.

PRECEDENTS

















HAPA

KERR WOOD LEIDAL

PUBLIC REALM EXPLORE

Special features for fun and exploration, for all ages and abilities:

- playgrounds; understand Trail Plan, Waterfront Strategy, and use principles of nature play and adventure
 - Parks and Open Space Strategy;
- consideration of safety but also the importance Avelopmental engagement with landscapes.

 AMA STATE OF THE STATE OF TH of risky play and challenge to provide positive





LOG JUMP + CROW'S NEST

Short ramps for small thrills along the path:

For launching and landing small self-propelled

water craft:

KAYAK LAUNCH

BIKE JUMPS

Nature play features for jumping and climbing: dried timbers structurally supported and

- textured for slip-resistance;
- placed seemingly randomly but within reach; evoking driftwood and raptor perches.

undeniable features for the aspiring daredevil. graded dirt or asphalt with bright warnings; height geared towards younger rides or the young at heart;

floating pier or slip with covered area; clean, minimal intrusion into the water that

adapts to ebb and flood of tide.

wood with stainless steel details;



















SPECIAL FEATURES

LIGHTING AND FENCES

Safety features for providing light and vertical or barrier separation of travel modes:

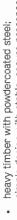
- mediating between automobile movement and the slower speeds and scale of pedestrian and people on bikes;
 - acknowledge Urban Design Guidelines and also dark sky principles;
- engage cycling groups to provide safe
 delutions to conflicts between user groups,
 Activity and traffic, increasing visibility, and
 Suring pedestrians feel safe.





BOLLARD

Vertical separation of paths with option for safety lighting:



 simple design with stable, secure presence; industrial or shipbuilding aesthetic through

wooden pole or light gray steel; 5m high with dual lumenaire design between bike and walking pathes;

wooden pole or light gray steel and sleek,

modern fixture.

Highest output lighting for urban edges and

darkest zones:

PEDESTRIAN LIGHT POLE

contemporary lens.

SCREEN/BARRIER

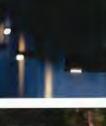
For creating a safe barrier or noise wall between two conditions:



- 1.1m high with durable construction; simple, contemporary design.



















SPECIAL FEATURES

WAYFINDING AND DATA STATIONS

Small, repeatable elements for wayfinding, services, and education:

- consistent design language to tie the trail
- together as a linear park; use Trail Plan, Waterfront Strategy, and Parks and Open Space Strategy;
 - tie together existing bike routes, paths, and park spaces to the dike and provide amenity





ded interest along the course of the trail with respect to the landscape and infrastructure as relates to sea level rise.



WAYFINDING

Mapboard with clear, legible graphics and consistent design language:

Marker reflecting weather and tide changes in

analog form:

Refill with air or water from a multi-use

checkpoint:

BIKE REPAIR/WATER FOUNTAIN

concrete and powdercoated steel

construction;

WEATHER/TIDE STATION

simple, legible form with playful metaphor; inspiring curiousity and return to track the

river's changes.

utilitarian industrial aesthetic with discrete durable, tamperproof design with overflow

water well-drained; design accents.

stainless or powdercoated steel;

- cedar with steel or resin board;
- post-like and visible from a distance but human-scaled;
- simple character with bold colour allowing quick reading by diverse groups.

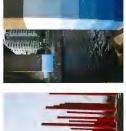




















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Phase 4, Fig 3-2

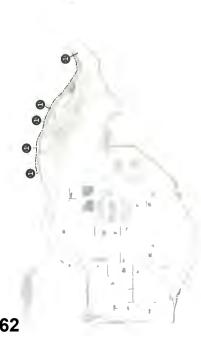
PHASE 4, OPTION 1 DIKE TYPOLOGIES

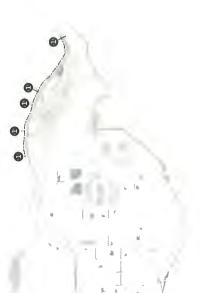
RAISE DIKE AND ROAD AND EXTEND LAND-SIDE (REACHES 1-5)

Excellent public realm opportunity within interesting stretch of riverfront landscape:

- provide observation features where appropriate existing parks, pump stations, and road pullouts where habitat already exists; reduce scale of path through planted edges and light features in areas without significant development;
 - Lennect to new bog park, local agriculture duding roadside fruit stands, and riverased businesses.

 Tale dusinesses.







RICHMOND DIKE MASTER PLAN | LANDSCAPE CONCEPTS 2018-08-D8

PHASE 4, OPTION 2 DIKE TYPOLOGIES

RAISE DIKE AND ROAD WITH RETAINING WALLS (REACH 4)

Constrained road shoulder provides opportunities for mediating traffic speeds and providing access to adjacent areas:

- explore use of special barrier to provide safety at retaining wall while reducing vehicle speeds for people on bikes and contributing to local
 - character;
- Other to make most of path experience
 Asy areas of riverfront could be provided with ecess for non-motorized boating, observation, interpretive feature at location higher up the liver:







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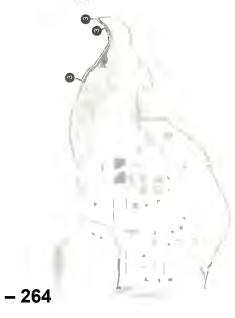
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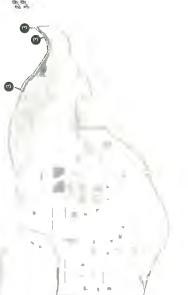
PHASE 4, OPTION 3 DIKE TYPOLOGIES

RAISE DIKE ONLY AND EXTEND RIVER-SIDE (REACHES 4-6)

Highly naturalized condition with opportunity for public engagement with river ecology and dike enhancement:

- provide public gathering elements to encourage public use of special conditions; provide access off of dike crest where
- appropriate, consider natural play features; enhance connections to bog forest, riverside
 - ullout areas, and intertidal habitat through shifting pathways and connections that gment natural spaces with a public egagement component.





RICHMOND DIKE MASTER PLAN | LANDSCAPE CONCEPTS 2018-08-08

HAPA KERR WOOD LEIDAL

Richmond

Phase 4, Fig 3-4

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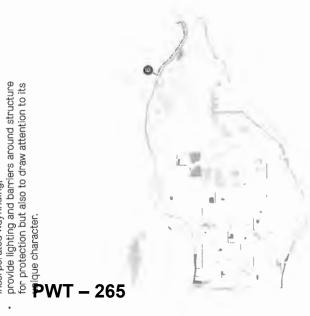
Phase 4, Fig 3-5

PHASE 4, OPTION 6 DIKE TYPOLOGIES

RAIL TRESTLE - RAISE ROAD / DIKE UNDER TRESTLE (REACH 4)

Constrained roadway under rail trestle:

- look to routing path around area, possibly nearer bog forest;
- explore innovative approaches to the trestle under structure including public art or
 - incorporated wayfinding;







KERR WOOD LEIDAL HAPA

RICHMOND DIKE MASTER PLAN | LANDSCAPE CONCEPTS 2018-08-08

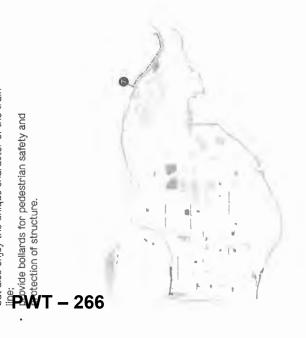
Phase 4, Fig 3-6

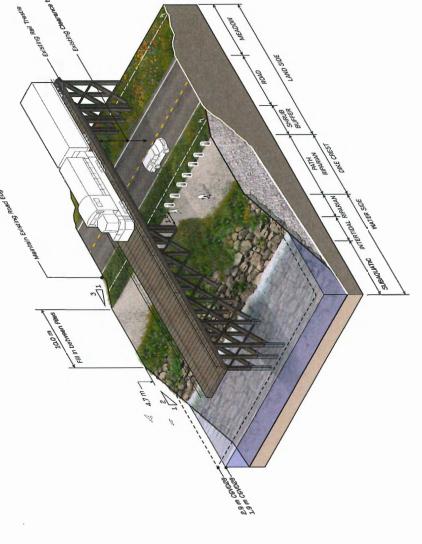
PHASE 4, OPTION 7 DIKE TYPOLOGIES

RAIL TRESTLE - FILL IN-BETWEEN TRESTLE PILE (REACH 4)

Path below rail trestle on water side:

- rail trestle and river provide excellent opportunities for incorporating public art or wayfinding features;
- dismount and others to proceed with caution but also enjoy the unique character of the train wide path funnels into narrower space at trestle to encourage people on bikes to







Richmond KW KERR WOOD LEIDAL HAPA







Manoah Steves Elementary School

10111 Fourth Avenue, Richmond, BC V7E 1V5 Tel.: 604-668-6660

Email: steves@sd38.bc.ca, Web: steves.sd38bc.ca, Twitter: @stevescyclones

Mr. Gordon Fitt

Principal

Mrs. Mika Livingston

Vice Principal

June 7, 2021

His Worship Mayor Malcolm Brodie and Council City of Richmond 6911 No. 3 Road Richmond, BC V6Y 2C1

cc Mr. Lloyd Bie, Director, Transportation

Dear Mayor Brodie and Council,

Our school, Manoah Steves Elementary School, is currently at the tail end of our school-wide seismic upgrade renovations, which we expect to be finished in September, 2021.

We hope to freshen up our outdoor space, too, and as part of that, and to reinforce our school district SOGI initiatives, we wondered if the City of Richmond might consider painting the crosswalk outside our school in rainbow colours.

If there is any other information we could provide to assist with a decision, please let us know.

Sincerely,

Vivienne Lowenstein Administrative Assistant vlowenstein@sd38.bc.ca

Luchstein